CHIROPRACTIC SCIENTIFIC REVIEW©

Indiana State Chiropractic Association
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Indiana State Chiropractic Association

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Preface

Back pain costs the U.S. $100B annually.

A summary of no less than 73 clinical trials involving spinal manipulation published in the Annals of Internal Medicine attests to the effectiveness of spinal manipulation in managing back pain with none of the trials having produced negative results.

Additionally, official guidelines from the governments of at least 8 countries in North America, western Europe and Australia propose that spinal manipulation is one of the two most-documented and effective management strategies for back pain [the other being the use of analgesics and nonsteroidal anti-inflammatory agents]. With this type of documented effectiveness, least side effects, and avoidance of expensive alternatives when possible, the treatments which chiropractors apply continues to demand increasing consideration from mainstream medicine in a healthcare environment that is increasingly dependent upon the documentation of rigorous scientific evidence.

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A) Cost Effectivenss

It was estimated that 1992 low back pain costs in the US were a staggering $60 billion when production lost was taken into consideration. Research has indicated that low back pain disability is growing 14 times faster than the population. It's the leading cause of disability and morbidity in middle-aged persons, and is the most expensive source of workers' compensation costs in North America. In the 30-50 age group, low back pain is the single most expensive health care problem.

The escalating costs associated with low back pain have prompted legislators, policy makers and insurance companies to investigate cost-containment strategies. As you will see in the following studies, chiropractic care has been consistently identified as one of the most effective and cost effective treatments for the management of many low back conditions, in addition to a number of other neuromusculoskeletal disorders.
Moreover, the volume of scientific evidence now being compiled makes a compelling case for the use of chiropractic as a means of controlling the escalating costs of our overburdened health care system.

- Prevalence of Selected Impairments. United States - 1971. National Center for Health Statistics, Hyattsville, Maryland - 1975, DHHS Publication No. (PHS)75-1526 (Series 10, No. 9) and 1981 DHHS Publication No. (PHS) 87-1587 (Series 10, No. 159)
- Back Injuries in Industry: A Retrospective Study Part I Overview and Cost Analysis. Spengler et al. Spine, 1986 - 11(3):241-245.

1)
The Manga Report (1993)

A Study to Examine the Effectiveness and Cost-Effectiveness of Chiropractic Management of Low-Back Pain

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August 1993

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The support of the Ministry of Health, Government of Ontario, which solely funded the project, is gratefully acknowledged.

EXECUTIVE SUMMARY

Introduction

The serious fiscal crisis of all governments in Canada is compelling them to contain and reduce health care costs. It has brought a new and unprecedented emphasis on evidence-based allocation of resources, with an overriding objective of improving

the cost-effectiveness of health care services.

The area of low-back pain (LBP) offers governments and the private sector an excellent opportunity to attain the twin goals of greater cost-effectiveness and a major reduction in health car costs. Today LBP has become one of the most costly causes of illness and disability in Canada - a phenomenon which does not appear to be generally appreciated or understood in medical and government circles in Canada. Studies on the prevalence and incidence of LBP suggest that it is ubiquitous, probably the leading cause of disability and morbidity in middle-aged persons, and by far the most expensive source of workers' compensation costs in Ontario - as indeed in most other jurisdictions.

Much of the treatment of LBP appears to be inefficient. Evidence from Canada, the USA, the UK and elsewhere shows that there are conflicting methods of treatment, many with little - if any scientific evidence of effectiveness, and very high costs of treatment. Despite this, levels of disability from LBP are increasing.

In the Province of Ontario LBP is managed mostly by physicians and chiropractors, with physiotherapists also playing a significant role. While medical services are fully insured under Medicare, chiropractic care services are only partially covered. LBP patients incur the highest out-of-pocket expenses for chiropractic services. Virtually,no out-of-pocket expenses are incurred for medical treatment, with the exception of drugs, and out-of-pocket expenses incurred for physiotherapy services fall somewhere in between the two.

Medical physicians, chiropractors, physiotherapists and an assortment of other professionals together offer about thirty-six therapeutic modalities for the treatment of LBP. In this study we focused principally on the effectiveness and cost effectiveness of chiropractic and medical management of LBP.

FINDINGS

F1.
On the evidence, particularly the most scientifically valid clinical studies, **spinal manipulation applied by chiropractors is shown to be more effective than alternative treatments for LBP.** Many medical therapies are of questionable validity or are clearly inadequate.

F2.
There is no clinical or case-control study that demonstrates or even implies that chiropractic spinal manipulation is unsafe in the treatment of low-back pain. Some

medical treatments are equally safe, but others are unsafe and generate iatrogenic complications for LBP patients. **Our reading of the literature suggests that chiropractic manipulation is safer than medical management of low-back pain.**

F3.

While it is prudent to call for even further clinical evidence of the effectiveness and efficacy of chiropractic management of LBP, what **the literature revealed to us is the much greater need for clinical evidence of the validity of medical management of LBP.** Indeed, several existing medical therapies of LBP are generally contraindicated on the basis of the existing clinical trials. **There is also some evidence in the literature to suggest that spinal manipulations are less safe and less effective when performed by non-chiropractic**

professionals.

F4.

There is an overwhelming body of evidence indicating that chiropractic management of low-back pain is more cost-effective than medical management. We reviewed numerous studies that range from very persuasive to convincing in support of this conclusion. The lack of any convincing argument or evidence to the contrary must be noted and is significant to us in forming our conclusions and recommendations. The evidence includes studies showing lower chiropractic costs for the same diagnosis and episodic need for care.

F5.

There would be highly significant cost savings if more management of LBP was transferred from medical physicians to chiropractors. Evidence from Canada and other countries suggests potential savings of many hundreds of millions annually. The literature clearly and consistently shows that the major savings from chiropractic management come from fewer and lower costs of auxiliary services, much fewer hospitalizations, and a highly significant reduction in chronic problems, as well as in levels and duration of disability. **Workers' compensation studies report that injured workers with the same specific diagnosis of LBP returned to work much sooner when treated by chiropractic physicians than by medical physicians.** This leads to very significant reductions in direct and indirect costs.

F6.

There is good empirical evidence that patients are very satisfied with chiropractic management of LBP and considerably less satisfied with physician management. Patient satisfaction is an important health outcome indicator and adds further weight to the clinical and health economic results favoring chiropractic management of LBP.

F7.

Despite official medical disapproval and economic disincentive to patients (higher private out-of-pocket cost), the use of chiropractic has grown steadily over the years. Chiropractors are now accepted as a legitimate healing profession by the public and an increasing number of medical physicians.

F8.

In our view, the constellation of the evidence of:

(a) the effectiveness and cost-effectiveness of chiropractic management of low-back pain.
(b) the untested, questionable or harmful nature of many current medical therapies.
(c) the economic efficiency of chiropractic care for low-back pain compared with medical care.
(d) the safety of chiropractic care.
(e) the higher satisfaction levels expressed by patients of chiropractors, together offers an overwhelming case in favor of much greater use of chiropractic services in the management of low-back pain.

F9.

The government will have to instigate and monitor the reform called for by our overall conclusions, and take appropriate steps to see that the savings are captured. The greater use of chiropractic services in the health care delivery system will not occur by itself, by accommodation between the professions, or by actions on the part of the Workers' Compensation Board and the private sector generally.

RECOMMENDATIONS

Our recommendations for reform include the following:

R1.

Current policy discourages the utilization of chiropractic services for the management of LBP. There should be a shift in policy to encourage and prefer chiropractic services for most patients with LBP.

R2.

Chiropractic services should be fully insured under the Ontario Health Insurance Plan, removing the economic disincentive for patients and referring health providers. This one step will bring a shift from medical to chiropractic management that can be expected to lead to very significant savings in health care expenditure, and even larger savings if a more comprehensive view of the economic costs of low-back pain is taken.

R3.

Chiropractic services should be fully integrated into the health care system. Because of the high incidence and cost of LBP, hospitals, managed health care groups (community) health centres, comprehensive health organizations, and health service organizations) and long-term care facilities should employ chiropractors on a full-time and/or part-time basis. **Additionally such organizations should be encouraged to refer patients to chiropractors.**

R4.

Chiropractors should be employed by tertiary hospitals in Ontario. Hospitals already employ chiropractic in the United States with good effect. **Similar recommendations have been made recently by government inquiries in Australia and Sweden, and following government funded research in the U.K. and other countries**. Unnecessary or failed surgery is not only costly but also represents low quality care. The opportunity for consultation, second opinion and wider treatment options are significant advantages we foresee from this initiative which has been employed with success in a clinical research setting at the University Hospital, Saskatoon.

R5.
Hospital privileges should be extended to all chiropractors for the purposes of treatment of their own patients who have been hospitalized for other reasons, and for access to diagnostic facilities relevant to their scope of practice and patients' needs.
R6.
Chiropractors should have access to all pertinent patient records and tests from hospitals, physicians, and other health care professionals upon the consent of their patients. Access should be given upon the request of chiropractors or their patients.
R7.
Since low-back pain is of such significant concern to workers' compensation, chiropractors should be engaged at a senior level by Workers' Compensation Board to assess policy, procedures and treatment of workers with back injuries. This should be on an interdisciplinary basis with other professional, technical and managerial staff so that there is early development of more constructive relationships between chiropractors, physicians, physiotherapists and Board staff and consultants. **A very good case can be made for making chiropractors the gatekeepers for management of low-back pain in the Workers' Compensation System in Ontario.**
R8.
The government should make the requisite research funds and resources available for further clinical evaluation of chiropractic management of LBP,

and for further socioeconomic and policy research concerning the management of LBP generally. Such research should include surveys to obtain a better understanding of patients' choices, attitudes and knowledge of treatments with respect to LBP. The objective of these surveys should be better information for health policy, programme planning and consumer education purposes.
R9.
Chiropractic education in Ontario should be in the multidisciplinary atmosphere of a university with appropriate public funding. Chiropractic is the only regulated health profession in Ontario without public funding for education at present, and it works against the best interests of the health care system for chiropractors to be educated in relative isolation from other health science students.
R10.
Finally, the government should take all reasonable steps to actively encourage cooperation between providers, particularly the chiropractic, medical and physical therapy professions. **Lack of cooperation has been a major factor in the current inefficient management of LBP**. Better cooperation is important if the govemment is to capture the large potential savings in question and, it should be noted, is desired by an increasing number of individuals within each of the professions.

2)
THE UTAH STUDY
In 1988 a Utah Workers' Compensation Board study found the total treatment costs for back-related injuries cost an average of $775.30 per case when treated by a doctor of chiropractic. When injured workers received standard medical treatment

as opposed to chiropractic treatment, the average cost per case was $1,665.43.

They also found the mean compensation cost paid out by the Utah Worker's Compensation Board for patients treated by medical doctors was $668.39, while the mean compensation cost paid for patients treated by chiropractic doctors was only $68.38.

- Cost per Case Analysis of Utah Industrial Back Injury Claims: Chiropractic Management vs. Medical Management for Diagnostically Equivalent Conditions. D.C. Tracts - 1989.
- Cost per Case Comparison of Back Injury Claims of Chiropractic versus medical Management for Conditions with Identical Diagnostic Codes. Jarvis KB, et al. Journal of Occupational Medicine - 1991;33:847-852.

3)
THE OAKLAND UNIVERSITY STUDY
After reviewing the health insurance claims for 395,641 chiropractic and medical care patients, Miron Stano, Ph.D., lead researcher, concluded:
Those patients who receive chiropractic care, either solely or in conjunction with medical care, experienced "significantly lower health care costs... on the order of $1,000 each over the two-year period" compared with those who received only medical care. Specifically, total insurance payments were $1,138 (30% higher) for those who elected medical care only. The lower costs for chiropractic patients were attributable both to lower inpatient and outpatient costs and indicated that "chiropractic treatment substitutes for other forms of outpatient care."

- Stano/Medstat Research. Miron Stano, Ph.D. Oakland University.

4)
THE VIRGINIA RESEARCH STUDY
An economic analysis conducted in Richmond, Virginia in 1992 found chiropractic care to be a lower cost option for back-related ailments. The researchers concluded that if chiropractic care was insured to the extent of other medical specialties, it would likely emerge as a first option for many patients with certain medical conditions. They also believed this could result in a decrease in the overall treatment costs for these conditions.

Additional research conducted by The College of William and Mary and the Medical College of Virginia in 1992 on mandated health insurance coverage and the economic impact of chiropractic coverage revealed:

- The low cost of chiropractic is due not to its low rate of use, but to its apparently offsetting impacts on costs in the face of high rates of utilization. Chiropractic is a growing component of the health care sector, and it is widely used by the population.
- Formal studies of the cost, effectiveness, or both of chiropractic, usually measured against other forms of treatment, show it to compare favorably with them.
- By every test of cost and effectiveness, the general weight of evidence shows chiropractic to provide important therapeutic benefits, at economical costs.

Additionally, these benefits are achieved with apparently minimal, even negligible, impacts on the costs of health insurance.

- The conclusion of this analysis is that chiropractic mandates help make available health care that is widely used by the American public and has proven to be cost-effective.
- A Comparison of the Costs of Chiropractors versus Alternative Medical Practitioners. Dean DH, Schmidt RM. University of Richmond, Richmond, Virginia - January 13, 1992.
- Mandated Health Insurance Coverage for Chiropractic Treatment: An Economic Assessment, with Implications for the Commonwealth of Virginia. Schifrin LG. The College of William and Mary, Williamsburg, Virginia, and Medical College of Virginia, Richmond, Virginia - January 1992.

5)

THE FLORIDA STUDY

This large State of Florida study examined 10,652 patients who sustained back-related injuries on the job. Their findings revealed that individuals who received chiropractic care compared with standard medical care for similar diagnoses experienced had a (i) 51.3 percent shorter temporary total disability duration (ii) lower treatment cost by 58.8 percent ($558 vs. $1,100 per case) (iii) 20.3 percent hospitalization rate in the chiropractic care group vs. 52.2 percent rate in the medical care group.

- An Analysis of Florida Workers' Compensation Medical Claims for Back Related Injuries. Wolk S. Foundation for Chiropractic Education and Research, Arlington, VA. - 1988.

6)

THE AV-MED STUDY

In this study, 80 patients who previously received medical treatment were subsequently referred to the Silverman Chiropractic Center. Of the 80 patients, 21 percent had just been diagnosed with spinal disc problems, 12 percent had been diagnosed as requiring surgery and 5 percent had received emergency room treatment. Following chiropractic treatment, none of the patients were required to have surgery, 86 percent of the patients needed no further care, and the estimated health care savings in the group of 80 was estimated to be $250,000.

- The Av-Med Study - 1993.

7)

THE AUSTRALIAN STUDY

In this Australian study, 1,996 workers' compensation cases were evaluated in patients who experienced work-related mechanical low back pain. It was found that those individuals who received chiropractic care for their back pain returned to work 4 times faster (6.26 days vs. 25.56 days) and had treatment that cost 4 times less ($392 vs. $1,569) than those who received treatments from medical doctors. Also, in those patients who received chiropractic care there was a significantly lower incidence of progression to a chronic low back pain status.

- Mechanical Low-Back Pain: A Comparison of Medical and Chiropractic Management Within the Victorian Work Care Scheme. Ebrall, PS. Chiropractic Journal of Australia - 1992;22:47-53.

8)
Government Studies on Chiropractic

There have been a number of large investigations conducted on chiropractic by the American, Canadian, New Zealand, Swedish and Australian governments over the last few decades. In all cases, their findings have supported the effectiveness and efficacy of Chiropractic.

Canada's 1993 Manga Report strongly recommended chiropractic care over medical care for the treatment and management of most low-back conditions. The 1994 AHCPR Study from the U.S. Department of Health and Human Services suggested that chiropractic spinal manipulation was a conservative and safe treatment for many low-back conditions and should be utilized prior to any surgical interventions in most cases.

Doctors of Chiropractic have now become integral to the development of governmental guidelines for the treatment of back conditions in Canada and the U.S. In addition, many hospitals are extending privileges to chiropractors and referrals between medical doctors and chiropractors are becoming increasingly common.

9)
THE AGENCY ON HEALTH CARE POLICY AND RESEARCH STUDY

On December 8, 1994, the *Agency for Health Care Policy and Research* (AHCPR) of the US Department of Health and Human Services released Clinical Practice Guidelines for the management of acute low back pain. Their guidelines were developed after extensive study of diagnostic and treatment methods for acute low back pain.

The guidelines were created by the AHCPR panel to provide primary care clinicians with information and recommended strategies for the assessment and treatment of acute low back problems. The AHCPR panel was made up of 23 members consisting of medical doctors, chiropractic doctors, nurses, experts in spinal research, physical therapists, an occupational therapist, a psychologist, and a consumer representative.

The following conclusions were made in this landmark study:
Conservative treatment such as spinal manipulation should be pursued in most before cases considering surgical intervention;
Prescription drugs such as oral steroids, antidepressant medications and colchicine are not recommended for acute low back problems.
Other interesting finds included:
The risk of serious complications from lumbar spinal manipulation is rare;
There is currently no evidence supporting the use of trigger point, ligamentous and facet injections, needle acupuncture or dry needling as treatment for acute back problems;

The panel found no evidence of benefit from the application of physical agents and modalities such as ice, heat, massage, traction, ultrasound, cutaneous laser treatment, transcutaneous electrical nerve stimulation (T.E.N.S.) and biofeedback techniques.

- Acute Low Back Problems in Adults. Clinical Practice Guidelines. Bigos S, et al. Agency for Health Care Policy and Research Publication No. 950642 (1994) - U.S. Department of Health and Human Services.

10)
THE MANGA REPORT
As the largest existing analysis of scientific literature on low back pain, the 1993 Ontario Ministry of Health commissioned study drew international attention when it recommended the management of low back pain be moved from medical doctors to chiropractic doctors.

Due to serious financial problems with the Canadian governments, the different types of treatments for low back conditions were evaluated in an effort to reduce and contain health care costs. Their findings showed chiropractic manipulation was the most cost effective and efficacious care for low back pain.

The researchers also stated that studies on the prevalence and incidence of low back pain suggest that it is the leading cause of disability and morbidity in middle-aged persons, and is by far the most expensive source of workers' compensation costs North America.

11)
The Canadian Government report concluded with the following findings:
On the evidence, particularly the most scientifically valid clinical studies, spinal manipulation applied by chiropractors is shown to be more effective than alternative treatments for low back pain. Many medical therapies are of questionable validity or are clearly inadequate; There is no clinical or case-control study that demonstrates or even implies that chiropractic spinal manipulation is unsafe in the treatment of low back pain. Some medical treatments are equally safe, but others are unsafe and generate iatrogenic (doctor-induced) complications for low back pain patients. Our reading of the literature suggests that chiropractic manipulation is safer than medical management of low back pain; indeed, several existing medical therapies of low back pain are generally contraindicated on the basis of the existing clinical trials. There is also some evidence in the literature to suggest that spinal manipulations are less safe and less effective when performed by nonchiropractic professionals.
There is an overwhelming body of evidence indicating that chiropractic management of low back pain is more cost-effective than medical management; There would be highly significant cost savings if more management of low back pain was transferred from physicians to chiropractors. Evidence from Canada and other countries suggests potential savings of many hundreds of millions annually;

Workers' compensation studies report that injured workers with the same specific diagnosis of low back pain returned to work much sooner when treated by chiropractors than by medical physicians;
There is good empirical evidence that patients are very satisfied with chiropractic management of low back pain and considerably less satisfied with medical physician management;
The use of chiropractic has grown steadily over the years and chiropractors are now accepted as a legitimate healing profession by the public and an increasing number of medical physicians;In our view, the following offers an overwhelming case in favor of much greater use of chiropractic services in the management of low back pain:

- the effectiveness and cost effectiveness of chiropractic management of low back pain
- the untested, questionable or harmful nature of many current medical therapies
- the economic efficiency of chiropractic care for low back pain compared with medical care
- the safety of chiropractic care
- the higher satisfaction levels expressed by patients of chiropractors.

The following recommendations were also included in the report:

- There should be a shift in policy to encourage and prefer chiropractic services for most patients with low back pain;
- Chiropractic services should be fully insured under the Ontario Health Insurance Plan;
- Chiropractic services should be fully integrated into the health care system;
- Chiropractors should be employed by tertiary hospitals in Ontario;
- Hospital privileges should be extended to all chiropractors for the purposes of treatment of their own patients who have been hospitalized for other reasons, and for access to diagnostic facilities relevant to their scope of practice and patients' needs;
- Chiropractic should have access to all pertinent patient records and tests from hospitals, physicians, and other health care professionals upon the consent of their patients;
- Since low back pain is of such significant concern to workers' compensation, chiropractors should be engaged at a senior level by Workers' Compensation Board to assess policy, procedures and treatment of workers with low back injuries;
- A very good case can be made for making chiropractors the gatekeepers for management of low back pain in the workers' compensation system in Ontario;
- The government should make the requisite research funds and resources available for further clinical evaluations of chiropractic management of low back pain, and for further socioeconomic and policy research concerning the management of low back pain generally;
- Chiropractic education in Ontario should be in the multidisciplinary atmosphere of a university with appropriate public finding;

- Finally, the government should take all reasonable steps to actively encourage cooperation between providers, particularly the chiropractic, medical and physiotherapy professions.
    - The Effectiveness and Cost Effectiveness of Chiropractic Management of Low-Back Pain (The Manga Report). Pran Manga and Associates (1993) - University of Ottawa, Canada.

12)
THE NEW ZEALAND COMMISSION REPORT
This 377 page report, Chiropractic In New Zealand, was the most comprehensive and detailed independent examination of chiropractic ever undertaken at that time. The report withstood judicial hearings and extensive investigations by the Commission in New Zealand, the United States, Canada, England and Australia.

According to the researchers, "We entered into our inquiry in early 1978. We had no clear idea what might emerge. We knew little about chiropractors. None of us had undergone any personal experience of chiropractic treatment. If we had any general impression of chiropractic it was probably that shared by many in the community: that chiropractic was an unscientific cult, not to be compared with orthodox medical or paramedical services. We might well have thought that chiropractors were people with perhaps a strong urge for healing, who had for some reason not been able to get into a field recognized by orthodox medicine and who had found an outlet outside the fringes of orthodoxy."

"But as we prepared ourselves for this inquiry it became apparent that much lay beneath the surface of these apparently simple terms of reference. In the first place it transpired that for many years chiropractors had been making strenuous efforts to gain recognition and acceptance as members of the established health care team. Secondly, it was clear that organized medicine in New Zealand was adamantly opposed to this on a variety of grounds which appeared logical and responsible. Thirdly, however, it became only too plain that the argument had been going on ever since chiropractic was developed as an individual discipline in the late 1800's, and that in the years between then and now the debate had generated considerable more heat than light."

"By the end of the inquiry we found ourselves irresistibly and with complete unanimity drawn to the conclusion that modern chiropractic is a soundly based and valuable branch of the health care in a specialized area..."

Their report includes the following findings:
Chiropractic is a branch of the healing arts specializing in the correction by spinal manual therapy of what chiropractors identify as biomechanical disorders of the spinal column - they carry out spinal diagnosis and therapy at a sophisticated and refined level; Chiropractors are the only health practitioners who are necessarily equipped by their education and training to carry out spinal manual therapy; General medical practitioners and physiotherapists have no adequate training in spinal manual therapy; Spinal manual therapy in the hands of a registered chiropractor is safe; The education and training of a registered chiropractor are

sufficient to enable him/her to determine whether there are contraindications to spinal manual therapy in a particular case, and whether the patient should have medical care instead of or as well as chiropractic care.

Spinal manual therapy can be effective in relieving musculoskeletal symptoms, such as back pain and other symptoms known to respond to such therapy, such as migraine; In a limited number of cases where there are organic and/or visceral symptoms, chiropractic treatment may provide relief, but this is unpredictable, and in such cases the patient should be under concurrent medical care if that is practicable; In the public interest and in the interests of patients, there must be no impediment to full professional cooperation between chiropractors and medical practitioners; It is wrong that the present law, or any medical ethical rules, should have the effect that a patient can receive spinal manual therapy which is subsidized by a health benefit only from those health professionals least qualified to deliver it; The responsibility for spinal manual therapy training, because of its specialized nature, should lie with the chiropractic profession and part-time or vacation courses in spinal manual therapy for other health professionals should not be encouraged.

- New Zealand Report. Hasselberg PD. Government Printer, Wellington - 1979.

13)
THE SWEDEN REPORT

Up until the late 1980's, Sweden had no legislation regulating the practice of chiropractic, although there were approximately 100 chiropractors in Sweden educated in accredited chiropractic colleges. In 1987, a commission on Alternative Medicine in Sweden conducted a detailed investigation of chiropractic education. They had the scientific literature assessed by university medical faculty and additionally commissioned a demographic survey by Statistics Sweden. Subsequent to the report, the Swedish government passed legislation recognizing and regulating the chiropractic profession in Sweden. Then, together with the governments from Denmark, Finland and Norway, it established a school of chiropractic at the University of Odense in Denmark to provide a regional chiropractic college for students from those countries.

The reports findings included:

Doctors of chiropractic should become registered practitioners and be brought within the national insurance system in Sweden;
Training for Doctors of Chiropractic follows a 4-5 year course of university level training and was found to be the equivalent to Swedish medical training - chiropractors have "competence in differential diagnosis" and should be regulated on a primary care basis"; "Measures to improve cooperation between chiropractors, registered medical practitioners and physiotherapists are vital" in the public interest.
Ref 11 Supra.

14)
THE AUSTRALIAN REPORT
In July of 1984 the Australian Federal Minister for Health asked their Medicare Benefits Review Committee to "consider requests for extending the scope of Medicare (government-funded health care) arrangements to provide benefits for certain paramedical services" - which included chiropractic services.

The Committee recommended funding for chiropractic in hospitals and other public institutions, and stated:
"We are aware of the very considerable organizational and professional obstacles... orthodox practitioners and, indeed, some chiropractors may initially find the experience an uneasy one, but we consider the differences that currently exist to be unreasonable and efforts should be made to bridge the gap."

"... the continuing schism between the two professions does little to help improve the health of the many Australians who might benefit from a joint chiropractic/medical approach to their problems."

- Second Report Medicare Benefits Review Committee. Thompson CJ. Commonwealth Government Printer, Canberra, Australia, Chapter 10 (Chiropractic) - June 1986.

15)
A Comparison of Health Care Costs for Chiropractic and Medical Patients
J Manipulative Physiol Ther 1993 (Jun); 16 (5): 291–299
Stano M; School of Business Administration, Oakland University, Rochester, MI 48039
http://www.ncbi.nlm.nih.gov/pubmed/8345311?dopt=Abstract
OBJECTIVE: To compare the health care costs of patients who have received chiropractic treatment for common neuromusculoskeletal disorders with those treated solely by medical and osteopathic physicians.
DESIGN: Retrospective statistical analysis of 2 yr of claims data on various categories of utilization and insurance payments for a large national sample of patients. SETTING: Ambulatory and inpatient care.
PATIENTS: A total of 395,641 patients with one or more of 493 neuromusculoskeletal ICD-9 codes.
OUTCOME MEASURES: Hospital admission rates and 10 categories of insurance payments.
RESULTS: Nearly one-fourth of patients were treated by chiropractors. Patients receiving chiropractic care experienced significantly lower health care costs as represented by third party payments in the fee-for-service sector. Total cost differences on the order of $1,000 over the 2-yr period were found in the total sample of patients as well as in subsamples of patients with specific disorders. The lower costs are attributable mainly to lower inpatient utilization. The cost differences remain statistically significant after controlling for patient demographics and insurance plan characteristics.
CONCLUSIONS: Although work is in progress to control for possible variations in

case mix and to compare outcomes in addition to costs, these preliminary results suggest a significant cost-saving potential for users of chiropractic care. The results also suggest the need to reexamine insurance practices and programs that restrict chiropractic coverage relative to medical coverage.

16)
Health Maintenance Care in Work-Related Low Back Pain and Its Association With Disability Recurrence
Journal of Occupational and Environmental Medicine 2011 (Apr); 53 (4): 396–404;
http://www.ncbi.nlm.nih.gov/pubmed/21407100
This study found that **you are twice as likely to end up disabled if you get your care from a Physical Therapist**, rather than from a DC, and that **patients were 60% more likely to be disabled if they choose an MD to manage their care**, rather than a DC.

17)
A Hospital-Based Standardized Spine Care Pathway: Report of a Multidisciplinary, Evidence-Based Process

J Manipulative Physiol Ther 2011 (Feb); 34 (2): 98–106
http://www.ncbi.nlm.nih.gov/pubmed/21334541
A health care facility (Jordan Hospital) implemented a multidimensional spine care pathway (SCP) using the National Center for Quality Assurance (NCQA) Back Pain Recognition Program (BPRP) as its foundation. The findings for 518 consecutive patients were included. One hundred sixteen patients were seen once and triaged to specialty care; 7% of patients received magnetic resonance imagings. **Four hundred thirty-two patients (83%) were classified and treated by doctors of chiropractic and/or physical therapists**. Results for the patients treated by doctors of chiropractic were mean of 5.2 visits, mean cost per case of $302, mean intake pain rating score of 6.2 of 10, and mean discharge score of 1.9 of 10; **95% of patients rated their care as "excellent**.

18)
Cost-effectiveness of Guideline-endorsed Treatments for Low Back Pain:A Systematic Review
Eur Spine J. 2011 (Jan 13) [Epub ahead of print]
http://www.ncbi.nlm.nih.gov/pubmed/21229367
This systematic review of the cost-effectiveness of treatments endorsed in the APS-ACP guidelines found that spinal manipulation was cost-effective for subacute and chronic low back pain, as were other methods usually within the chiropractor's scope of practice (interdisciplinary rehabilitation, exercise, and acupuncture). For acute low back pain, this review found insufficient evidence for reaching a conclusion about the cost-effectiveness of spinal manipulation. It also found no evidence at all on the cost-effectiveness of medication for low back pain..

19)
Cost of Care for Common Back Pain Conditions Initiated With Chiropractic Doctor vs Medical Doctor/Doctor of Osteopathy as First Physician: Experience of One Tennessee-Based General Health InsurerJ Manipulative
Physiol Ther 2010 (Nov); 33 (9): 640–643
http://www.jmptonline.org/article/S0161-4754%2810%2900216-2/abstract

Paid costs for episodes of care initiated with a DC were almost 40% less than episodes initiated with an MD. Even after risk adjusting each patient's costs, we found that episodes of care initiated with a DC were 20% less expensive than episodes initiated with an MD. **This clearly demonstrates the savings that are possible when a patient is permitted to choose a chiropractor, rather than an MD for their care.**

20)
Clinical Utilization and Cost Outcomes from an Integrative Medicine Independent Physician Association: An Additional 3-year Update
J Manipulative Physiol Ther 2007 (May); 30 (4): 263–269
http://www.ncbi.nlm.nih.gov/pubmed/17509435
A new retrospective analysis of 70,274 member-months in a 7-year period within an IPA, comparing medical management to chiropractic management, **demonstrated decreases of 60.2% in-hospital admissions, 59.0% hospital**

days, 62.0% outpatient surgeries and procedures, and 83% pharmaceutical costs when compared with conventional medicine IPA performance. This clearly demonstrates that chiropractic nonsurgical nonpharmaceutical approaches generates reductions in both clinical and cost utilization when compared with PCPs using conventional medicine alone.

21)
Effects of a Managed Chiropractic Benefit on the Use of Specific Diagnostic and Therapeutic Procedures in the Treatment of Low Back and Neck Pain
J Manipulative Physiol Ther 2005 (Oct); 28 (8): 564–569
http://www.ncbi.nlm.nih.gov/pubmed/16226623
For the treatment of low back and neck pain, **the inclusion of a chiropractic benefit resulted in a reduction in the rates of surgery, advanced imaging, inpatient care, and plain-film radiographs** . This effect was greater on a per-episode basis than on a per-patient basis.

22)
Cost-effectiveness of Medical and Chiropractic Care for Acute and Chronic Low Back Pain
J Manipulative Physiol Ther 2005 (Oct); 28 (8): 555–563
http://www.ncbi.nlm.nih.gov/pubmed/16226622
Acute and chronic chiropractic patients experienced better outcomes in pain, functional disability, and patient satisfaction. Chiropractic care appeared relatively cost-effective for the treatment of chronic LBP. Chiropractic and medical care performed comparably for acute patients. **Practice-based clinical outcomes**

were consistent with systematic reviews of spinal manipulation efficacy: manipulation-based therapy is at least as good as and, in some cases, better than other therapeusis. This evidence can guide physicians, payers, and policy makers in evaluating chiropractic as a treatment option for low back pain.

23)
Cost Effectiveness of Physical Treatments for Back Pain in Primary Care
British Medical Journal 2004 (Dec 11); 329 (7479): 1381
http://www.bmj.com/content/329/7479/1381.full

We believe that this is the first study of physical therapy for low back pain to show convincingly that both manipulation alone and manipulation followed by exercise provide cost effective additions to care in general practice. Indeed, as we trained practice teams in the best care of back pain, we may have underestimated the benefit of physical therapy (spinal manipulation) when compared with "usual care" in general practice. The detailed clinical outcomes reported in the accompanying paper reinforce these findings by showing that the improvements in health status reported here reflect statistically significant improvements in function, pain, disability, physical and mental aspects of quality of life, and beliefs about back pain.(1)

24)
Comparative Analysis of Individuals With and Without Chiropractic Coverage: Patient Characteristics, Utilization, and Costs
Archives of Internal Medicine 2004 (Oct 11); 164 (18): 1985–1892
http://archinte.ama-assn.org/cgi/content/full/164/18/1985
A 4-year retrospective claims data analysis comparing more than 700,000 health plan members within a managed care environment found that **members had lower annual total health care expenditures, utilized x-rays and MRIs less, had less back surgeries**, and for patients with chiropractic coverage, compared with those without coverage, **also had lower average back pain episode-related costs ($289 vs $399)**.
The authors concluded: "Access to managed chiropractic care may reduce overall health care expenditures through several effects, including (1) positive risk selection; **(2) substitution of chiropractic for traditional medical care, particularly for spine conditions**; (3) more conservative, less invasive treatment profiles; and (4) lower health service costs associated with managed chiropractic care

25)
An Evaluation of Medical and Chiropractic Provider Utilization and Costs: Treating Injured Workers in North Carolina
J Manipulative Physiol Ther 2004 (Sep); 27 (7): 442–448
http://www.ncbi.nlm.nih.gov/pubmed/15389175
These data, with the acknowledged limitations of an insurance database, indicate lower treatment costs, less workdays lost, lower compensation payments, and lower utilization of ancillary medical services for patients treated by DCs. Despite the lower cost of chiropractic management, the use of

chiropractic services in North Carolina appears very low.

26)
Chiropractic Care: Is It Substitution Care or Add-on Care in Corporate Medical Plans?
J Occup Environ Med 2004 (Aug);46 (8):847-855
http://www.ncbi.nlm.nih.gov/pubmed/15300137
An analysis of claims data from a managed care health plan was performed to evaluate whether patients use chiropractic care as a substitution for medical care or in addition to medical care. For the 4-year study period, there were 3,129,752 insured member years in the groups with chiropractic coverage and 5,197,686 insured member years in the groups without chiropractic coverage. **These results (of this file review) indicate that patients use chiropractic care as a direct substitution for medical care.**

27)
Clinical and Cost Outcomes of an Integrative Medicine IPA
J Manipulative Physiol Ther 2004 (Jun) ; 27 (5): 336–347
http://www.ncbi.nlm.nih.gov/pubmed/15195041
Analysis of clinical and cost outcomes on 21,743 member months over a 4-year period demonstrated decreases of 43.0% in hospital admissions per 1000, 58.4% hospital days per 1000, 43.2% outpatient surgeries and procedures per 1000, and 51.8% pharmaceutical cost reductions when compared with normative conventional medicine IPA performance for the same HMO product in the same geography over the same time frame.

28)
A Practice-Based Study of Patients With Acute and Chronic Low Back Pain Attending Primary Care and Chiropractic Physicians: Two-Week to 48-Month Follow-up
J Manipulative Physiol Ther 2004 (Mar); 27 (3): 160–169
http://www.ncbi.nlm.nih.gov/pubmed/15129198
This study found that chiropractic care is more effective than medical care at treating chronic low-back pain in patients' first year of symptoms.

29)
Cost Effectiveness of Physiotherapy, Manual Therapy, and General Practitioner Care for Neck Pain: Economic Evaluation Alongside a Randomised Controlled Trial
British Medical Journal 2003 (Apr 26); 326 (7395): 911
http://www.bmj.com/content/326/7395/911.full
A hands-on approach to treating neck pain by manual therapy may help people get better faster and at a lower cost than more traditional treatments, according to this study. **After seven and 26 weeks, they found significant improvements in recovery rates in the manual therapy group compared to the other 2 groups**. For example, at week seven, 68% of the manual therapy group had recovered from their neck pain vs. 51% in the physical therapy group and 36% in the medical care group.

30)
Chiropractic Treatment of Workers' Compensation Claimants in the State of Texas
MGT of America, Austin, Texas ~ February 2003
http://www.dynamicchiropractic.com/mpacms/dc/article.php?id=9212
In 2002, the Texas Chiropractic Association (TCA) commissioned an independent study to determine the use and effectiveness of chiropractic with regard to workers' compensation, the results of which were published in February 2003. According to the report, **chiropractic care was associated with significantly lower costs and more rapid recovery in treating workers with low-back injuries**. They found: Lower back and neck injuries accounted for 38 percent of all claims costs. Chiropractors treated about 30 percent of workers with lower back injuries, but were responsible for only 17.5 percent of the medical costs and 9.1 percent of the total costs. **These findings were even more intertesting:** The average claim for a worker with a low-back injury was $15,884. However, if a worker received at least 75 percent of his or her care from a chiropractor, the total cost per claimant decreased by nearly one-fourth to $12,202. **If the chiropractor provided at least 90 percent of the care, the average cost declined by more than 50 percent, to $7,632**.

31)
Manual Therapy, Physical Therapy, or Continued Care by a General Practitioner for Patients with Neck Pain. A Randomized, Controlled Trial
Ann Intern Med 2002 (May 21); 136 (10): 713-722
http://www.ncbi.nlm.nih.gov/pubmed/12020139
Neck pain is a common problem, but the effectiveness of frequently applied conservative therapies has never been directly compared. **In this study, manual therapy was a favorable treatment option for patients with neck pain compared with physical therapy or continued care by a general practitioner.**

32)
Patient Satisfaction With the Chiropractic Clinical Encounter
Abstract #19986
Patient satisfaction with the chiropractic clinical encounter
Karen T. Boulanger, BA, Cheryl Hawk, DC, PhD, and Cynthia R. Long, PhD.
Palmer Center for Chiropractic Research, 741 Brady Street, Davenport, IA 52803, 319-884-5160, Boulanger_k@palmer.edu
http://apha.confex.com/apha/129am/techprogram/paper_19986.htm
Data were collected from 2986 adult patients of 172 U.S. and Canadian chiropractors in a practice-based research program over a one-week period in November 1999. Of the 1822 patients reporting pain, 56.2% rated the care they received for it as "excellent," 30.6% "very good;" 9.3% "good;" 1.3% "fair;" and 0.2% "poor;" 2.0% did not respond. Patients were quite satisfied with the care they received with 83% reporting that their chiropractor always listened carefully to them and always explained things in a way they could understand; 88% reported their chiropractor always showed respect for what they had to say; 78% felt their chiropractor always spent enough time with them.

33)
Studies on Chiropractic: Patient Satisfaction

Cherkin, D.C., MacCornack, F.A. (1989) "Patient Evaluation of Low Back Pain Care from Family Physicians and Chiropractors", Western Journal of Medicine, Vol.150(3), pp. 351-355..,

Garrett, J., Jackman, A., Mclaughlin, C., Fryer, J., Smucker, D.R. (1995) "The Outcomes and Costs of Care for Acute Low Back Pain Among Patients Seen By Primary Care Practitioners, Chiropractors, and Orthopedic Surgeons", New England Journal of Medicine, Vol. 333, pp. 913-917.

Shekelle, P.G., Markovich, M., Louie, R. (1995) "Factors Associated with Choosing a Chiropractor for Episodes of Back Pain Care", Medical Care, Vol. 33, pp. 842-850.

http://www.ncbi.nlm.nih.gov/pubmed/8423419
http://www.ncbi.nlm.nih.gov/pubmed/9168407
http://www.chiro.org/ChiroZine/ABSTRACTS/Patient_Satisfaction_With_Chiropractic.shtml
http://www.ncbi.nlm.nih.gov/pubmed/11753328
http://www.ncbi.nlm.nih.gov/pubmed/7666878
http://www.ncbi.nlm.nih.gov/pubmed/8184314

In today's consumer driven health care environment, patient satisfaction is an important health outcome measure. There have been several surveys conducted in recent years assessing patient satisfaction with chiropractic care, which was found to be extremely high. In addition, these surveys invariably found that the level of satisfaction was significantly higher for care received from chiropractors in comparison to the medical profession. Surveys have also indicated that chiropractic patients are willing to return for chiropractic treatment for a similar condition and would recommend chiropractic treatment to friends, family and colleagues.

34)
Testimony to the Department of Veterans Affairs' Chiropractic Advisory Committee

George B. McClelland, D.C., Foundation for Chiropractic Education and Research ~ March 25, 2003
http://www.chiro.org/LINKS/ABSTRACTS/Testimony_to_the_Department_of_Veterans_Affairs.shtml

From a number of studies, there is little to contradict the assertion that patient satisfaction with chiropractic care, in a variety of settings, has consistently been high. [1-4] Indeed, for matched back pain conditions, patient satisfaction with chiropractic treatment has invariably been shown to be significantly greater than that with conventional management [administered by a primary care physician, an orthopedist, or an HMO provider]. [5-7] Satisfied patients are far more likely to be compliant in their treatment, [8] theoretically bestowing chiropractic patients with yet another advantage over treatment by other providers in terms of outcomes.

B) Safety of Chiropractic

35)
Safety of Chiropractic: Review of history

In the early 1960's, the American Medical Association (AMA) decided to try to

contain and eliminate Chiropractic as a profession. [1] The AMA's purpose was to prevent medical physicians from referring patients to Chiropractors, as well as preventing them from accepting referrals from Chiropractors; to prevent Chiropractors from obtaining access to hospital diagnostic and radiology services; to prevent medical physicians from teaching at chiropractic colleges, or engaging in any joint research; and, to stifle any other form of cooperation between the two professions. The AMA also told its membership, medical students, insurance companies, and the general public that Chiropractic was an "unscientific cult".

In 1976, five Chiropractors filed a lawsuit against the AMA (and other named entities) for violation of the Sherman Anti-trust Laws. After 15 years of litigation, the U.S. Court of Appeals stated that the AMA intended to "destroy a competitor," and that there was evidence "showing that the AMA was motivated by economic concerns". The court found that the AMA had concealed evidence showing its guilt, and was caught "doctoring" documents. The AMA was also "guilty of systematic, long term wrong doing and has not acknowledged its lawlessness". [1]

Following the Court enforced reversal of AMA's policy, tiny splinter groups formed, with the intention of labeling chiropractic as a quackish cult. Their methods mimicked the earlier AMA suppression tactics: Create doubt about the quality of chiropractic education, and mislead the public into believing that chiropractic claims ALL disease is caused by subluxations. Although these groups hide behind the noble claim that they wish to protect the public from unscientific practices, their true motives are transparent. Their sole intention is to suggest that only allopathic medicine is well supported by scientific research, which is hardly true!

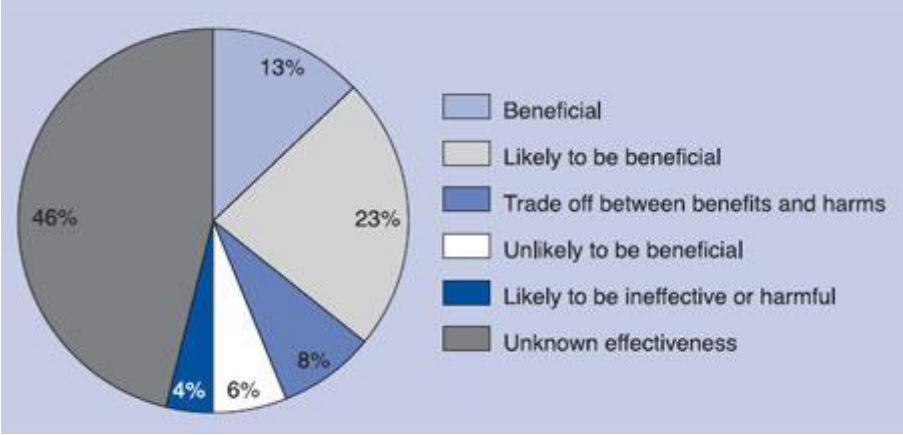
In an editorial in the highly esteemed *British Medical Journal*, titled *Where is the Wisdom? The Poverty of Medical Evidence*, BMJ's editor Dr. Richard Smith recounts a lecture he attended with renowned health policy consultant Dr. David Eddy. Eddy found, after doing significant research, that only about 13% of medical interventions are supported by, solid scientific evidence and that only 1% of the articles in medical journals are scientifically sound. Why is that? Because most of those articles quote from other articles which make unsupported and unfounded claims.

The Increasing Popularity of Alternative Medicine

After publication of David M. Eisenberg's 1993 *New England Journal of Medicine* article (*Unconventional Medicine in the United States*), various factions of modern medicine became increasingly anxious and aggressive in their accusations that alternative approaches to medical healthcare were not supported by research. [2]

This same group was NOT forthcoming in mentioning the small fraction of established medical practices that have ever met these same stringent requirements. They certainly never mention the low level of success which medicine delivers for the same health complaints that chiropractic is so famous for.

Interesting Sidebar from the British Medical Journal
Scientific heavyweights deplore the NHS money wasted on "unproved and disproved" treatments used by practitioners of complementary and alternative medicine (CAM), [1 2] but Lewith, a CAM proponent (see previous letter), is cited elsewhere as saying that the BMJ reckons that 50% of the treatments used in general practice aren't proved, and 5% are pretty harmful but still being used. [3]
His data were taken from the BMJ Clinical Evidence website. A pie chart (see it below in the Evidence-based Practice posting) indicates that, of about 2500 treatments supported by good evidence, only 15% of treatments were rated as beneficial, 22% as likely to be beneficial, 7% part beneficial and part harmful, 5% unlikely to be beneficial, 4% likely to be ineffective or harmful, and in the remaining 47% the effect of the treatment was "unknown."



Read more on this topic

The text says, "The figures suggest that the research community has a large task ahead and that most decisions about treatments still rest on the individual judgements of clinicians and patients." On 9 October 2007 the situation had changed—but not for the better. Treatments rated "beneficial" had decreased from 15% to 13%.

REFERENCES:
1. Kamerow D. Wham, bang, thank you CAM. British Medical Journal 2007 (Sep 29); 335: 647

2. Colquhoun D. What to do about CAM? British Medical Journal 2007 (Oct 13); 335: 736
3. Cope J. The great debate. Healthwriter 2007 (Apr): 1-3.

The High Risks of the Medical Approach
Dr. Lucian Leape, researcher at the Harvard Medical School of Public Health, also states that only 13% of medical procedures have ever been tested for appropriateness by randomized trials. He noted that adverse events occurred in 3.7 percent of all hospitalizations. Worse yet, 13.6 percent of those adverse events led to death! [3]. He is also quoted as saying:

"Medicine is now a high risk industry, like aviation. But, the chance of dying in an aviation accident is one in 2 million, while the risk of dying from a medical accident is one in 200!" [4]

The most comprehensive review of "adverse events" (also referred to as "Iatrogenic Injury") caused by modern medicine is the article *Death by Medicine*, written by Gary Null, Ph.D.; Carolyn Dean MD, ND; Martin Feldman, MD; Debora Rasio, MD; and Dorothy Smith, PhD. [5].

This fully referenced report reveals that:

- 2.2 million people experience in-hospital, adverse reactions to prescribed drugs per year.
- 20 million unnecessary antibiotics are prescribed annually for viral infections
- 7.5 million unnecessary medical and surgical procedures are performed annually, and

- 8.9 million people are exposed to unnecessary hospitalization every year!

The most stunning statistic, however, is that the total number of deaths caused by conventional medicine is an astounding 783,936 per year!
That is a mind-boggling 2147 people killed daily!
That's 7 jumbo jet plane crashes, each and every day.
That's a 9-11 incident occurring every other day...FOREVER.

The Safety of Chiropractic
Canada has a government-run national health care system. As occurred with Medicare in this country, there had been such pressure on the Canadian government to include chiropractic as a covered benefit, that the Ontario Ministry of Health hired a renowned heath care economist to make a recommendation. The first "Manga Report" [6] was published in 1993.

This comprehensive study reviewed all the published literature on low back pain and made some astounding suggestions. In a nutshell, it concluded that: chiropractic should be the treatment of choice for low back pain – excluding traditional medical care altogether!

The specific Findings of the report were:

- There is an overwhelming body of evidence indicating that chiropractic management of low-back pain is more cost-effective than medical management
- Many medical therapies are of questionable validity or are clearly inadequate

- There is no clinical or case-control study that demonstrates or even implies that chiropractic spinal manipulation is unsafe in the treatment of low-back pain. Some medical treatments are equally safe, but others are unsafe and generate iatrogenic complications for LBP patients.
- Chiropractic is more cost-effective. There would be highly significant cost savings if more management of LBP was transferred from medical physicians to chiropractors.
- There is good empirical evidence that patients are very satisfied with chiropractic management of LBP and considerably less satisfied with physician management

The specific Recommendations were:

- Chiropractic services should be fully insured under the Ontario Health Insurance Plan
- Chiropractic services should be fully integrated into the health care system. Because of the high incidence and cost of LBP, hospitals, managed health care groups, community health centers, comprehensive health organizations, and health service organizations and long-term care facilities should employ chiropractors on a full-time and/or part-time basis
- A good case could be made for placing chiropractic as the gatekeepers for all musculoskeletal complaints that presented to hospitals.

More Bad News For Medical Patients

A series of articles reporting on the lack of medical training in musculoskeletal disorders was published between 1998 and 2002 by Kevin B. Freedman, MD [7], [8]. It seems that the department chairs of several hospital-based orthopedic residency programs designed a basic examination on musculoskeletal competency and gave it to their residents. 82 per cent of medical school graduates failed the examination. Four years later the test was simplified and, once again, 78% of the examinees failed to demonstrate basic competency in musculoskeletal medicine. When this test was given to final quarter chiropractic students 70% of them passed the exact same exam! [9]

The differences between these 2 student groups should be noted. The medical students had already graduated from medical school (as MDs) and had completed their rotations through various hospital departments. Finally, they had been accepted into a hightly competitive orthopedic residency program...the pinnacle of medical musculoskeletal specialists. The chiropractic students however were still just students. 80% medical failure versus 70% chiropractic success

A. The Safety of Cervical Adjusting

No one pays closer attention to injury statistics than Malpractice Insurance carriers. Scott Haldeman, DC, PhD, MD, reviewed malpractice claims records for a 10-year period between 1988 and 1997. In reviewing the outcomes following the application of 134.5 million cervical manipulations (commonly referred to as the chiropractic adjustment), the records indicated that there were 23 reported cases of stroke or vertebral artery dissection (VAD). [10] Of this group, 10 of the patients had the complicating factors of high blood pressure, use of oral contraceptives, or a history of smoking, all of which are associated with vascular disease. The actual incidence of stroke or VAD following cervical manipulation was found to be one per 5.85 million cervical adjustments. That means that the average chiropractor could work for 1430 years (or practice 48 full chiropractic careers!) before they might be involved with this type of litigation.

Other reports listing a higher frequency of adverse events have been compromised by the tendency of those authors to inappropriately list the practitioner as a chiropractor, even when it turned out that the injury was caused by a medical doctor, a physical therapist or a hairdresser! [11], [12]

Rather than raising concerns about the safety of chiropractic, these statistics emphasize that spinal manipulation, in the hands of unskilled practitioners, is dangerous, and the practice must be closely regulated. [13]

The *World Health Organization* recently released a comprehensive set of guidelines that clearly states that chiropractic is a separate profession, rather than a set of techniques that can be learned in short courses by other health professionals. They also make it clear that medical doctors and other health professionals, in countries where the practice of chiropractic is not regulated by law, should undergo extensive training to re-qualify as chiropractors before claiming to offer chiropractic services. In some countries there have been recent efforts by medical groups to provide short courses of approximately 200 hours in chiropractic technique. WHO's guidelines indicate that a medical graduate should a require an additional minimum of 1800 class hours, including 1000 hours of supervised clinical training, before claiming to offer chiropractic services. [14]

B. The Safety of Low Back Adjusting

Lower back injury alleged to have occurred following spinal manipulative therapy has been reported in patients with pre-existing disc herniation or prolapse. While it is suggested that the forces required to cause a disruption of the annular fibers of the healthy intervertebral disc well exceed that of a rotational manipulative thrust, some disc herniation/protrusion may certainly be aggravated by an inappropriately applied manipulative maneuver, as it may be by other simple activities of daily living such as bending, sneezing, or lifting. The most frequently described severe complication is compression of the cauda equina by massive midline nuclear herniation at the level of the 3rd, 4th or 5th intervertebral disc.

Of the 30 cauda equina complications associated with manipulation reported in the French, German and English literature over an 80 year period, only 8 were allegedly related to chiropractic treatment. [15]

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C) Patient Satisfaction

36)
Consumer Reports Lists Chiropractic Patients As Most Satisfied
Consumer Reports ~ May 2009
http://www.consumerreports.org/cro/magazine-archive/may-2009/health/back-pain/overview/back-pain-ov.htm
A study in the May issue of Consumer Reports shows that hands-on therapies were tops among treatments for relief of back pain. The study, which surveyed more than 14,000 consumers, was conducted by the Consumer Reports Health Ratings Center. The report states that, "eighty-eight percent of those who tried chiropractic manipulation said it helped a lot, and 59 percent were 'completely' or 'very' satisfied with their chiropractor."

37)
Consumer Reports ~ May 2009 plus this second review.
April 10, 2009
http://www.consumerreports.org/cro/magazine-archive/may-2009/health/back-pain/overview/back-pain-ov.htm
A study in the May issue of Consumer Reports shows that hands-on therapies were tops among treatments for relief of back pain. The study, which **surveyed more than 14,000 consumers**, was conducted by the Consumer Reports Health Ratings Center.

According to the report, the survey respondents tried a variety of different treatments and rated the treatments on how helpful and satisfied they were with the results. The report concluded that hands-on therapies were the top-rated, and that, "eighty-eight percent of those who tried chiropractic manipulation said it helped a lot, and 59 percent were 'completely' or 'very' satisfied with their chiropractor."

Results at a glance:

Professional	Highly satisfied
Chiropractor	**59%**
Physical therapist	55%
Acupuncturist	53%
Physician, specialist	44%
Physician, primary-care doctor	**34%**

From the article:

About 80 percent of U.S. adults have at some point been bothered by back pain. The Consumer Reports Health Ratings Center recently surveyed more than 14,000 subscribers who had lower-back pain in the past year but had never had back surgery. **More than half said pain severely limited their daily routine for a week or longer, and 88 percent said it recurred through the year**. Many said the pain interfered with sleep, sex, and efforts to maintain a healthy weight. Back pain can be tough to treat. Most of our respondents tried five or six different treatments. They rated the helpfulness of the treatments tried and their satisfaction with the health-care professionals visited.

Hands-on therapies were among the top-rated. Fifty-eight percent of those who tried chiropractic manipulation said it helped a lot, and 59 percent were "completely" or "very" satisfied with their chiropractor. Massage and physical therapy were close runners-up.

Many of those who tried spinal injections found them to be very helpful, although the techniques their doctors used varied. Most respondents had used some type of medication. Forty-five percent of those who took prescription drugs said they helped a lot, double the percentage of those who said they were helped by over-the-counter medications.

38)
Chiropractic Services in the Canadian Armed Forces: A Pilot Project
Military Medicine 2006 (Jun); 171 (6): 572–576
http://www.ncbi.nlm.nih.gov/pubmed/16808144?dopt=AbstractPlus
This article reports on satisfaction associated with the introduction of chiropractic services within a military hospital, through a Canadian Armed Forces Pilot Project. We distributed a 27-item survey that inquired about demographic information and satisfaction with chiropractic services to 102 military personnel presenting for on-site chiropractic services at the Archie McCallum Hospital in Halifax, Nova Scotia. **The majority of military personnel (94.2%) and referring physicians (80.0%) expressed satisfaction with chiropractic services.**

39)
Factors Associated With Patient Satisfaction With Chiropractic Care:Survey and Review of the Literature
J Manipulative Physiol Ther 2006 (Jul); 29 (6): 455–462
http://www.ncbi.nlm.nih.gov/pubmed/16904491
The results here generally confirm the findings elsewhere in the literature. Of the 23% of the adult population who have ever visited a chiropractor, overall rates of satisfaction are once again found to be quite high (83% satisfied or better) and the number dissatisfied is quite low (less than 10% dissatisfied or very dissatisfied). This is remarkable given the fact that much of the financial burden of the care is borne by patients, and the preponderance of care is for difficult chronic problems of back and neck.

40)
Symptomatic Outcomes and Perceived Satisfaction Levels of Chiropractic Patients with a Primary Diagnosis Involving Acute Neck Pain
J Manipulative Physiol Ther 2006 (May); 29 (4): 288–296
http://www.ncbi.nlm.nih.gov/pubmed/16690383
A total of 115 patients were contacted, of whom 94 became study participants, resulting in 60 women (64%) and 34 men. The mean age was 39.6 years (SD, 15.7). The mean number of visits was 24.5 (SD, 21.2). Pain levels improved significantly from a mean of 7.6 (median, 8.0) before treatment to 1.9 (median, 2.0) after treatment ($P < .0001$). **The overall patient satisfaction rate was 94%.**

41)
Back Pain and Satisfaction with Chiropractic Treatment: What Role Does the Physical Outcome Play?
Clin J Pain 2005 (Jul); 19 (4): 263–268
http://www.ncbi.nlm.nih.gov/pubmed/12840621?dopt=Abstract
Patients were asked about effects on pain, anxiety, normal activity, work, depression, lifestyle, satisfaction, and overall improvement. Stepwise multiple regression analyses were used to evaluate the contribution of change scores to overall improvement and satisfaction. There are initial indications in the literature that information giving, and the reconfiguration of patients' perceptions of the problem, may contribute to patient satisfaction generally.

42)
Patient Satisfaction With Chiropractic Physicians In An Independent Physicians' Association
J Manipulative Physiol Ther 2001 (Nov); 24 (9): 556–559
http://www.ncbi.nlm.nih.gov/pubmed/11753328
Various aspects of chiropractic care were given a rating of "excellent" by the following percentage of respondents: Length of time to get an appointment (84.9%); convenience of the office (57.7%); access to the office by telephone (77.3%); length of wait at the office (75.7%); time spent with the provider (74.3%); explanation of what was done during the visit (72.8%); technical skills of the chiropractor (83.3%); and the personal manner of the chiropractor (92.4%). The visit overall was rated as excellent by 83.3% of responders, and 95.5% stated they would definitely recommend the provider to others.

43)
Patient Characteristics, Practice Activities, and One-month Outcomes for Chronic, Recurrent Low-back Pain Treated by Chiropractors and Family Medicine Physicians: A Practice-based Feasibility Study
J Manipulative Physiol Ther 2000 (May); 23 (4): 239–245
http://www.ncbi.nlm.nih.gov/pubmed/10820296?dopt=Abstract
Patients with chronic low-back pain treated by chiropractors show greater improvement and satisfaction at 1 month than patients treated by family physicians. Nonclinical factors may play an important role in patient progress.

Findings from the Health Resources and Services Administration-funded project will include a report on the influence of practice activities, including more frequent visits by chiropractic patients, on the clinical course of low-back pain and patient outcomes.

44)
Patient Satisfaction With Chiropractic Care in Los Angeles
AHSR FHSR Annu Meet Abstr Book 1994; 11: 11
http://gateway.nlm.nih.gov/MeetingAbstracts/ma?f=102211961.html
This RAND Corporation Study found **For overall care, 92% of the patients choose the care as either excellent or the best**. Although the ratings on all the items are high the highest ratings were given to the more personal qualities of the practitioner: courtesy, politeness, and respect shown to the patient (92%); interest shown in the patient as a person (91%); willingness to listen (89%); ability to put the patient at ease (89%). These results support those of previous studies on chiropractic that suggest that the high satisfaction with chiropractic care is a result more of the personal health encounter than the therapeutic outcome. They also suggest that other providers could learn much from the interpersonal art of chiropractors.

45)
Patient Satisfaction With Chiropractic Care
J Manipulative Physiol Ther 1993 (Jan); 16 (1): 25–32
http://www.ncbi.nlm.nih.gov/pubmed/8423419
Patients expressed high levels of satisfaction with their doctors and the care they received. Although women were slightly more satisfied than men, other patient characteristics such as level of education, income, employment status or previous chiropractic care did not influence response means.

46)
The Chiropractic Outcome Study: Pain, Functional Ability and Satisfaction With Care
J Manipulative Physiol Ther 1997 (May); 20 (4): 235–240
http://www.ncbi.nlm.nih.gov/pubmed/9168407
Based on these results, it seems that patients suffering from back and/or neck complaints experience chiropractic care as an effective means of resolving or ameliorating pain and functional impairments, thus reinforcing previous results showing the benefits of chiropractic treatment for back and neck pain.

47)
Patient Satisfaction With the Chiropractic Clinical Encounter: Report From a Practice-based Research Program
Journal of the Neuromusculoskeletal System 2001: 9 (4): 109–117
http://www.chiro.org/ChiroZine/ABSTRACTS/Patient_Satisfaction_With_Chiropractic.shtml
The majority of patients were highly satisfied with their care; 85.0% reported that their chiropractor always listened carefully; 85.3% that the DC explained things understandably; 88.2% that the DC showed respect for what they had to say; and

75.6% that he/she involved them in decisions as much as they wanted. The median proportion of patients, per DC, with a chief complaint who said their doctor always spent enough time with them was 82% (IQR: 19%) and 82.3% reported that their chiropractors never recommended more visits than necessary.

48)
Patient Satisfaction With Chiropractic Physicians in an Independent Physicians' Association
J Manipulative Physiol Ther 2001 (Nov); 24 (9): 556–559
http://www.ncbi.nlm.nih.gov/pubmed/11753328
Various aspects of chiropractic care were given a rating of "excellent" by the following percentage of respondents: Length of time to get an appointment (84.9%); convenience of the office (57.7%); access to the office by telephone (77.3%); length of wait at the office (75.7%); time spent with the provider (74.3%); explanation of what was done during the visit (72.8%); technical skills of the chiropractor (83.3%); and the personal manner of the chiropractor (92.4%). The visit overall was rated as excellent by 83.3% of responders, and 95.3% stated they would definitely recommend the provider to others.

49)
The Outcomes and Costs of Care for Acute Low Back Pain Among Patients Seen by Primary Care Practitioners, Chiropractors, and Orthopedic Surgeons
N Engl J Med 1995 (Oct 5); 333 (14): 913–917
http://www.ncbi.nlm.nih.gov/pubmed/7666878
The status at six months was ascertained for 1555 of the 1633 patients enrolled in the study (95 percent). The times to functional recovery, return to work, and complete recovery from low back pain were similar among patients seen by all six groups of practitioners, but there were marked differences in the use of health care services. The mean total estimated outpatient charges were highest for the patients seen by orthopedic surgeons and chiropractors and were lowest for the patients seen by HMO and primary care providers. **Satisfaction was greatest among the patients who went to the chiropractors.**

50)
Patient Evaluations of Low Back Pain Care From Family Physicians and Chiropractors
West J Med 1989 (Mar); 150 (3): 351–355
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1026476/pdf/westjmed00127-0095.pdf
Patients of chiropractors were three times as likely as patients of family physicians to report that they were very satisfied with the care they received for low back pain (66% versus 22%, respectively). Compared with patients of family physicians, patients of chiropractors were much more likely to have been satisfied with the amount of information they were given, to have perceived that their provider was concerned about them, and to have felt that their provider was comfortable and confident dealing with their problem.

51)
Comparing the Satisfaction of Low Back Pain Patients Randomized to Receive Medical or Chiropractic Care: Results From the UCLA Low-back Pain Study
Am J Public Health 2002 (Oct); 92 (10): 1628–1633
http://www.ncbi.nlm.nih.gov/pubmed/12356612
Communication of advice and information to patients with low back pain increases their satisfaction with providers and accounts for much of the difference between chiropractic and medical patients' satisfaction.

52)
Patient Satisfaction With the Chiropractic Clinical Encounter
http://apha.confex.com/apha/129am/techprogram/paper_19986.htm
Data were collected from 2986 adult patients of 172 U.S. and Canadian chiropractors in a practice-based research program over a one-week period in November 1999. Of the 1822 patients reporting pain, 56.2% rated the care they received for it as "excellent," 30.6% "very good;" 9.3% "good;" 1.3% "fair;" and 0.2% "poor;" 2.0% did not respond. Patients were quite satisfied with the care they received with 83% reporting that their chiropractor always listened carefully to them and always explained things in a way they could understand; 88% reported their chiropractor always showed respect for what they had to say; 78% felt their chiropractor always spent enough time with them.

53)
Studies on Chiropractic: Patient Satisfaction
http://www.bcchiro.com/bcca/publications-and-resources/studies/patient-satisfaction.html
In today's consumer driven health care environment, patient satisfaction is an important health outcome measure. There have been several surveys conducted in recent years assessing patient satisfaction with chiropractic care, which was found to be extremely high. In addition, these surveys invariably found that the level of satisfaction was significantly higher for care received from chiropractors in comparison to the medical profession. Surveys have also indicated that chiropractic patients are willing to return for chiropractic treatment for a similar condition and would recommend chiropractic treatment to friends, family and colleagues.

54)
Patient Satisfaction With Chiropractic Care
J Manipulative Physiol Ther 1993 (Jan); 16 (1): 25–32
http://www.ncbi.nlm.nih.gov/pubmed/8423419
Patients expressed high levels of satisfaction with their doctors and the care they received. Although women were slightly more satisfied than men, other patient characteristics such as level of education, income, employment status or previous chiropractic care did not influence response means.

55)
The Chiropractic Outcome Study: Pain, Functional Ability and Satisfaction With Care
J Manipulative Physiol Ther 1997 (May); 20 (4): 235–240
http://www.ncbi.nlm.nih.gov/pubmed/9168407
Based on these results, it seems that patients suffering from back and/or neck complaints experience chiropractic care as an effective means of resolving or ameliorating pain and functional impairments, thus reinforcing previous results showing the benefits of chiropractic treatment for back and neck pain.

56)
Patient Satisfaction With the Chiropractic Clinical Encounter: Report From a Practice-based Research Program
Journal of the Neuromusculoskeletal System 2001: 9 (4): 109–117
http://www.chiro.org/ChiroZine/ABSTRACTS/Patient_Satisfaction_With_Chiropractic.shtml
The majority of patients were highly satisfied with their care; 85.0% reported that their chiropractor always listened carefully; 85.3% that the DC explained things understandably; 88.2% that the DC showed respect for what they had to say; and 75.6% that he/she involved them in decisions as much as they wanted. The median proportion of patients, per DC, with a chief complaint who said their doctor always spent enough time with them was 82% (IQR: 19%) and 82.3% reported that their chiropractors never recommended more visits than necessary.

57)
Patient Satisfaction With Chiropractic Physicians in an Independent Physicians' Association
J Manipulative Physiol Ther 2001 (Nov); 24 (9): 556–559
http://www.ncbi.nlm.nih.gov/pubmed/11753328
Various aspects of chiropractic care were given a rating of "excellent" by the following percentage of respondents: Length of time to get an appointment (84.9%); convenience of the office (57.7%); access to the office by telephone (77.3%); length of wait at the office (75.7%); time spent with the provider (74.3%); explanation of what was done during the visit (72.8%); technical skills of the chiropractor (83.3%); and the personal manner of the chiropractor (92.4%). The visit overall was rated as excellent by 83.3% of responders, and 95.3% stated they would definitely recommend the provider to others.

58)
The Outcomes and Costs of Care for Acute Low Back Pain Among Patients Seen by Primary Care Practitioners, Chiropractors, and Orthopedic Surgeons
N Engl J Med 1995 (Oct 5); 333 (14): 913–917
http://www.ncbi.nlm.nih.gov/pubmed/7666878
he status at six months was ascertained for 1555 of the 1633 patients enrolled in the study (95 percent). The times to functional recovery, return to work, and complete recovery from low back pain were similar among patients seen by all six groups of practitioners, but there were marked differences in the use of health care

services. The mean total estimated outpatient charges were highest for the patients seen by orthopedic surgeons and chiropractors and were lowest for the patients seen by HMO and primary care providers. Satisfaction was greatest among the patients who went to the chiropractors.

59)
Comparing the Satisfaction of Low Back Pain Patients Randomized to Receive Medical or Chiropractic Care: Results From the UCLA Low-back Pain Study
Am J Public Health 2002 (Oct); 92 (10): 1628–1633
http://www.ncbi.nlm.nih.gov/pubmed/12356612
Communication of advice and information to patients with low back pain increases their satisfaction with providers and accounts for much of the difference between chiropractic and medical patients' satisfaction.

60)
Patient Satisfaction With the Chiropractic Clinical Encounter
http://apha.confex.com/apha/129am/techprogram/paper_19986.htm
Data were collected from 2986 adult patients of 172 U.S. and Canadian chiropractors in a practice-based research program over a one-week period in

November 1999. Of the 1822 patients reporting pain, 56.2% rated the care they received for it as "excellent," 30.6% "very good;" 9.3% "good;" 1.3% "fair;" and 0.2% "poor;" 2.0% did not respond. Patients were quite satisfied with the care they received with 83% reporting that their chiropractor always listened carefully to them and always explained things in a way they could understand; 88% reported their chiropractor always showed respect for what they had to say; 78% felt their chiropractor always spent enough time with them.

61)
The Gallup Study
In 1991 the Gallup Organization performed a nationwide demographic study to determine the attitudes, opinions, and behaviors of both users and nonusers of chiropractic services.
Overall, 90% felt that chiropractic health care was effective: more than 80% were satisfied with the treatment they received; nearly 75% felt that most of their expectations were met during the last visit or series of visits; 68% said they would likely see a doctor of chiropractic again for treatment of a similar condition, and 50% would likely be willing to see a doctor of chiropractic for some other problem chiropractors treat. Nearly 80% of the chiropractic users felt that the cost of chiropractic treatment was reasonable.
Demographic Characteristics of Users of Chiropractic Services. The Gallup Organization, Princeton, New Jersey - 1991

62)
The Harris Poll
According to this 1994 Harris Poll, patients were more satisfied with chiropractic care than care from medical doctors and other health care professionals.

Those who sought care from a chiropractor were more likely to be very satisfied with their care than those who visited any other practitioner. (Choices were between Chiropractic Doctors, Medical Doctors, Physical Therapists, or Osteopathic Doctors) Of those who have seen both types of practitioner, the majority were more likely to be satisfied with the care of the chiropractor than with that of the medical doctor.

63)
1994 Harris Poll
Patient Evaluations of Care from Family Physicians and Chiropractors
Findings from this study indicate that patients under chiropractic care had 3 times the satisfaction rate as did patients under the care of Family Physicians. In addition, the patient's perception of the doctor's confidence in diagnosing and treating low back pain was almost 3 times higher in patients receiving chiropractic care compared with those receiving care from family physicians.

64)
Patient Evaluations of Low Back Pain Care From Family Physicians and Chiropractors
Western Journal of Medicine 1989 (Mar); 150 (3): 351–355
Cherkin DC, MacCornack FA
We compare health maintenance organization enrollees' evaluations of the care they received from family physicians and chiropractors for low back pain. Patients of chiropractors were three times as likely as patients of family physicians to report that they were very satisfied with the care they received for low back pain (66% versus 22%, respectively). Compared with patients of family physicians, patients of chiropractors were much more likely to have been satisfied with the amount of information they were given, to have perceived that their provider was concerned about them, and to have felt that their provider was comfortable and confident dealing with their problem. Although the more positive evaluations of chiropractors may be related to differences in the patient populations served by the two providers or to benefits of spinal manipulation, it is suggested that a potentially more potent force--the therapeutic effect of the patient and provider interaction itself--may explain the observed differences.

65)
Patient Satisfaction With Chiropractic Care in Los Angeles
AHSR FHSR Annu Meet Abstr Book 1994; 11: 11
http://gateway.nlm.nih.gov/MeetingAbstracts/ma?f=102211961.html
This RAND Corporation Study found For overall care, 92% of the patients choose the care as either excellent or the best. Although the ratings on all the items are high the highest ratings were given to the more personal qualities of the practitioner: courtesy, politeness, and respect shown to the patient (92%); interest shown in the patient as a person (91%); willingness to listen (89%); ability to put the patient at ease (89%). These results support those of previous studies on chiropractic that suggest that the high satisfaction with chiropractic care is a result more of the personal health encounter than the therapeutic outcome. They also

suggest that other providers could learn much from the interpersonal art of chiropractors.

66)
Comparing the Satisfaction of Low Back Pain Patients Randomized to Receive Medical or Chiropractic Care:Results From the UCLA Low-back Pain Study

Am J Public Health 2002 (Oct); 92 (10): 1628–1633

Hertzman-Miller RP, Morgenstern H, Hurwitz EL, Yu F, Adams AH, Harber P, Kominski GF
Department of Epidemiology, UCLA School of Public Health, University of California-Los Angeles, Los Angeles, CA, USA. hertzman_miller@post.harvard.edu

Approximately one third as many back pain patients seek chiropractic care compared to those who seek medical care. In earlier randomized clinical trials, investigators found spinal manipulation to have similar or better rates of patient satisfaction when compared to medical approaches such as physical therapy, McKenzie method and standard medical therapy. This study examined the differences in satisfaction between patients assigned to either medical care or chiropractic care in a managed care organization. In this randomized trial, the chiropractic patients were more satisfied with their back care after 4 weeks of treatment. The researchers concluded that providers in managed care organizations may be able to increase the satisfaction of their low back pain patients by communicating advice and information to patients about their condition and treatment.

OBJECTIVES: This study examined the difference in satisfaction between patients assigned to chiropractic vs medical care for treatment of low back pain in a managed care organization.
METHODS: Satisfaction scores (on a 10-50 scale) after 4 weeks of follow-up were compared among 672 patients randomized to receive medical or chiropractic care.
RESULTS: The mean satisfaction score for chiropractic patients was greater than the score for medical patients (crude difference = 5.5; 95% confidence interval = 4.5, 6.5). Self-care advice and explanation of treatment predicted satisfaction and reduced the estimated difference between chiropractic and medical patients' satisfaction.
CONCLUSIONS: Communication of advice and information to patients with low back pain increases their satisfaction with providers and accounts for much of the difference between chiropractic and medical patients' satisfaction.

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D) Effectiveness of Chiropractic Treatment

67)

Spine 2011 ; 36 : 1427 – 1437
Spine Publish Ahead of Print
DOI: 10.1097/BRS.0b013e3181f5dfe0

Does maintained Spinal manipulation therapy for chronic non-specific low back pain result in better long term outcome?

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Abstract:
Study Design. A prospective single blinded placebo controlled study was conducted.
Objective. to assess the effectiveness of spinal manipulation therapy (SMT) for the management of chronic non-specific low back pain (LBP) and to determine the effectiveness of maintenance SMT in long-term reduction of pain and disability levels associated with chronic low-back conditions after an initial phase of treatments.
Summary of background. SMT is a common treatment option for low back pain. Numerous clinical trials have attempted to evaluate its effectiveness for different subgroups of acute and chronic LBP but the efficacy of maintenance SMT in chronic non-specific LBP has not been studied.
Subjects and Methods. 60 patients with chronic, nonspecific LBP lasting at least 6 months were randomized to receive either (1) 12 treatments of sham SMT over a one-month period, (2) 12 treatments, consisting of SMT over a one-month period, but no treatments for the subsequent nine months, or (3) 12 treatments over a one-month period, along with "maintenance spinal manipulation" every two weeks for the following nine months. To determine any difference among therapies, we measured pain and disability scores, generic health status, and back-specific patient satisfaction at baseline and at 1-month, 4-month, 7-month and 10-month intervals.
Results: Patients in second and third groups experienced significantly lower pain and disability scores than first group at the end of 1-month period (P=0.0027 and 0.0029 respectively). However, only the third group that was given spinal manipulations during the follow-up period showed more improvement in pain and disability scores at the 10-month evaluation. In the no maintained SMT group, however, the mean pain and disability scores returned back near to their pretreatment level.
Conclusion. SMT is effective for the treatment of chronic non specific LBP. To obtain long-term benefit, this study suggests maintenance spinal manipulations after the initial intensive manipulative therapy.

Key points:
This study demonstrated that spinal manipulation therapy is an effective modality in chronic non-specific LBP for short-term effects.

Application of spinal manipulation therapy yielded better results when compared with the sham manipulation. We suggest that maintained spinal manipulation is beneficial to patients of chronic nonspecific LBP particularly those who gain improvement after initial intensive manipulation to maintain the improved post-treatment pain and disability levels.

68)
Effectiveness of manual therapies: the UK evidence report.
Chiropr Osteopat. 2010 Feb 25;18:3.
Bronfort G, Haas M, Evans R, Leininger B, Triano J.
http://www.ncbi.nlm.nih.gov/pubmed/20184717
Source
Northwestern Health Sciences University, Bloomington, MN, USA.
gbronfort@nwhealth.edu
Abstract
BACKGROUND:
The purpose of this report is to provide a succinct but comprehensive summary of the scientific evidence regarding the effectiveness of manual treatment for the management of a variety of musculoskeletal and non-musculoskeletal conditions.
METHODS:
The conclusions are based on the results of systematic reviews of randomized clinical trials (RCTs), widely accepted and primarily UK and United States evidence-based clinical guidelines, plus the results of all RCTs not yet included in the first three categories. The strength/quality of the evidence regarding effectiveness was based on an adapted version of the grading system developed by the US Preventive Services Task Force and a study risk of bias assessment tool for the recent RCTs.
RESULTS:
By September 2009, 26 categories of conditions were located containing RCT evidence for the use of manual therapy: 13 musculoskeletal conditions, four types of chronic headache and nine non-musculoskeletal conditions. We identified 49 recent relevant systematic reviews and 16 evidence-based clinical guidelines plus an additional 46 RCTs not yet included in systematic reviews and guidelines.Additionally, brief references are made to other effective non-pharmacological, non-invasive physical treatments.
CONCLUSIONS:
Spinal manipulation/mobilization is effective in adults for: acute, subacute, and chronic low back pain; migraine and cervicogenic headache; cervicogenic dizziness; manipulation/mobilization is effective for several extremity joint conditions; and thoracic manipulation/mobilization is effective for acute/subacute neck pain. The evidence is inconclusive for cervical manipulation/mobilization alone for neck pain of any duration, and for manipulation/mobilization for mid back pain, sciatica, tension-type headache, coccydynia, temporomandibular joint disorders, fibromyalgia, premenstrual syndrome, and pneumonia in older adults. Spinal manipulation is not effective for asthma and dysmenorrhea when compared to sham manipulation, or for Stage 1 hypertension when added to an antihypertensive diet. In children, the evidence is inconclusive regarding the effectiveness for otitis media and enuresis, and it is not effective for infantile colic and asthma when

compared to sham manipulation.Massage is effective in adults for chronic low back pain and chronic neck pain. The evidence is inconclusive for knee osteoarthritis, fibromyalgia, myofascial pain syndrome, migraine headache, and premenstrual syndrome. In children, the evidence is inconclusive for asthma and infantile colic.

69)
Chronic spinal pain - a randomized clinical trial comparing medication, acupuncture, and spinal manipulation.
Spine 2003;28:1490-1503.
Giles LGF, Muller R.

A randomized, controlled clinical trial published in Spine reveals that chiropractic manipulation (adjustment) is superior to both drugs and acupuncture in the treatment of chronic spinal pain (people with pain lasting more than 13 weeks). The study, conducted at a multidisciplinary spinal pain outpatient unit in an Australian public hospital, involved 115 patients randomly assigned to receive one of three interventions: medication, needle acupuncture or chiropractic manipulation.

Patients randomized to the acupuncture or spinal manipulation group were given an initial physical examination by the treating clinician to determine which form of acupuncture needle placement and needling would take place, or what type of spinal manipulation would be performed, respectively. Patients randomized to the medication group were given Celebrex, unless the patient had used it previously. The next drug of choice was Vioxx, followed by paracetamol (up to 4g/day). Doses were left to the sports physician's discretion.
Chiropractic patients were given two treatments per week.

The patients were assessed four times: at the initial visit, and two, five and nine weeks after the initial treatment. While a number of patients didn't finish the study, due to noncompliance or treatment changes, the statistical significance of the results was maintained for most outcomes. At the end of the study, the group receiving manipulation experienced the most recovered patients (9) compared with three for the acupuncture group and only two for the medication group. This was significant, considering the nature of chronic spine pain.

One of the study's most remarkable findings was that patients in the manipulation group reported a 47 percent improvement on a general overall health questionnaire, compared to only 15 percent for the acupuncture group and 18 percent for the medication group.

70)
Efficacy of spinal manipulation and mobilization for low back pain and neck pain: a systematic review and best evidence synthesis
The Spine Journal Volume 4, Issue 3 , Pages 335-356, May 2004
Gert Bronfort, PhD, DC;Mitchell Haas, DC, MA;Roni L. Evans, DC, MS;Lex M. Bouter, PhD
Received 26 February 2003; accepted 2 June 2003.
Abstract
Background context
Despite the many published randomized clinical trials (RCTs), a substantial number of reviews and several national clinical guidelines, much controversy still remains

regarding the evidence for or against efficacy of spinal manipulation for low back pain and neck pain.

Purpose

To reassess the efficacy of spinal manipulative therapy (SMT) and mobilization (MOB) for the management of low back pain (LBP) and neck pain (NP), with special attention to applying more stringent criteria for study admissibility into evidence and for isolating the effect of SMT and/or MOB.

Study design

RCTs including 10 or more subjects per group receiving SMT or MOB and using patient-oriented primary outcome measures (eg, patient-rated pain, disability, global improvement and recovery time).

Methods

Articles in English, Danish, Swedish, Norwegian and Dutch reporting on randomized trials were identified by a comprehensive search of computerized and bibliographic literature databases up to the end of 2002. Two reviewers independently abstracted data and assessed study quality according to eight explicit criteria. A best evidence synthesis incorporating explicit, detailed information about outcome measures and interventions was used to evaluate treatment efficacy. The strength of evidence was assessed by a classification system that incorporated study validity and statistical significance of study results. Sixty-nine RCTs met the study selection criteria and were reviewed and assigned validity scores varying from 6 to 81 on a scale of 0 to 100. Forty-three RCTs met the admissibility criteria for evidence.

Results

Acute LBP: There is moderate evidence that SMT provides more short-term pain relief than MOB and detuned diathermy, and limited evidence of faster recovery than a commonly used physical therapy treatment strategy.

Chronic LBP: There is moderate evidence that SMT has an effect similar to an efficacious prescription nonsteroidal anti-inflammatory drug, SMT/MOB is effective in the short term when compared with placebo and general practitioner care, and in the long term compared to physical therapy. There is limited to moderate evidence that SMT is better than physical therapy and home back exercise in both the short and long term. There is limited evidence that SMT is superior to sham SMT in the short term and superior to chemonucleolysis for disc herniation in the short term. However, there is also limited evidence that MOB is inferior to back exercise after disc herniation surgery.

Mix of acute and chronic LBP: SMT/MOB provides either similar or better pain outcomes in the short and long term when compared with placebo and with other treatments, such as McKenzie therapy, medical care, management by physical therapists, soft tissue treatment and back school.

Acute NP: There are few studies, and the evidence is currently inconclusive. Chronic NP: There is moderate evidence that SMT/MOB is superior to general practitioner management for short-term pain reduction but that SMT offers at most similar pain relief to high-technology rehabilitative exercise in the short and long term.

Mix of acute and chronic NP: The overall evidence is not clear. There is moderate evidence that MOB is superior to physical therapy and family physician care, and similar to SMT in both the short and long term. There is limited evidence that SMT, in both the short and long term, is inferior to physical therapy.

Conclusions
Our data synthesis suggests that recommendations can be made with some confidence regarding the use of SMT and/or MOB as a viable option for the treatment of both low back pain and NP. There have been few high-quality trials distinguishing between acute and chronic patients, and most are limited to shorter-term follow-up. Future trials should examine well-defined subgroups of patients, further address the value of SMT and MOB for acute patients, establish optimal number of treatment visits and consider the cost-effectiveness of care.

71)
Chiropractic manipulation in the treatment of acute back pain and sciatica with disc protrusion: a randomized double-blind clinical trial of active and simulated spinal manipulations.
Spine J. 2006 Mar-Apr;6(2):131-7. Epub 2006 Feb 3.
Santilli V, Beghi E, Finucci S.
Source
Direttore Cattedra Medicina Fisica e Riabilitativa, Università di Roma La Sapienza, P.le Aldo Moro 5, Roma, Rome, 00185, Italy.
Abstract
BACKGROUND CONTEXT:
Acute back pain and sciatica are major sources of disability. Many medical interventions are available, including manipulations, with conflicting results.
PURPOSE:
To assess the short- and long-term effects of spinal manipulations on acute back pain and sciatica with disc protrusion.
STUDY DESIGN/SETTING:
Randomized double-blind trial comparing active and simulated manipulations in rehabilitation medical centers in Rome and suburbs.
PATIENT SAMPLE:
102 ambulatory patients with at least moderate pain on a visual analog scale for local pain (VAS1) and/or radiating pain (VAS2).
OUTCOME MEASURES:
Pain-free patients at end of treatment; treatment failure (proportion of patients stopping the assigned treatment for lack of effect on pain); number of days with no, mild, moderate, or severe pain; quality of life; number of days on nonsteroidal anti-inflammatory drugs; number of drug prescriptions; VAS1 and VAS2 scores; quality of life and psychosocial findings; and reduction of disc protrusion on magnetic resonance imaging.
METHODS:
Manipulations or simulated manipulations were done 5 days per week by experienced chiropractors, with a number of sessions which depended on pain relief or up to a maximum of 20, using a rapid thrust technique. Patients were assessed at admission and at 15, 30, 45, 90, and 180 days. At each visit, all indicators of pain relief were used.
RESULTS:
A total of 64 men and 38 women aged 19-63 years were randomized to manipulations (53) or simulated manipulations (49). Manipulations appeared more effective on the basis of the percentage of pain-free cases (local pain 28 vs. 6%;

p<.005; radiating pain 55 vs. 20%; p<.0001), number of days with pain (23.6 vs. 27.4; p<.005), and number of days with moderate or severe pain (13.9 vs. 17.9; p<.05). Patients receiving manipulations had lower mean VAS1 (p<.0001) and VAS2 scores (p<.001). A significant interaction was found between therapeutic methods and time. There were no significant differences in quality of life and psychosocial scores. There were only two treatment failures (manipulation 1; simulated manipulation 1) and no adverse events.

CONCLUSIONS:

Active manipulations have more effect than simulated manipulations on pain relief for acute back pain and sciatica with disc protrusion.

72)

Nonpharmacologic therapies for acute and chronic low back pain: a review of the evidence for an American Pain Society/American College of Physicians clinical practice guideline.

Ann Intern Med. 2007 Oct 2;147(7):492-504.

Chou R, Huffman LH; American Pain Society; American College of Physicians.

Source

Oregon Evidence-based Practice Center and Oregon Health & Science University, Portland, Oregon 97239, USA. chour@ohsu.edu

Abstract

BACKGROUND:

Many nonpharmacologic therapies are available for treatment of low back pain.

PURPOSE:

To assess benefits and harms of acupuncture, back schools, psychological therapies, exercise therapy, functional restoration, interdisciplinary therapy, massage, physical therapies (interferential therapy, low-level laser therapy, lumbar supports, shortwave diathermy, superficial heat, traction, transcutaneous electrical nerve stimulation, and ultrasonography), spinal manipulation, and yoga for acute or chronic low back pain (with or without leg pain).

DATA SOURCES:

English-language studies were identified through searches of MEDLINE (through November 2006) and the Cochrane Database of Systematic Reviews (2006, Issue 4). These electronic searches were supplemented by hand searching of reference lists and additional citations suggested by experts.

STUDY SELECTION:

Systematic reviews and randomized trials of 1 or more of the preceding therapies for acute or chronic low back pain (with or without leg pain) that reported pain outcomes, back-specific function, general health status, work disability, or patient satisfaction.

DATA EXTRACTION:

We abstracted information about study design, population characteristics, interventions, outcomes, and adverse events. To grade methodological quality, we used the Oxman criteria for systematic reviews and the Cochrane Back Review Group criteria for individual trials.

DATA SYNTHESIS:

We found good evidence that cognitive-behavioral therapy, exercise, spinal manipulation, and interdisciplinary rehabilitation are all moderately effective for

chronic or subacute (>4 weeks' duration) low back pain. Benefits over placebo, sham therapy, or no treatment averaged 10 to 20 points on a 100-point visual analogue pain scale, 2 to 4 points on the Roland-Morris Disability Questionnaire, or a standardized mean difference of 0.5 to 0.8. We found fair evidence that acupuncture, massage, yoga (Viniyoga), and functional restoration are also effective for chronic low back pain. For acute low back pain (<4 weeks' duration), the only nonpharmacologic therapies with evidence of efficacy are superficial heat (good evidence for moderate benefits) and spinal manipulation (fair evidence for small to moderate benefits). Although serious harms seemed to be rare, data on harms were poorly reported. No trials addressed optimal sequencing of therapies, and methods for tailoring therapy to individual patients are still in early stages of development. Evidence is insufficient to evaluate the efficacy of therapies for sciatica.

LIMITATIONS:

Our primary source of data was systematic reviews. We included non-English-language trials only if they were included in English-language systematic reviews.

CONCLUSIONS:

Therapies with good evidence of moderate efficacy for chronic or subacute low back pain are cognitive-behavioral therapy, exercise, spinal manipulation, and interdisciplinary rehabilitation. For acute low back pain, the only therapy with good evidence of efficacy is superficial heat.

73)

Low-Back Pain and Related Leg Complaints

J Manipulative Physiol Ther 2008 Nov;31(9):659-674.

Chiropractic spinal manipulation is widely used to treat low-back pain and related complaints.

Lawrence DJ, Meeker W, Branson R, Bronfort G, Cates JR, Haas M, Haneline M, Micozzi M, Updyke W, Mootz R,Triano JJ, Hawk C. Chiropractic

Management of Low Back Pain and Low Back-Related Leg Complaints: A Literature Synthesis.

THE OBJECTIVE of this literature synthesis was to provide a balanced interpretation of the literature to identify safe
and effective treatment options for low-back pain and related leg complaints.

THIS STUDY conducted a search of literature on low-back pain through the following major healthcare databases:
PubMed, Mantis and the Cochrane Database, yielding 807 source documents, from which guidelines, randomized
controlled trials (RCTs), systematic reviews and cohort studies were selected for further review. A total of 12 guidelines
documents, 64 RCTs, 20 systematic reviews/meta-analyses and 12 cohort studies were analyzed.

CONCLUSIONS

Existing research evidence on chiropractic management of low-back pain and related leg complaints shows the following:
• Spinal manipulation is used to reduce pain and improve function in patients with both chronic low-back pain and
acute and sub-acute low-back pain.

• Patients undergoing spinal manipulative treatment for low-back pain often experience improvement in function, in addition to a reduction in their pain levels.
• When used in conjunction with spinal manipulation, exercise is likely to improve the patients' symptoms, increase the
speed of recovery, and reduce the recurrence of pain.
• Exercise coupled with the reassurance of the healthcare provider that the patient will do well has also been shown
valuable in patients with chronic low-back pain and low-back problems associated with radicular symptoms.
• There is less evidence for the use of spinal manipulation in the treatment of leg complaints related to low-back pain.
• Patients experiencing severe symptoms may benefi t from pain management in collaboration with other healthcare providers, in addition to spinal manipulative treatment.

74)
Treating Chronic Mechanical Spinal Pain
Spinal manipulation may provide broader and more signifi cant long-term benefi t for chronic spinal pain patients than acupuncture and medication.
J Manipulative Physiol Ther 2005;28(1):3-11.
Muller R, Giles LGF. Long-Term Follow-Up of a Randomized Clinical Trial
Assessing the Efficacy of Medication, Acupuncture, and Spinal Manipulation for Chronic Mechanical Spinal Pain Syndromes.
J Manipulative Physiol Ther 2005;28(1):3-11.
BACKGROUND
Chronic mechanical back pain and neck pain, which are often caused by an injury or disease, present a diagnostic and treatment challenge and pose a signifi cant fi nancial strain on the health care system. Some evidence shows
that a multidisciplinary team approach to treating spinal pain results in high patient satisfaction. The evidence about the superiority of a particular treatment for non-specifi c chronic spinal pain is inconclusive.
THE OBJECTIVE of this study was to assess the long-term effect of medication, needle acupuncture and spinal manipulation on treating patients with chronic (> 13 weeks) spinal pain.
THIS STUDY conducted a one-year follow-up of a randomized clinical trial investigating the effectiveness of medication (Celebrex, Vioxx and/or acetaminophen), acupuncture or high-velocity low-amplitude spinal
manipulation on treating chronic spinal pain. Sixty-nine patients were randomized into three treatment groups,receiving one type of treatment for nine weeks. The one-year follow-up was conducted through Oswestry Back
Pain Index, Neck Disability Index, Short-Form-36 and Visual Analog Scales. The study analyzed the results of treatment of 40 patients who had received only one randomly allocated type of treatment.
RESULTS
Comparison of the initial and long-term follow-up questionnaires produced the following results:

• Only the group receiving spinal manipulation showed long-term treatment benefit, with five of the original
seven improvements remaining statistically significant after one year.
• Only one of seven improvements remained statistically significant in each of the acupuncture and the medication treatment groups at follow-up.

CONCLUSION

For treating chronic spinal pain, spinal manipulation, if not contraindicated, may provide broader and more significant long-term benefits than acupuncture or pain-relief medication.

75)

ASTHMA

Changes in Asthma Symptoms and Bedwetting in a Four Year Old Child Receiving Chiropractic Care: A Case Report

Chiropractic Journal of Australia 2010 (Mar); 40 (1): 34–36

A four-year-old child diagnosed with asthma and a history of allergies, bedwetting and disrupted sleep presented for chiropractic care. After a trial of chiropractic care the child no longer had asthma symptoms, bedwetting had ceased and a positive change in other presenting symptoms was noted. There are a growing number of case reports that describe improvements in childhood problems such as asthma and nocturnal enuresis in children receiving chiropractic care. Thus far clinical trials have failed to provide sufficient evidence to support the potential link between improvements in these childhood problems and chiropractic care. Further study is required to investigate the role chiropractors may play in caring for children with these disorders.

76)

Chiropractic Care for Patients with Asthma:
A Systematic Review of the Literature

J Can Chiropr Assoc. 2010 (Mar); 54 (1): 24–32

http://www.jcca-online.org/ecms.ashx/PDF/2010/2010-1/jcca-v54-1-024indd.pdf

Results of the eight retrieved studies indicated that chiropractic care showed improvements in subjective measures and, to a lesser degree objective measures, none of which were statistically significant. It is evident that some asthmatic patients may benefit from this treatment approach; however, at this time, the evidence suggests chiropractic care should be used as an adjunct, not a replacement, to traditional medical therapy.

77)

Chiropractic Care of a Pediatric Patient with Asthma, Allergies, Chronic Colds & Vertebral Subluxation

Journal of Pediatric, Maternal & Family Health - Chiropractic 2009;3:1–7

http://www.chiro.org/research/ABSTRACTS/Chiropractic_Care_of_a_Pediatric_Patient.shtml

A 7-year-old male was presented by his parents for chiropractic evaluation and possible care. The patient suffered from chronic colds, allergies, and asthma since the age of 5 months. At the time of initial evaluation, the patient was on a 1x/day dose of prescription Alavert for allergies and Albuterol for asthma. The patient was

cared for using specific, low-force adjustments with the Activator Instrument to address areas of vertebral subluxation in the cervical, thoracic, and lumbosacral spine. Within two weeks of initiating chiropractic care, the patient was able to discontinue his allergy and asthma medications (as decided upon by his parents) and the use of his nebulizer.

78)
Self-reported Nonmusculoskeletal Responses to Chiropractic Intervention: A Multination Survey
J Manipulative Physiol Ther 2005 (Jun); 28 (5): 294–302
http://www.ncbi.nlm.nih.gov/pubmed/15965403
Positive reactions were reported by 2% to 10% of all patients and by 3% to 27% of those who reported to have such problems. **Most common were improved breathing (27%), digestion (26%), and circulation (21%)**.

79)
Chiropractic Co-management of Medically Treated Asthma
Clinical Chiropractic 2005 (Sep); 8 (3): 140–144
http://www.sciencedirect.com/science/article/pii/S1479235405000453
This article presents three cases where patients, being treated by conventional pharmacological means, had chiropractic manipulation administered to the upper thoracic spine twice a week for a period of 6 weeks. Objective measurements were

collected using a peak flow meter and subjective data using an asthma specific questionnaire. All three cases resulted in increased subjective and objective parameters and suggest the need for larger studies with appropriate methodology.

80)
Spinal Manipulation May Benefit Asthma Patients Foundation for Chiropractic Education and Research (FCER)
http://www.chiro.org/research/ABSTRACTS/Manipulation_May_Benefit_Asthma.shtml
Patients afflicted with asthma may benefit from spinal manipulation in terms of symptoms, immunological capacity, and endocrine effects, an audience was told on October 5 at the 9th International Conference on Spinal Manipulation in Toronto. The investigative team, headed by Ray Hayek, Ph.D., has been conducting a trial at 16 treatment centers in Australia involving 420 patients with an average age of 46 in an effort to find out what effects spinal manipulation has on symptoms, depression and anxiety, general health status, and the levels of immunity as reflected by the concentrations of both an immunoglobulin (IgA) and an immunosuppressant (cortisol).

81)
Asthma Trial Update: Preliminary Data Encouraging ~ Your Help Needed to Put Funding "Over the Top"
Vincent P. Lucido, D.C., President of FCER
http://www.chiro.org/research/DISCONTINUED/Asthma_Trial_Update.html

This trial is of paramount importance in addressing the major flaws in a previous and unfortunately highly visible clinical trial published in The New England Journal of Medicine. [1] It also represents one of the few investigations that taps into the field of endocrinology—an area that must be addressed if one is to gain further insight into the systemic effects of spinal dysfunctions and their management by chiropractic care. This research represents only a handful of investigations that have addressed the consequences of manipulation involving chemical (as opposed to electrical) messengers within the body.

82)
Response to the "Manual Therapy for Asthma" Cochrane Review Anthony Rosner, PhD, FCER Director of Research
http://www.chiro.org/research/FULL/Response_to_Manual_Therapy.html
Hondras' recently published systematic review of randomized clinical trials [1] addressed to manual therapy represents a sincere effort to summarize those investigations in what is commonly regarded as the gold standard of clinical research. That said, however, one has to remain particularly vigilant against accepting randomized clinical trials at face value, particularly in those instances involving physical interventions, in which the complete blinding of practitioners [and most likely patients as well] in the traditional RCT design is all but impossible.

83)
Effect of Chiropractic Treatment on the Endocrine and Immune System in Asthmatic Patients
Proceedings of the 2002 International Conference on Spinal Manipulation. 2002 (Oct)
http://www.chiro.org/research/ABSTRACTS/Effect_of_Chiropractic_Treatment.shtml
The broad aims of this FCER funded study is to determine whether stress is a factor in the pathophysiology of asthma and to determine if chiropractic management of asthmatics can alleviate stress induced asthma. More specifically for this meeting, our study aims to determine whether chiropractic treatment has beneficial effects on the endocrine system through measurement of salivary cortisol and on the immune system via salivary IgA determination.

84)
Chronic Pediatric Asthma and Chiropractic Spinal Manipulation: A Prospective Clinical Series and Randomized Clinical Pilot Study
J Manipulative Physiol Ther 2001 (Jul); 24 (6): 369–377
http://www.ncbi.nlm.nih.gov/pubmed/11514813
After 3 months of combining chiropractic SMT with optimal medical management for pediatric asthma, the children rated their quality of life substantially higher and their asthma severity substantially lower. These improvements were maintained at the 1-year follow-up assessment.
http://www.chiro.org/research/FULL/Chronic_pediatric_asthma_LETTER.html

85)
Chiropractic Management of 47 Asthma Cases
Todays Chiropractic 2000(Nov)

http://www.erinelster.com/articles.aspx?ArticleID=271
Over a seven-year period, 47 cases of asthma were managed in an outpatient setting. Every case was followed for a minimum of two years to observe effectiveness of care. The study group comprised 28 males and 19 females, ranging from 7 to 42 years of age. Of the 47 cases, 32 patients ranged in age from 7 to 19 years.

86)
Manual Medicine Diversity:
Research Pitfalls and the Emerging Medical Paradigm
http://www.meridianinstitute.com/ceu/ceu22ost.html
J Am Osteopath Assoc 2001; 101 (8) Aug: 441-444 Recent studies published in leading medical journals have concluded that chiropractic treatment is not particularly helpful for relieving asthma and migraine symptoms because even though study participants showed notable improvement in symptoms, those subjects who received sham manual medicine treatments also showed improvement. Yet **the sham treatment received by control groups in these studies is reminiscent in many ways of traditional osteopathic manipulation**. This seems to represent not only a failure to recognize the value of many manual medicine techniques but also an ignorance of the broad spectrum of manual medicine techniques used by various practitioners, from osteopathic physicians to chiropractors to physical therapists.

87)
Osteopathic Manipulative Treatment Applications
for the Emergency Department Patient
J Am Osteopath Assoc 1996; 96 (7) Jul: 403–409
http://www.ncbi.nlm.nih.gov/pubmed/8758873
The emergency department (ED) setting offers osteopathic physicians multiple opportunities to provide osteopathic manipulative treatment (OMT) as either the primary therapy or as an adjunct to the intervention. In doing so, osteopathic physicians can decrease or eliminate the morbidity and symptoms associated with protracted dysfunction. Low back pain, chest pain, torticollis, **asthma**, and sinusitis are some of the illnesses in which OMT should be implemented as part of the management plan

88)
A Wholistic Approach to the Treatment of Bronchial Asthma
in a Chiropractic Practice
Chiro J Aust 1993; 23 (1): 4–8
http://www.chiro.org/pediatrics/ABSTRACTS/Wholistic_Approach.shtml
Three case studies involving two children and a mature adult with established diagnoses of bronchial asthma are presented. Management in each case involve chiropractic adjustments combined with a "clinical ecology" approach which has been found useful in identifying food and environmental allergens that may act as triggering factors for asthma attacks. This paper suggests that such a broad-based

management approach may lead to higher rates of response to chiropractic treatment of asthma, as well as providing greater long-term relief for its victims.

Blood Pressure

89)
Atlas Vertebra Realignment and Achievement of Arterial Pressure Goal in Hypertensive Patients: A Pilot Study
Journal of Human Hypertension 2007 (May); 21 (5): 347–352
http://www.nuccra.org/themes/nuccra/images_new/pdf/Hypertension2007.pdf
Anatomical abnormalities of the cervical spine at the level of the Atlas vertebra are associated with relative ischaemia of the brainstem circulation and increased blood pressure (BP). Manual correction of this mal-alignment has been associated with reduced arterial pressure. Using a double blind, placebo-controlled design at a single center, 50 drug naive (n=26) or washed out (n=24) patients with Stage 1 hypertension were randomized to receive a National Upper Cervical Chiropractic (NUCCA) procedure or a sham procedure. Patients received no antihypertensive meds during the 8-week study duration. The primary end point was changed in systolic and diastolic BP comparing baseline and week 8, with a 90% power to detect an 8/5 mm Hg difference at week 8 over the placebo group. The study cohort had a mean age 52.7+/-9.6 years, consisted of 70% males. At week 8, there were differences in systolic BP (-17+/-9 mm Hg, NUCCA versus -3+/-11 mm Hg, placebo; P<0.0001) and diastolic BP (-10+/-11 mm Hg, NUCCA versus -2+/-7 mm Hg; P=0.002). No adverse effects were recorded. **We conclude that restoration of Atlas alignment is associated with marked and sustained reductions in BP similar to the use of two-drug combination therapy.**

90)
Sympathetic and Parasympathetic Responses to Specific Diversified Adjustments to Chiropractic Vertebral Subluxations of the Cervical and Thoracic Spine
J Chiropr Med. 2008 (Sep); 7 (3): 86–93
http://www.ncbi.nlm.nih.gov/pubmed/19646369
Diastolic pressure (indicating a sympathetic response) dropped significantly postadjustment among those receiving cervical adjustments, accompanied by a moderate clinical effect (0.50). Pulse pressure increased significantly among those receiving cervical adjustments, accompanied by a large effect size (0.82). It is preliminarily suggested that cervical adjustments may result in parasympathetic responses, whereas thoracic adjustments result in sympathetic responses. Furthermore, it appears that these responses may demonstrate the relationship of autonomic responses in association to the particular segment(s) adjusted.

91)
Practice-based Randomized Controlled-comparison Clinical Trial of Chiropractic Adjustments and Brief Massage Treatment at Sites of Subluxation in Subjects with Essential Hypertension: Pilot Study
J Manipulative Physiol Ther 2002 (May); 25 (4): 221–239
http://www.ncbi.nlm.nih.gov/pubmed/12021741

This pilot study elucidated several procedural issues that should be addressed before undertaking a full-scale clinical trial on the effects of chiropractic adjustments in patients with essential hypertension. A multidisciplinary approach to recruitment may need to be used in any future efforts because of the limited subject pool of patients who have hypertensive disease but are not taking medications for its control. Measures need to be used to assure comparable groups regarding prognostic variables such as weight. Studies such as these demonstrate the feasibility of conducting a full-scale 3-group randomized clinical trial in the private practice setting.

92)
Significant Changes in Systolic Blood Pressure Post Vectored Upper Cervical Adjustment vs. Resting Control Groups: A Possible Effect of the Cervicosympathetic and/or Pressor Reflex
J Manipulative Physiol Ther 2001 (Feb); 24 (2): 101–109
http://www.ncbi.nlm.nih.gov/pubmed/11208222
The results indicate that palpation and vectored atlas adjustment causes a significant decrease in systolic blood pressure in patients with putative upper cervical subluxation/joint dysfunction in comparison with resting controls. Similar results were also demonstrated when subjects acted as their own controls. The lack of randomization, blinding, and a manipulated control group are factors that weaken these findings. The sudden drop in systolic pressure is proposed to be due to stimulation of the cervicosympathetic reflex or moderation of muscle tone and elimination of the effects of the pressor reflex.

93)
Chiropractic Management of a Hypertensive Patient
J Manipulative Physiol Ther 1993 (Oct); 16 (8): 544–549
http://www.ncbi.nlm.nih.gov/pubmed/8263434
Specific contact short lever arm spinal adjustments may cause a hypotensive effect in a medicated hypertensive patient that may lead to complications (e.g., hypotension). Since a medicated hypertensive patient's blood pressure may fall below normal while he or she is undergoing chiropractic care, it is advised that the blood pressure be closely monitored and medications adjusted, if necessary, by the patient's medical physician.

94)
Effects of Cervical Adjustments on Lateral Flexion Passive End–range Asymmetry and on Blood Pressure, Heart Rate and Plasma Catecholamine Levels
J Manipulative Physiol Ther 1991 (Oct); 14 (8): 450–456
http://www.ncbi.nlm.nih.gov/pubmed/1940682
Posttreatment goniometric measurements revealed that in sham-adjusted controls, mean lateral-flexion asymmetries had not changed significantly during the 4-hr time period examined. However, in subjects who received lower cervical adjustments, dramatic ameliorations of asymmetry magnitude were observed which persisted throughout the entire 4-hr posttreatment time period. On the other hand,

in the face of this rather robust biomechanical effect, heart rate and blood pressure measurements obtained at -60 and -15 min prior to treatments, and at 5, 30, 60, 120 and 240 min following treatments, revealed no significant differences between adjusted and sham-adjusted subjects at any of the time periods examined.

95)
Time Course Considerations for the Effect of Lower Cervical Adjustments with Respect to the Amelioration of Cervical Lateral Flexion Passive End–range Asymmetries, and on Blood Pressure, Heart Rate, and Plasma Catecholamine Levels
J Manipulative Physiol Ther. 1990 (Jul); 13 (6): 297–304
http://www.ncbi.nlm.nih.gov/pubmed/2394946
Additionally, based on simultaneous serial monitoring of heart rate, blood pressure, and plasma catecholamine concentrations, it does not appear that the therapeutic procedure used in these studies is particularily stressful or traumatic, at least in otherwise asymptomatic subjects.

96)
Preliminary Study of Blood Pressure Changes in Normotensive Subjects Undergoing Chiropractic Care
J Manipulative Physiol Ther 1988 (Aug); 11 (4): 261–266
http://www.ncbi.nlm.nih.gov/pubmed/3171413?dopt=Abstract
The purpose of this study was to evaluate the reliability of clinical blood pressure readings and to begin a series of experiments to determine if chiropractic adjustments cause any significant changes in blood pressure. Seventy-five students undergoing routine chiropractic health care at Palmer College of Chiropractic Clinic volunteered to participate in the blood pressure measurement protocol in one 10-min visit. Blood pressure was recorded by right arm cuff sphygmomanometer by an experienced chiropractor immediately before and again immediately after either the specific cervical adjustment or the control procedure, which was simply motion palpation. The doctors measuring blood pressures did not know to which group the subject had been assigned. Both systolic and diastolic blood pressures were statistically significantly lowered in the Experimental but not the Control group (p less than 0.01). The difference in the mean blood pressures was small and was brought about by 14 of the Experimental subjects who experienced a clinically relevant 10-20 mm hg drop. Reliability of blood pressure measurements by two doctors was established under similar conditions in an additional 25 subjects.

97)
Effects of Chiropractic Treatment on Blood Pressure and Anxiety:A Randomized, Controlled Trial
J Manipulative Physiol Ther 1988 (Dec); 11 (6): 484–488
http://www.ncbi.nlm.nih.gov/pubmed/3075649?dopt=Abstract
Results indicated that systolic and diastolic blood pressure decreased significantly in the active treatment condition, whereas no significant changes occurred in the placebo and control conditions. State anxiety significantly decreased in the active and control conditions. Results provide support for the hypothesis that blood pressure is reduced following chiropractic treatment. Further study is needed to

examine the long-term effects of chiropractic treatment on blood pressure.

98)
The Management of Hypertensive Disease: A Review of Spinal Manipulation and the Efficacy of Conservative Therapeusis
J Manipulative Physiol Ther 1986 (Mar); 9 (1): 27–32
http://www.ncbi.nlm.nih.gov/pubmed/3517211?dopt=Abstract
When considering the ailments that plague mankind, certainly one of the enigmatic conditions is hypertensive disease. This perplexing disorder is recognized insidiously in the clinical setting. It is believed to occur because of the complex interactions of a variety of factors which act on the components of the blood vasculature. Although afflicted individuals may appear relatively asymptomatic, the additive influences of such factors eventually culminate in deleterious sequelae. Overall, hypertension appears to be related to stress, diet and lifestyle. The autonomic nervous system, particularly its sympathetic component, appears to mediate such accumulated factors, affecting the overall clinical scenario of hypertension. Although generally aligned with the aging process, this condition also may affect younger individuals. Hypertension, therefore, may be regarded as a prime condition warranting specialized care that includes proper education during the formative years, modification of dietary habits in conjunction with daily exercise regimens, and regular spinal maintenance, all of which are covered by modern chiropractic clinical practice.

Chronic Neck Pain

99)
Predictors for Identifying Patients With Mechanical Neck Pain Who Are Likely to Achieve Short-Term Success With Manipulative Interventions Directed at the Cervical and Thoracic Spine
J Manipulative Physiol Ther. 2011 (Mar); 34 (3): 144–152
http://www.ncbi.nlm.nih.gov/pubmed/21305970
The current study identified several prognostic clinical factors including pain intensity greater than 4.5 points, cervical extension less than 46°, hypomobility of T1 vertebra, a negative ULTT, and female sex that may potentially identify patients with mechanical neck pain who are likely to experience a rapid and positive response to the application of cervical and thoracic spine thrust manipulations. **If 4 of 5 variables were present (LR+, 1.9), the likelihood of success increased from 61.7% to 86.3%**.

100)
Management of Neck Pain in Royal Australian Air Force Fast Jet Aircrew
Military Medicine 2011 (Jan); 176 (1): 106–109
http://www.ncbi.nlm.nih.gov/pubmed/21305970
Eighty-two RAAF FJ aircrew responded to the survey. **Ninety-five percent of the respondents experienced flight-related neck pain**. The most commonly sought treatment modalities were on-base medical and physiotherapy services. **Many respondents reported that currently provided on-base treatment and**

ancillary services such as chiropractic therapy are the most effective in alleviating symptoms.

101)
The Cervical Flexion-Relaxation Ratio: Reproducibility and Comparison Between Chronic Neck Pain Patients and Controls
Spine (Phila Pa 1976). 2010 (Nov 15); 35 (24): 2103–2108
http://www.ncbi.nlm.nih.gov/pubmed/20581761
The cervical extensor muscles exhibit a consistent flexion-relaxation (FFR) phenomenon in healthy control subjects and the measurement is highly reproducible when measured 4 weeks apart in both controls and chronic neck pain patients. The FRR in neck pain patients is significantly higher than in control subjects suggesting that this measure may be a useful marker of altered neuromuscular function.

102)
Rehabilitation Program for Traumatic Chronic Cervical Pain Associated With Unsteadiness: A Single Case Study
Chiropractic & Osteopathy 2008 (Nov 17); 16 (1): 15
http://chiromt.com/content/pdf/1746-1340-16-15.pdf
This case report indicates that an 8-week rehabilitation program combining therapeutic exercises with spinal manipulative therapy may have had an effect on improvement of postural control in a trauma Chronic Neck Pain patient with unsteadiness. These results warrant further studies to investigate the relationships between pain amelioration, sensorimotor control of the cervical spine, muscle fitness and postural steadiness.

103)
Predictors For Immediate and Global Responses to Chiropractic Manipulation of the Cervical Spine
J Manipulative Physiol Ther 2008 (Mar); 31 (3): 172–183
http://www.ncbi.nlm.nih.gov/pubmed/18394493
This study is the first attempt to identify variables that can predict immediate outcomes in terms of improvement and worsening of presenting symptoms, and global improvement, after cervical spine manipulation. **From the findings, it was possible to identify some predictors of immediate improvement in presenting symptoms after cervical spine manipulation. Patients presenting with symptoms of "reduced neck, shoulder, arm movement, stiffness," "neck pain," "upper, mid back pain," "headache," "shoulder, arm pain," and/or "none or one presenting symptom only" are likely to report immediate improvement in these symptoms after treatment.** Patients presenting with any 4 of these symptoms were shown to have the highest probability of immediate improvement. This finding may enhance clinical decision making for selecting cervical manipulation in the treatment of patients with one or more of these complaints. Although it was possible to identify a number of predictor variables for immediate worsening in presenting symptoms and global improvement after cervical spine manipulation, these failed to provide a robust predictive model

for clinical application.

104)
The Benefits Outweigh the Risks for Patients Undergoing Chiropractic Care for Neck Pain: A Prospective, Multicenter, Cohort Study
J Manipulative Physiol Ther 2007 (Jul); 30 (6): 408–418
http://www.ncbi.nlm.nih.gov/pubmed/17693331
In contrast to clinical trials of prescription medication, researchers in the area of conservative care for musculoskeletal complaints have focused their attention on treatment effectiveness and, to a much lesser degree, on adverse events. This study, consisting of patients treated in a wide variety of chiropractic practices and settings, describes both positive and negative, and short- and long-term clinical outcomes for a relatively large study population with neck pain. **Although many of the subjects (in this study) had chronic, recurrent neck pain and had undergone prior care for this complaint, many patients experienced benefit from the treatment (based upon diminished pain and disability, the percentage of patients recovered and percentage satisfied with care). Furthermore, many responded relatively quickly to treatment (48% were recovered at the fourth visit).**

105)
Conservative Management of Mechanical Neck Disorders:
A Systematic Review
J Rheumatol 2007 (May); 34 (5): 1083–1102
http://www.ncbi.nlm.nih.gov/pubmed/17295434
In a review of 88 unique RCTs, the authors found that "**Exercise combined with mobilization/manipulation**, exercise alone, and intramuscular lidocaine for chronic MND; intravenous glucocorticoid for acute whiplash associated disorders; and low-level laser therapy **demonstrated either intermediate or longterm benefits**. Optimal dosage of effective techniques and prognostic indicators for responders to care should be explored in future research."

106)
Chronic Mechanical Neck Pain in Adults Treated by Manual Therapy: A Systematic Review of Change Scores in Randomized Clinical Trials
J Manipulative Physiol Ther 2007 (Mar); 30 (3): 215–227
http://www.ncbi.nlm.nih.gov/pubmed/17416276
There is moderate- to high-quality evidence that subjects with chronic neck pain not due to whiplash and without arm pain and headaches show clinically important improvements from a course of spinal manipulation or mobilization at 6, 12, and up to 104 weeks posttreatment. The current evidence does not support a similar level of benefit from massage.

107)
The Impact of Psychosocial Factors on Neck Pain and Disability Outcomes Among Primary Care Patients: Results from the UCLA Neck Pain Study
Disabil Rehabil 2006 (Nov 15); 28 (21): 1319–1329
http://www.ncbi.nlm.nih.gov/pubmed/17083180

Of 960 eligible patients, 336 were enrolled and 80% were followed up through 6 months. Coping strategies involving self-assurance resulted in better disability outcomes, whereas getting angry or frustrated resulted in worse pain and disability outcomes. **Participants with high levels of social support from individuals were more likely to experience clinically meaningful reductions in pain and disability.** No consistent relations of internal health locus of control, and physical and psychological job demands with improvements in pain and disability were detected.

108)
Immediate Effects on Neck Pain and Active Range of Motion After a Single Cervical High-velocity Low-amplitude Manipulation in Subjects Presenting with Mechanical Neck Pain: A Randomized Controlled Trial
J Manipulative Physiol Ther 2006 (Sep); 29 (7): 511–517
http://www.ncbi.nlm.nih.gov/pubmed/16949939
A group of 70 patients with neck pain (25 males and 45 females, ages 20-55 years) participated in this study. The lateral gliding test was used to establish an intervertebral joint dysfunction at the C3 through C4 or C4 through C5 levels. The subjects were randomly divided into either an experimental group, which received an HVLA thrust, or a control group, which received manual mobilization. **Results suggest that a single cervical HVLA manipulation is more effective in reducing neck pain at rest, and in increasing active cervical range of motion, than a control mobilization procedure in subjects suffering from mechanical neck pain.**

109)
Symptomatic Outcomes and Perceived Satisfaction Levels of Chiropractic Patients with a Primary Diagnosis Involving Acute Neck Pain
J Manipulative Physiol Ther 2006 (May); 29 (4): 288–296
http://www.ncbi.nlm.nih.gov/pubmed/16690383
A total of 115 patients were contacted, of whom 94 became study participants, resulting in 60 women (64%) and 34 men. The mean age was 39.6 years (SD, 15.7). The mean number of visits was 24.5 (SD, 21.2). Pain levels improved significantly from a mean of 7.6 (median, 8.0) before treatment to 1.9 (median, 2.0) after treatment ($P < .0001$). **The overall patient satisfaction rate was 94%.**

110)
Return to Work After Two Years of Total Disability: A Case Report
J Occup Rehabil 2006 (Jun 3): 16 (2): 247–254
http://www.ncbi.nlm.nih.gov/pubmed/16752089
This paper describes the conservative management of a patient who was disabled from work for 2 years, using an integrated approach including chiropractic manipulation, pain education, restricted duty and clear communications among all parties involved. After 15 weeks, the patient returned to her previous occupation as a nurse, first part time, and subsequently full time.

111)
Improvement After Chiropractic Care in Cervicocephalic Kinesthetic Sensibility and Subjective Pain Intensity in Patients with Nontraumatic Chronic Neck Pain
J Manipulative Physiol Ther 2006 (Feb); 29 (2): 100–106
http://www.ncbi.nlm.nih.gov/pubmed/16752089
There was no difference between the treatment patients and the control subjects at the beginning with regard to age, sex, subjective pain intensity, range of motion,

and HRA. At the 5-week follow-up, the treatment patients showed significant reductions in pain and improvement of all HRA aspects measured whereas the control subjects did not show any reduction in pain and improvement in only one HRA aspect. **The results of this study suggest that chiropractic care can be effective in influencing the complex process of proprioceptive sensibility and pain of cervical origin**. Short, specific chiropractic treatment programs with proper patient information may alter the course of chronic cervical pain.

112)
Effects of a Managed Chiropractic Benefit on the Use of Specific Diagnostic and Therapeutic Procedures in the Treatment of Low Back and Neck Pain
J Manipulative Physiol Ther 2005 (Oct); 28 (8): 564–569
http://www.ncbi.nlm.nih.gov/pubmed/16226623
For the treatment of low back and neck pain, **the inclusion of a chiropractic benefit resulted in a significant reduction in the rates of surgery, advanced imaging, inpatient care, and plain-film radiographs.** This effect was greater on a per-episode basis than on a per-patient basis.

113)
Exercises for Mechanical Neck Disorders
Cochrane Database Syst Rev 2005 (Jul 20);3:CD004250
http://www.ncbi.nlm.nih.gov/pubmed/16034925
The evidence summarised in this systematic review indicates that specific exercises may be effective for the treatment of acute and chronic MND, with or without headache. To be of benefit, a stretching and strengthening exercise program should concentrate on the musculature of the cervical, shoulder-thoracic area, or both. **A multimodal care approach of exercise, combined with mobilisation or manipulation for subacute and chronic MND with or without headache, reduced pain, improved function, and global perceived effect in the short and long term**.

114)
Cervicogenic Head and Neck Pain in the ENT Clinic
HNO 2005 (May 11)
http://www.ncbi.nlm.nih.gov/pubmed/15887003
It is discussed controversially whether cervicogenic pain in the head and/or neck is a pathogenic entity. **The good results obtained with manual therapy in patients with head and neck pain contradict the refusal of the majority of the neurologists to accept the diagnosis "cervicogenic headache."**

Complaints about headache are frequently encountered in the general ENT clinic. The versatile picture of the cervicogenic headache is caused by the complex neural connections in the region of the upper cervical spine. The differential diagnosis of the cervicogenic headache is described.

115)
Determining the Relationship Between Cervical Lordosis and Neck Complaints
J Manipulative Physiol Ther 2005 (Mar); 28 (3): 187-193
http://www.ncbi.nlm.nih.gov/pubmed/15855907

In a study of 277 lateral cervical x-rays, patients with lordosis of 20° or less were more likely to have cervicogenic symptoms ($P < .001$). The association between cervical pain and lordosis of 0° or less was significant ($P < .0001$). The odds that a patient with cervical pain had a lordosis of 0° or less was 18 times greater than for a patient with a noncervical complaint. Patients with cervical pain had less lordosis and this was consistent over all age ranges.

116)
Long-Term Follow-up of a Randomized Clinical Trial Assessing the Efficacy of Medication, Acupuncture, and Spinal Manipulation for Chronic Mechanical Spinal Pain Syndromes
J Manipulative Physiol Ther 2005 (Jan); 28 (1): 3-11
http://www.ncbi.nlm.nih.gov/pubmed/15726029
The results of this "fastidious" approach were able to add some information regarding the efficacy of treatment regimens in patients with chronic spinal pain syndromes. **Overall, patients who have chronic mechanical spinal pain syndromes and received spinal manipulation gained significant broad-based beneficial short-term and long-term outcomes**. For patients receiving acupuncture, consistent improvements were also observed, although without reaching statistical significance (with a single exception). For patients receiving medication, the findings were less favorable. Larger studies are now clearly justified.

117)
Chronic Pain in Persons With Neuromuscular Disease
Clin J Pain 2005 (Jan); 21 (1): 18–26
http://www.chiro.org/ChiroZine/ABSTRACTS/Chronic_Pain_in_Persons.shtml
In this paper, researchers in a medical school rehabilitation department were interested in finding out what treatments were most effective at reducing pain for neuromuscular diseases (like amyotrophic lateral sclerosis and myotonic muscular dystrophies). Interestingly, **chiropractic scored the highest relief rating (7.33 out of 10), scoring higher than the relief provided by these medical treatments: nerve blocks (6.75) or Opioid analgesics (6.37).**

118)
Dose Response for Chiropractic Care of Chronic Cervicogenic Headache and Associated Neck Pain: A Randomized Pilot Study

J Manipulative Physiol Ther 2004 (Nov); 27 (9): 547—553
http://www.ncbi.nlm.nih.gov/pubmed/15614241
Patients were randomly allocated to 1, 3, or 4 visits per week for 3 weeks. All patients received high-velocity low-amplitude spinal manipulation. Doctor of Chiropractics could apply up to 2 physical modalities at each visit from among heat and soft tissue therapy. They could also recommend modification of daily activities and rehabilitative exercises. A large clinical trial on the relationship between pain relief and the number of chiropractic treatments is feasible. **Findings give preliminary support for the benefit of larger doses, 9 to 12 treatments, of chiropractic care for the treatment of cervicogenic headache.**

119)
Efficacy of Spinal Manipulation and Mobilization for Low Back Pain and Neck Pain: A Systematic Review and Best Evidence Synthesis
Spine Journal (of the North American Spine Society) 2004 (May); 4 (3): 335–356
http://www.chiro.org/research/FULL/Efficacy_of_Spinal_Manipulation_and_Mobilization.pdf
Our data synthesis suggests that recommendations can be made with some confidence regarding the use of SMT and/or MOB as a viable option for the treatment of both low back pain and neck pain. There have been few high-quality trials distinguishing between acute and chronic patients, and most are limited to shorter-term follow-up. Future trials should examine well-defined subgroups of patients, further address the value of SMT and MOB for acute patients, establish optimal number of treatment visits and consider the cost-effectiveness of care.

120)
Impairment in the Cervical Flexors: A Comparison of Whiplash and Insidious Onset Neck Pain Patients
Manual Therapy 2004 (May); 9 (2): 89–94
http://www.ncbi.nlm.nih.gov/pubmed/15040968
The results indicated that both the insidious onset neck pain and whiplash groups had higher measures of EMG signal amplitude (normalized root mean square) in the sternocleidomastoid during each stage of the test compared to the control subjects (all $P<0.05$) and had significantly greater shortfalls from the pressure targets in the test stages ($P<0.05$). No significant differences were evident between the neck pain groups in either parameter indicating that this physical impairment in the neck flexor synergy is common to neck pain of both whiplash and insidious origin.

121)
Chiropractic Management of Intractable Chronic Whiplash Syndrome
Clinical Chiropractic 2004 (Mar): 7 (1): 16—23
http://www.sciencedirect.com/science/article/pii/S1479235403000750
The management protocol in this case consisted of chiropractic spinal manipulative therapy, soft tissue work and post-isometric relaxation (PIR) techniques to address biomechanical somatic dysfunction. In addition, active rehabilitation exercises, self-stretches and proprioceptive exercises were utilised to address postural and muscle imbalance. On the seventh treatment, the patient reported no neck pain, no

headaches and unrestricted cervical spine range of motion. At 4 months follow-up, the patient continued to be free of headaches and neck stiffness and reported only mild, intermittent neck pain.

122)
Chronic Spinal Pain: A Randomized Clinical Trial Comparing Medication, Acupuncture, and Spinal Manipulation
Spine (Phila Pa 1976) 2003 (Jul 15); 28 (14): 1490–1502
http://www.ncbi.nlm.nih.gov/pubmed/12865832
The highest proportion of early (asymptomatic status) recovery was found for manipulation (27.3%), followed by acupuncture (9.4%) and medication (3%). Manipulation achieved the best overall results, with improvements of 50% (P = 0.01) on the Oswestry scale, 38% (P = 0.08) on the NDI, 47% (P < 0.001) on the SF-36, and 50% (P < 0.01) on the VAS for back pain, 38% (P < 0.001) for lumbar standing flexion, 20% (P < 0.001) for lumbar sitting flexion, 23% (P = 0.1) for cervical sitting flexion, and 18% (P = 0.02) for cervical sitting extension.

123)
Cost Effectiveness of Physiotherapy, Manual Therapy, and General Practitioner Care for Neck Pain: Economic Evaluation Alongside a Randomised Controlled Trial
http://www.bmj.com/content/326/7395/911.full
British Medical Journal 2003 (Apr 26); 326 (7395): 911 A hands-on approach to treating neck pain by manual therapy may help people get better faster and at a lower cost than more traditional treatments, according to this study. **After seven and 26 weeks, they found significant improvements in recovery rates in the manual therapy group compared to the other 2 groups**. For example, at week seven, 68% of the manual therapy group had recovered from their neck pain vs. 51% in the physical therapy group and 36% in the medical care group..

124)
Two-year Follow-up of a Randomized Clinical Trial of Spinal Manipulation and Two Types of Exercise for Patients with Chronic Neck Pain
Spine 2002 (Nov 1); 27 (21): 2383–2389
http://www.ncbi.nlm.nih.gov/pubmed/12438988
The results of this study demonstrate an advantage of spinal manipulation combined with low-tech rehabilitative exercise and MedX rehabilitative exercise versus spinal manipulation alone over two years and are similar in magnitude to those observed after one-year follow-up. These results suggest that treatments including supervised rehabilitative exercise should be considered for chronic neck pain sufferers. Further studies are needed to examine the cost effectiveness of these therapies and how spinal manipulation compares to no treatment or minimal intervention.

125)
Manual Therapy, Physical Therapy, or Continued Care by a General Practitioner for Patients with Neck Pain. A Randomized, Controlled Trial

Ann Intern Med 2002 (May 21); 136 (10): 713-722
http://www.ncbi.nlm.nih.gov/pubmed/12020139
Neck pain is a common problem, but the effectiveness of frequently applied conservative therapies has never been directly compared. **In this study, manual therapy was a favorable treatment option for patients with neck pain compared with physical therapy or continued care by a general practitioner.**

126)
A Pilot Randomized Clinical Trial on the Relative Effect of Instrumental (MFMA) Versus Manual (HVLA) Manipulation in the Treatment of Cervical Spine Dysfunction
J Manipulative Physiol Ther 2001 (May); 24 (4): 260–271
http://www.ncbi.nlm.nih.gov/pubmed/11353937
The results of this clinical trial indicate that both instrumental (MFMA) manipulation and manual (HVLA) manipulation have beneficial effects associated with reducing pain and disability and improving cervical range of motion in this patient population. A randomized, controlled clinical trial in a similar patient base with a larger sample size is necessary to verify the clinical relevance of these findings.

127)
Clinical Study on Manipulative Treatment of Derangement of the Atlantoaxial Joint
J Tradit Chin Med 1999 (Dec); 19 (4): 273–278
http://www.ncbi.nlm.nih.gov/pubmed/10921131
The derangement of the atlantoaxial joint is one of main cervical sources of dizziness and headache, which were based on the observation on the anatomy of the upper cervical vertebrae, analysis of X-ray film of the atlantoaxial joint, and the manipulative treatment in 35 patients with cervical spondylosis.

128)
Spinal Pain Syndromes: Nociceptive, Neuropathic, and Psychologic Mechanisms
J Manipulative Physiol Ther 1999 (Sep); 22 (7): 458–472
http://www.ncbi.nlm.nih.gov/pubmed/10519563
Although the treatment of neuropathic pain is difficult, sufficient evidence in the literature demonstrates that the treatment of nociceptive pain should be multimodal and involve spinal manipulation, muscle lengthening/stretching, trigger point therapy, rehabilitation exercises, electrical modalities, a variety of nutritional factors, and mental/emotional support.

129)
Chronic Spinal Pain Syndromes: A Clinical Pilot Trial Comparing Acupuncture, A Nonsteroidal Anti-inflammatory Drug, and Spinal Manipulation
J Manipulative Physiol Ther 1999 (Jul); 22 (6): 376–381
http://www.ncbi.nlm.nih.gov/pubmed/10478769

The consistency of the results provides, in spite of several discussed shortcomings of this pilot study, evidence that in patients with chronic spinal pain syndromes spinal manipulation, if not contraindicated, results in greater improvement than acupuncture and medicine.

130)
Dysafferentation: A Novel Term to Describe the Neuropathophysiological Effects of Joint Complex Dysfunction. A Look at Likely Mechanisms of Symptom Generation
J Manipulative Physiol Ther 1998 (May); 21 (4): 267–280
http://www.chiro.org/ChiroZine/ABSTRACTS/Seaman_dysafferentiation.shtml
Joint complex dysfunction should be included in the differential diagnosis of pain and visceral symptoms because joint complex dysfunction can often generate symptoms which are similar to those produced by true visceral disease.

131)
The Chiropractic Outcome Study:
Pain, Functional Ability and Satisfaction With Care
J Manipulative Physiol Ther 1997 (May); 20 (4): 235–240
http://www.ncbi.nlm.nih.gov/pubmed/9168407
Based on these results, it seems that patients suffering from back and/or neck complaints experience chiropractic care as an effective means of resolving or ameliorating pain and functional impairments, thus reinforcing previous results showing the benefits of chiropractic treatment for back and neck pain.

132)
The Effects of Spinal Manipulation on Cervical Kinesthesia in Patients With Chronic Neck Pain: A Pilot Study
J Manipulative Physiol Ther 1997 (Feb); 20 (2): 80–85
http://www.ncbi.nlm.nih.gov/pubmed/9046455
Subjects receiving manipulation demonstrated a mean reduction in visual analogue scores of 44%, along with a 41% improvement in mean scores for the head repositioning skill. In comparison, a 9% mean reduction in visual analogue scores and a 12% improvement in head repositioning scores was observed for the stretching group. The difference in the outcomes of the head repositioning skill scores was significant ($p < \text{or} = .05$).

133)
Chronic Cervical Zygapophysial Joint Pain After Whiplash:
A Placebo–Controlled Prevalence Study
SPINE 1996 (Aug 1); 21 (15): 1737–1744
http://www.ncbi.nlm.nih.gov/pubmed/8855458
The prevalence of cervical zygapophysial joint pain after whiplash has been studied by means of comparative local anesthetic blocks. The concern is that such blocks may be compromised by placebo responses and that prevalence estimates based on such blocks may exaggerate the importance of this condition. In this study, sixty-eight consecutive patients referred for chronic neck pain after whiplash were studied. Those who did not experience pain relief together with the patients with

dominant neck pain proceeded to undergo placebo-controlled local anesthetic blocks. Two different local anesthetics and a placebo injection of normal saline were administered in random order and under double-blindfolded conditions. A positive diagnosis was made if the patient's pain was completely and reproducibly relieved by each local anesthetic but not by the placebo injection. **Overall, the prevalence of cervical zygapophysial joint pain (C2-C3 or below) was 60% (93% confidence interval, 46%, 73%).**

134)
A Risk Assessment of Cervical Manipulation vs. NSAIDs for the Treatment of Neck Pain
J Manipulative Physiol Ther 1995 (Oct); 18 (8): 530–536
http://www.ncbi.nlm.nih.gov/pubmed/8583176
As for comparative safety, the best available evidence indicates that NSAID use poses a significantly greater risk of serious complications and death than the use of cervical manipulation for comparable conditions. In conclusion, **the best evidence indicates that cervical manipulation for neck pain is much safer than the use of NSAIDs, by as much as a factor of several hundred times.** There is no evidence that indicates NSAID use is any more effective than cervical manipulation for neck pain.

135)
Validity of Five Common Manual Neck Pain–provoking Tests
Scand J Rehabil Med 1995 (Sep); 27 (3): 131–136
http://www.ncbi.nlm.nih.gov/pubmed/8602474
This study revealed that palpation for pain was the most reproducable and accurate assessment of reported neck pain. They state: *"Palpation over the facet joints in the cervical spine was found to be the most appropriate screening test to corroborate the replies in self–reported questionnaires on dysfunctions of the neck."*

136)
The Prevalence of Chronic Cervical Zygapophysial Joint Pain After Whiplash
Spine Journal 1995 (Jan 1); 20 (1): 20–26
http://www.ncbi.nlm.nih.gov/pubmed/7709275
In a significant proportion of patients with whiplash, chronic, refractory neck pain develops. Provisional data suggest many of these patients have zygapophysial joint pain, but the diagnosis has been established by single, uncontrolled diagnostic block. In this study, fifty consecutive, referred patients with chronic neck pain after whiplash injury were studied using double-blind, controlled, diagnostic blocks of the cervical zygapophysial joints. On separate occasions, the joint was blocked with either lignocaine or bupivacaine in random order. A positive diagnosis was made only if both blocks relieved the patient's pain and bupivacaine provided longer relief. **In this population, cervical zygapophysial joint pain was the most common source of chronic neck pain after whiplash.**

137)
Chronic Spinal Pain: A Randomized Clinical Trial Comparing Medication, Acupuncture, and Spinal Manipulation
Spine (Phila Pa 1976) 2003 (Jul 15); 28 (14): 1490-1502
http://www.ncbi.nlm.nih.gov/pubmed/12865832
Randomization proved to be successful. The highest proportion of early (asymptomatic status) recovery was found for manipulation (27.3%), followed by acupuncture (9.4%) and medication (5%). Manipulation achieved the best overall results, with improvements of 50% (P = 0.01) on the Oswestry scale, 38% (P = 0.08) on the NDI, 47% (P < 0.001) on the SF-36, and 50% (P < 0.01) on the VAS for back pain, 38% (P < 0.001) for lumbar standing flexion, 20% (P < 0.001) for lumbar sitting flexion, 25% (P = 0.1) for cervical sitting flexion, and 18% (P = 0.02) for cervical sitting extension. However, on the VAS for neck pain, acupuncture showed a better result than manipulation (50% vs 42%).

138)
Long-Term Follow-up of a Randomized Clinical Trial Assessing the Efficacy of Medication, Acupuncture, and Spinal Manipulation for Chronic Mechanical Spinal Pain Syndromes
J Manipulative Physiol Ther 2005 (Jan); 28 (1): 3-11
http://www.ncbi.nlm.nih.gov/pubmed/15726029
The results of this "fastidious" approach were able to add some information regarding the efficacy of treatment regimens in patients with chronic spinal pain syndromes. **Overall, patients who have chronic mechanical spinal pain syndromes and received spinal manipulation gained significant broad-based beneficial short-term and long-term outcomes**. For patients receiving acupuncture, consistent improvements were also observed, although without reaching statistical significance (with a single exception). For patients receiving medication, the findings were less favorable. Larger studies are now clearly justified.

Scoliosis

139)
Four-Year Follow-Up of a Patient Undergoing Chiropractic Rehabilitation for Adolescent Idiopathic Scoliosis
Journal of Pediatric, Maternal & Family Health - Chiropractic 2011;2:54-58
http://chiropracticpediatricresearch.web.officelive.com/2011_1120_scoliosis.aspx
A 14 year old female with adolescent idiopathic scoliosis presented to a private chiropractic rehabilitation clinic for care. She had complaints of mild thoracic and right sacroiliac pain which worsened during prolonged sitting or while running long distances. Her scoliosis measured 24° in the thoracic spine and 17° in the lumbar spine. Abnormalities in chest expansion and axial trunk rotation were also observed

and recorded. Patient participated in a multimodal chiropractic rehabilitation program consisting of 28 clinic visits over 17 months. She also committed to a specific home exercise program. After 17 months, her curvatures decreased to 15°/6°, while showing concomitant improvements in peak expiratory flow, axial

trunk rotation, and chest expansion. These outcome measures further improved at follow-up after 4 years with the Cobb angles reducing to 12°/4° respectively.

140)
Scoliosis Treatment Using a Combination of Manipulative and Rehabilitative Therapy: A Retrospective Case Series
BMC Musculoskeletal Disorders 2004 (Sep 14); 5: 32
http://www.biomedcentral.com/1471-2474/5/32#IDA1QZ2H
The combined use of spinal manipulation and postural therapy appeared to significantly reduce the severity of the Cobb angle in all 19 subjects. These results warrant further testing of this protocol.

141)
Manipulation for the Control of Back Pain and Curve Progression in Patients with Skeletally Mature Idiopathic Scoliosis: Two Cases
J Manipulative Physiol Ther 1994 (May); 17 (4): 253–257
http://www.ncbi.nlm.nih.gov/pubmed?term=%22Tarola%20GA%22[Author]
Diversified-type CMT has a favorable effect on acute back pain when used palliatively. The procedure may also have a favorable long term effect of preventing recurrence of back pain and on retarding curve progression when used routinely 1-2 times per month.]

Whiplash Injury

142)
A Symptomatic Classification of Whiplash Injury and the Implications for Treatment
Journal of Orthopaedic Medicine 1999; 21 (1): 22–25
http://212.53.87.81/cgi/jomabs2.pl?File=211&Art=4
Whiplash injuries are common. Chiropractic is the only proven effective treatment in chronic cases. Our study enables patients to be classified at initial assessment in order to target those patients who will benefit from such treatment.

143)
Chiropractic Treatment of Chronic 'Whiplash' Injuries
http://www.ncbi.nlm.nih.gov/pubmed/9039361
Injury 1996 (Nov); 27 (9): 643–645
Twenty-six (93 per cent) patients improved following chiropractic treatment (U = 34, P < 0.001). The encouraging results from this retrospective study merit the instigation of a prospective randomized controlled trial to compare conventional with chiropractic treatment in chronic 'whiplash' injury.

144)
Conservative Management of Mechanical Neck Pain: Systematic Overview and Meta-analysis
British Medical Journal 1996 (Nov 23); 313 (7068): 1291–1296
http://www.bmj.com/content/313/7068/1291.full

Twenty four randomised clinical trials met the selection criteria and were categorised by type of intervention: nine used manual treatments; 12 physical medicine methods; four drug treatment; and three education of patients (four trials investigated more than one form of intervention).

Headache

145)
Manual Therapies for Migraine: A Systematic Review
http://www.springerlink.com/content/a41rw34473125167/fulltext.html
J Headache Pain. 2011 (Apr); 12 (2): 127–133
Migraine occurs in about 15% of the general population. Migraine is usually managed by medication, but some patients do not tolerate migraine medication due to side effects or prefer to avoid medication for other reasons. Non-pharmacological management is an alternative treatment option. We systematically reviewed randomized clinical trials (RCTs) on manual therapies for migraine. The RCTs suggest that massage therapy, physiotherapy, relaxation and chiropractic spinal manipulative therapy might be equally effective as propranolol and topiramate in the prophylactic management of migraine. However, the evaluated RCTs had many methodological shortcomings.

146)
Dose Response and Efficacy of Spinal Manipulation for Chronic Cervicogenic Headache: A Pilot Randomized Controlled Trial
The Spine Journal 2010 (Feb): 10 (2): 117-128
http://www.studiomazzini.net/pdf/WIpyWL-sdarticle.pdf
Eighty patients with chronic cervicogenic headache (CGH) were randomized to receive either 8 or 16 treatment sessions with either chiropractic care (Spinal Manipulation or SMT) or a minimal light massage (LM) as the control group. Both SMT groups improved much more than the control groups, with greater improvements in the group that received more care.
147)
Intractable Migraine Headaches During Pregnancy Under Chiropractic Care
Complementary Therapies in Clinical Practice 2009 (Nov); 15 (4): 192–7
http://www.ncbi.nlm.nih.gov/pubmed/19880080
The absence of hormone fluctuations and/or the analgesic effects of increased beta-endorphins are thought to confer improvements in headache symptoms during pregnancy. However, for a number of pregnant patients, they continue to suffer or have worsening headache symptoms. The use of pharmacotherapy for palliative care is a concern for both the mother and the developing fetus and alternative/complementary care options are sought. We present a 24-year-old gravid female with chronic migraine headaches since age 12years. Previous unsuccessful care included osteopathy, physical therapy, massage and medication. Non-steroidal anti-inflammatory medication with codeine provided minor and temporary relief. Chiropractic care involving spinal manipulative therapy (SMT) and adjunctive therapies resulted in symptom improvement and independence from medication. This document provides supporting evidence on the safety and possible effectiveness of chiropractic care for patients with headaches during pregnancy.

148)
An Open Study Comparing Manual Therapy With the Use of Cold Packs in the Treatment of Post-traumatic Headache
Cephalalgia 1990 Oct; 10(5): 241–50
http://www.ncbi.nlm.nih.gov/pubmed/2272094
It is concluded that the type of manual therapy used in this study seems to have a specific effect in reducing post-traumatic headache. The result supports the hypothesis of a cervical mechanism causing post-traumatic headache and suggests that post-traumatic dizziness, visual disturbances and ear symptoms could be part of a cervical syndrome.

149)
Non-invasive Physical Treatments for Chronic/Recurrent Headache
Cochrane Database Syst Review 2004; (3): CD001878
http://www.ncbi.nlm.nih.gov/pubmed/15266458
For the prophylactic treatment of migraine headache, there is evidence that spinal manipulation may be an effective treatment option with a short-term effect similar to that of a commonly used, effective drug (amitriptyline). For the prophylactic treatment of chronic tension-type headache, amitriptyline is more effective than spinal manipulation during treatment. However, spinal manipulation is superior in the short term after cessation of both treatments. For the prophylactic treatment of cervicogenic headache, there is evidence that both neck exercise (low-intensity endurance training) and spinal manipulation are effective in the short and long term when compared to no treatment. There is also evidence that spinal manipulation is effective in the short term when compared to massage or placebo spinal manipulation, and weaker evidence when compared to spinal mobilization.

150)
A Randomized Controlled Trial of Exercise and Manipulative Therapy for Cervicogenic Headache
SPINE (Phila Pa 1976) 2002 (Sep 1); 27 (17): 1835—1843
http://www.ncbi.nlm.nih.gov/pubmed/12221344
Manipulative therapy and exercise can reduce the symptoms of cervicogenic headache, and the effects are maintained.

151)
The Effect of Spinal Manipulation in the Treatment of Cervicogenic Headache
J Manipulative Physiol Ther 1997 (Jun); 20 (5): 326–330
http://www.ncbi.nlm.nih.gov/pubmed/9200048
The use of analgesics decreased by 36% in the manipulation group, but was unchanged in the soft-tissue group. **The number of headache hours per day decreased by 69% in the manipulation group, compared with 37% in the soft-tissue group. Finally, headache intensity per episode decreased by 36% in the manipulation group, compared with 17% in the soft-tissue group.**

152)
Manipulation and Mobilization of the Cervical Spine.
A Systematic Review of the Literature
SPINE (Phila Pa 1976) 1996 (Aug 1); 21 (15): 1746–1760
http://www.ncbi.nlm.nih.gov/pubmed/8855459
The combination of three of the randomized controlled trials comparing spinal manipulation with other therapies for patients with subacute or chronic neck pain showed an improvement on a 100-mm visual analogue scale of pain at 3 weeks of 12.6 mm (93% confidence interval, -0.15, 25.5) for manipulation compared with muscle relaxants or usual medical care. The highest quality randomized controlled trial demonstrated that spinal manipulation provided short-term relief for patients with tension-type headache. The complication rate for cervical spine manipulation is estimated to be between 5 and 10 per 10 million manipulations.

153)
Manual Therapies for Migraine: A Systematic Review
J Headache Pain. 2011 (Feb 5) [Epub ahead of print]
http://www.springerlink.com/content/a41rw34473125167/fulltext.html
Migraine occurs in about 15% of the general population. Migraine is usually managed by medication, but some patients do not tolerate migraine medication due to side effects or prefer to avoid medication for other reasons. Non-pharmacological management is an alternative treatment option. We systematically reviewed randomized clinical trials (RCTs) on manual therapies for migraine. The RCTs suggest that massage therapy, physiotherapy, relaxation and chiropractic spinal manipulative therapy might be equally effective as propranolol and topiramate in the prophylactic management of migraine. However, the evaluated RCTs had many methodological shortcomings.

154)
A Randomized Controlled Trial of Chiropractic
Spinal Manipulative Therapy for Migraine
J Manipulative Physiol Ther 2000 (Feb); 23 (2): 91–95
http://www.ncbi.nlm.nih.gov/pubmed/10714533
The results of this study support previous results showing that some people report significant improvement in migraines after chiropractic SMT. A high percentage (>80%) of participants reported stress as a major factor for their migraines. It appears probable that chiropractic care has an effect on the physical conditions related to stress and that in these people the effects of the migraine are reduced.

155)
Chiropractic Management of Migraine Without Aura: A Case
StudyAustralasia Chiropractic and Osteopathic Journal 1999 (Nov): 8 (3)
http://www.chiro.org/LINKS/ABSTRACTS/Migraine_Without_Aura.shtm
It now appears clear that chiropractic care may be used to assist patients with migraine. Research is currently being undertaken to investigate the potential mechanisms of chiropractic in the treatment of migraine. This research should also assess what (if any) prognostic signs can be identified to assist practitioners making a more informed decision on the treatment of choice for migraine.

156)
A Twelve Month Clinical Trial of Chiropractic
Spinal Manipulative Therapy for Migraine
Australasia Chiropractic and Osteopathic Journal 1999 (Jul): 8 (2)
http://www.chiro.org/LINKS/ABSTRACTS/Twelve_Month.shtml
32 participants showed statistically significant ($p < 0.05$) improvement in migraine frequency, VAS, disability, and medication use, when compared to initial baseline levels. A further assessment of outcomes after a six month follow up (based on 24 participants), continued to show statistically significant improvement in migraine frequency ($p < 0.005$), VAS ($p < 0.01$), disability ($p < 0.05$), and medication use ($p < 0.01$), when compared to initial baseline levels. .

157)
Efficacy of Spinal Manipulation for Chronic Headache: A Systematic Review
J Manipulative Physiol Ther 2001 (Sep); 24 (7): 457–466
http://www.ncbi.nlm.nih.gov/pubmed/11562654
SMT appears to have a better effect than massage for cervicogenic headache. It also appears that SMT has an effect comparable to commonly used first-line prophylactic prescription medications for tension-type headache and migraine headache.

158)
Efficacy of spinal manipulation and mobilization for low back pain and neck pain: a systematic review and best evidence synthesis
The Spine Journal Volume 4, Issue 3 , Pages 335-356, May 2004
Gert Bronfort, PhD, DC;Mitchell Haas, DC, MA;Roni L. Evans, DC, MS;Lex M. Bouter, PhD
Received 26 February 2003; accepted 2 June 2003.
Abstract
Background context
Despite the many published randomized clinical trials (RCTs), a substantial number of reviews and several national clinical guidelines, much controversy still remains regarding the evidence for or against efficacy of spinal manipulation for low back pain and neck pain.
Purpose
To reassess the efficacy of spinal manipulative therapy (SMT) and mobilization (MOB) for the management of low back pain (LBP) and neck pain (NP), with special attention to applying more stringent criteria for study admissibility into evidence and for isolating the effect of SMT and/or MOB.
Study design
RCTs including 10 or more subjects per group receiving SMT or MOB and using patient-oriented primary outcome measures (eg, patient-rated pain, disability, global improvement and recovery time).
Methods
Articles in English, Danish, Swedish, Norwegian and Dutch reporting on randomized trials were identified by a comprehensive search of computerized and bibliographic literature databases up to the end of 2002. Two reviewers independently abstracted data and assessed study quality according to eight explicit criteria. A best evidence

synthesis incorporating explicit, detailed information about outcome measures and interventions was used to evaluate treatment efficacy. The strength of evidence was assessed by a classification system that incorporated study validity and statistical significance of study results. Sixty-nine RCTs met the study selection criteria and were reviewed and assigned validity scores varying from 6 to 81 on a scale of 0 to 100. Forty-three RCTs met the admissibility criteria for evidence.

Results

Acute LBP: There is moderate evidence that SMT provides more short-term pain relief than MOB and detuned diathermy, and limited evidence of faster recovery than a commonly used physical therapy treatment strategy.

Chronic LBP: There is moderate evidence that SMT has an effect similar to an efficacious prescription nonsteroidal anti-inflammatory drug, SMT/MOB is effective in the short term when compared with placebo and general practitioner care, and in the long term compared to physical therapy. There is limited to moderate evidence that SMT is better than physical therapy and home back exercise in both the short and long term. There is limited evidence that SMT is superior to sham SMT in the short term and superior to chemonucleolysis for disc herniation in the short term. However, there is also limited evidence that MOB is inferior to back exercise after disc herniation surgery.

Mix of acute and chronic LBP: SMT/MOB provides either similar or better pain outcomes in the short and long term when compared with placebo and with other treatments, such as McKenzie therapy, medical care, management by physical therapists, soft tissue treatment and back school.

Acute NP: There are few studies, and the evidence is currently inconclusive.

Chronic NP: There is moderate evidence that SMT/MOB is superior to general practitioner management for short-term pain reduction but that SMT offers at most similar pain relief to high-technology rehabilitative exercise in the short and long term.

Mix of acute and chronic NP: The overall evidence is not clear. There is moderate evidence that MOB is superior to physical therapy and family physician care, and similar to SMT in both the short and long term. There is limited evidence that SMT, in both the short and long term, is inferior to physical therapy.

Conclusions

Our data synthesis suggests that recommendations can be made with some confidence regarding the use of SMT and/or MOB as a viable option for the treatment of both low back pain and NP. There have been few high-quality trials distinguishing between acute and chronic patients, and most are limited to shorter-term follow-up. Future trials should examine well-defined subgroups of patients, further address the value of SMT and MOB for acute patients, establish optimal number of treatment visits and consider the cost-effectiveness of care.

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E) Education-Chiropractic vs. Physical Therapy

All information for these comparisons was derived form the institution's catalogs and student interviews at Oregon Health Sciences University.

Comparative class courses correspond horizontally.

The Doctor of Chiropractic is considered a "first professional degree." Unlike the Doctor of Philosophy (Ph.D.) degree, first professional degrees do not presuppose that a student has earned a Bachelor's and a Master's degree. In addition to chiropractic, first professional degrees are characteristic of other health professions [such as dentistry (D.D.S), medicine (M.D.), optometry (O.D.), etc.] and also law (J.D.) and theology. (See 1991 Western States Chiropractic College Catalog.)

There have been nearly thirty clinical studies conducted comparing **manipulative therapy** to other types of treatment for low back pain. Spinal manipulation has been to be constantly as **effective or more effective** than an array of other comparison treatments for low back pain. (Nyiendo, J. Chiropractic effectiveness, Portland, Oregon; Oregon Chiropractic Physicians Association, April, 1991).

COONTINUING EDUCATION REQUIREMENTS

Chiropractics Physicians – The Oregon Board of Chiropractic Examiners' administrative rules require **45 hours of continuing education** for relicensure.

Medical Physicians/ Osteopathic Physicians- The Oregon board of Medical examiners' administrative rules **do not require continuing education** for relicensure.

Physical Therapists- the Oregon Physical Therapists' Licensing Board **does not require continuing education** for relicensure.

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PHYSICIAN / NON-PHYSICIAN COMPARISON

CHIROPRACTIC PHYSCIAN WESTERN STATES CHIROPRACTIC COLLEGE 1990-1992		PHYSICAL THERAPIST PACIFIC UNIVERSITY 1990-1991	
Course Title	**Class Hours**	**Course Title**	**Class Hours**
Gross Anatomy I-III	288	Gross Human Anatomy	171
Spinal Anatomy I-III	24		
Histology I, II	144		
Biochemistry I, II	120		
Physiology I, II	132	Applied Human Physiology	87
Neurophysiology	72		
Neuroanatomy	96	Functional Neuroanatomy	132
Embryology	24		
Nutrition	48		
Clinical Nutrition	24		
Physical Diagnosis I, II	144		
Clinical Psychology	36	Psychological Aspects Illness/ Disability	45
General Pathology I, II	120	Fundamentals of Pathology	15
Clinical Pathology	36		
Genetics	48		
CPR/Emergency Care	24		
Microbiology & Public Health	72		
Clinical Microbiology & Public Health	84		
Toxicology & Pharmacology	48		
Dermatology & Infectious Disease	24		
Clinical Lab	60		
Correlative & Differential Diagnosis	48	Physical Therapy Evaluation Seminar	30
Neuromusculoskeletal-		MS. Disabilities & Therapeutic Pro.	75
Diagnosis/ Treatment I-IV	252	Neurological Disab. & Therapeutic Pro	75
Physiotherapy I, II	120	Physical Agents I, II	105
		Fundamentals of Therapeutic Exercise	30
		Motor Contort & Therapeutic Proceed.	60
Soft Tissue Therapies I, II	48		
Gastroenterology Diagnosis/ Treatment	60	Medical Disability & Therapeutic Proceed.	45
Cardio respiratory Diagnosis/ Therapy	60		
Genitourinary Survey	60		
		Special Topics	30
Obstetrics	36		
Jurisprudence & Ethics	24	Professional Issues	45
Radiographic Anatomy I-III	84		
Bone Pathology I-IV	120		
Radiographic Report Writing	12		
Roentgenometrics I, II	24		
Radiographic Technique I-III	120		
Patient/ Practice Management I-III	84	Organization & Administration	45
		Professional Communication	45
Clinical Pediatrics	24		
Clinical Geriatrics	24	Health Care & the Geriatric Patient	30
Biomechanics & Palpation I-IV	204	Human Motion & Biomechanics I, III	120
Adjustive Technique I-IX	408		
Eye/ Ear/ Nose/Throat	24		
Narrative Report Writing	24		
Radiology Report Writing	12		
Clinical Research Methodology I, II	60	Research and Thesis	171
Principles of Chiropractic I-V	96		
Minor Surgery/ Proctology	36		
TOTAL CALSS HOURS	**3,732**	**TOTAL CLASS HOURS**	**1,356**
Clinical Observation I-III	60	Clinical Experience I-III	280
Clinic Phase I,II,III-A,B,C,D	816	Clinical Internship I-III	800
TOTAL CLINIC HOURS	**876**	**TOTAL CLINIC HOURS**	**1,080**
TOTAL D.C. REQURIEMENTS	**4,608**	**TOTAL P.T. REQUIREMENTS**	**2,436**

Oregon law requires the prescription of a physician for treatment by a physical therapist. Physical therapists are not trained to diagnose and are unable to request

PHYSICIAN COMPARISON

CHIROPRACTIC PHYSICIAN
WESTERN STSTES CHIROPRACTIC COLLEGE 1988-1990

Course Title	Class Hours
Gross Anatomy I-III	288
Histology I, II	144
Biochemistry I, II	120
Physiology I, II	132
Embryology	24
Neuroanatomy	96
Nutrition	48
Clinical Nutrition	36
Physical Diagnosis I, II	144
Clinical Psychology	36
General Pathology I, II	120
Genetics	48
CPR/ Emergency Care	24
Microbiology & Public Health	84
Clinical Microbiology & Public Health	84
Toxicology & Pharmacology	48
Dermatology & Infectious Disease	24
Clinical Lab	60
Neurophysiology	72
Gastroenterology Diagnosis/ Treatment	48
Cardiorespiratory Diagnosis/ Treatment	24
Clinical Pathology	36
Genitourinary Survey	60
Jurisprudence & Ethics	24
Radiological Interpretation I-V	120
Radiographic Anatomy I-III	84
Roentgenometrics I, II	24
Soft Tissue Radiographic Interp. I, II	48
Radiographic Technique I, II	120
Minor Surgery/ Proctology	24
Obstetrics	36
Patient/ Practice Management I- IV	108
Adjustive Technique I- IX	**396**
Clinical Pediatrics	24
Clinical Geriatrics	24
Spinal Anatomy	24
Biomechanics & Palpation I- IV 264	**264**
Neuromusculoskeletal DX/TX I-IV	**276**
Correlative & Differential Diagnosis	48
Physiotherapy I, II	120
Narrative Report Writing	24
Clinical Research Methodology I, II	60
Principles of Chiropractic Philosophy I-IV	120
TOTAL CLASS HOURS	**3,768**
Clinic Observation I-III	72
Clinic Phase I,II,III A,B,C,D	822
TOTAL CLINIC HOURS	894
TOTAL D.C. REQUIREMENTS	**4,662**

Optional hours not included in totals

MEDICAL PHYSICIAN
OREGON HEALTH SCIENCES UNIVERSITY 1988-1990

Course Title	Class Hours
Gross Anatomy	190
Histology	84
Medical Biochemistry	145
Human Physiology	149
Developmental Physiology	40
Neuroanatomy	84
Nutrition	20
Ophthalmology	36
Otolaryngology	72
Medical Psychology	49
Introduction to Psychiatry	43
General Pathology	68
Medical Genetics	32
Cardiopulmonary Resuscitation	
Introduction to Medical Microbiology	90
Introduction to Public Health	26
Public Health and Epidemiology	40
Immunology	35
Pharmacology	72
Pathophysiology of Skin. Bone C.T.	69
Blood/ Reticuloendothelial Pathophys.	117
Pathophysiology of the CNS/ Muscle and Special Sensory Organs	158
Neurology and Neurosurgery	216
Gastrointestinal Pathophysiology	123
Respiratory Pathophysiology	79
Cardiovascular Pathophysiology	117
Endocrine Pathophysiology	43
Reproductive Pathophysiology	55
Renal Pathophysiology	117
Law and Medicine	24
Radiographic Diagnosis	24
Child Health (CON 620, lecture)	48
TOTAL CLASS HOURS	**2,465**
Patient Evaluation	192
Third- Year Medicine	432
Child Health	384
Psychiatry Clinical Clerkship	216
Obstetrics and Gynecology	216
Surgery	432
Special Programmed Instruction	
TOTAL HOSPITAL HOURS	2,412
TOTAL M.D. REQUIREMENTS	**4,877**

Optional hours not included in totals.

OSTEOPATHIC PHYSICIAN
CHICAGO COLLEGE OF OSTEOPATHIC MEDICINE 1989-1990

Course Title	Class Hours
Gross Anatomy (401,2)	264
Histology	77
Biochemistry (410,2)	143
Physiology (401,2)	176
Embryology (401)	11
Neuroanatomy (401,2)	66
Introduction to Clinical Med. (401,2,3)	33
Psychology (403)	22
Psychiatry (401,2) (504,5)	53
Pathology (401, 502,3)	181
Pharmacology (501,2)	125
Prep. For Clinical Practice (501)	300
Osteopathic Manipulation Med. I-V	**162**
Introduction to Clinical Med. IV, V	63
History of Medicine (401)	11
Electives (500.01, .02,. 03)	70
TOTAL CLASS HOURS	**1,93**
Family Medicine (601, 2)	800
Internal Medicine (601)	800
Pediatrics (601)	240
Psychiatry (601)	160
Obstetrics/ Gynecology (601)	240
Emergency Medicine (601)	160
Pathology (601)	80
Surgery (601)	640
Electives (701, 801)	640
TOTALHOSPITAL HOURS	3,840
TOTAL D.O. REQUIREMENTS	**5,77**

Optional hours included in totals.

Physical Therapists inadequately trained to safely administer spinal manipulation

**Chiropractic in New Zealand, Report of the Commission of Inquiry into Chiropractic
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Wellington, New Zealand 19790 Crown Copyright.
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The Government Printer, Wellington, New Zealand, 1979**

Scott Haldeman, DC, PhD, MD, FRCP (C), FAAN, FCCS (C), was a witness at the New Zealand Commission of Inquiry, the most comprehensive and detailed independent examination of chiropractic ever undertaken at the time. The report withstood judicial hearings and extensive investigations by the Commission in New Zealand, the United States, Canada, England and Australia. Dr. Haldeman stated for the record that for a medical physician to become proficient in spinal manipulative techniques an additional year of full-time education and training, beyond the medical degree, would be required, and even more time for the graduate physical therapist.

Dr. Haldeman is a foremost international authority on the management of spinal pain, and has qualified as both a chiropractic physician and medical physician. He serves as Clinical Professor, Department of Neurology at University of California, Irvine, Adjunct Professor in the Research Division at SCUHS and Adjunct Professor of Department of Epidemiology at School of Public Health, University of California, Los Angeles. He is on the editorial board of 6 scientific journals including journal Spine and The Spine Journal. He has published over 180 articles or book chapters, over 70 scientific abstracts, and has authored or edited 7 textbooks. Dr. Haldeman is certified by the American Board of Neurology and Psychiatry, is a Fellow of the Royal College of Physicians of Canada and the American Academy of Neurology, and a Diplomate of the American Board of Electrodiagnostic Medicine, the American Board of Electroencephalography and Neurophysiology and the American Board of Clinical Physiology.

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159)
Chiropractic is superior to physical therapy and physician care for work related low back pain disability recurrence in work-related nonspecific lbp,
JOURNAL OF OCCUPATIONAL AND ENVIRONMENTAL MEDICINE

The use of health maintenance care provided by physical therapist or physician services was associated with a higher disability recurrence than in chiropractic services or no treatment
Cifuentes, M; Willetts, J; Wasiak, R. Health Maintenance Care in Work-Related Low Back Pain and Its Association With Disability Recurrence. JOURNAL OF OCCUPATIONAL AND ENVIRONMENTAL MEDICINE 53 (4). APR 2011. p.396-404

To compare occurrence of repeated disability episodes across types of health care providers who treat claimants with new episodes of work-related low back pain (LBP). Method: A total of 894 cases followed 1 year using workers' compensation

claims data. Provider types were defined for the initial episode of disability and subsequent episode of health maintenance care. Results: Controlling for demographics and severity, the hazard ratio [HR] of disability recurrence for patients of physical therapists (HR = 2.0; 95% confidence interval [CI] = 1.0 to

3.9) or physicians (HR = 1.6; 95% CI = 0.9 to 6.2) was higher than that of chiropractor (referent, HR = 1.0), which was similar to that of the patients non-treated after return to work (HR = 1.2; 95% CI = 0.4 to 3.8). Conclusions: In work-related nonspecific LBP, the use of health maintenance care provided by physical therapist or physician services was associated with a higher disability recurrence than in chiropractic services or no treatment.

Effectiveness of Physical Therapy for the Management of Chronic Spine **Disorders:** A Propensity Score Approach

Janet K Freburger,Timothy S Carey and George M Holmes,JK Freburger, PT, PhD, is Research Associate and Fellow, Cecil G. Sheps Center for Health Services Research, University of North Carolina, Chapel Hill, NC ,TS Carey, MD, MPH, is Director, Cecil G. Sheps Center for Health Services Research, and Professor, Departments of Medicine and Social Medicine, School of Medicine, University of North Carolina, Chapel Hill ,GM Holmes, PhD, is Research Associate and Fellow, Cecil G. Sheps Center for Health Services Research, University of North Carolina, Chapel Hill,(janet_freburger{at}unc.edu) Address all correspondence to Dr Freburger at 725 Airport Rd, CB#7590, Chapel Hill, NC 27599-7590 (USA)

Abstract

Background and Purpose. Evidence on the effectiveness of physical therapy for the management of chronic spine disorders is limited. The purpose of this study was to use a large current database, the National Spine Network database, to assess the effectiveness of physical therapy in the management of chronic spine disorders.

Subjects. The participants were people who had spine problems lasting 3 months or longer and who were seen for an initial visit and a follow-up visit (N=4,479) at 1 of 17 US spine centers.

Methods. A propensity score approach was used to create a matched sample of participants who received physical therapy (intervention group) and participants who did not receive physical therapy (control group). The 2 groups were similar with regard to more than 50 baseline characteristics. Outcomes were assessed with the Oswestry Disability Index (ODI) and the 36-Item Short-Form Health Survey (SF-36).

Results. Both the intervention and control groups improved between the initial and the follow-up visits on ODI scores and on SF-36 physical function, role physical, and bodily pain scores. Although the amount of improvement in the outcome measures was significantly greater for the intervention group than for the control group, the differences were small (3–5 points). When the subgroup of participants who had the greatest propensity for receiving physical therapy was examined, differences in the amount of improvement between the intervention and control groups were larger (5–13 points).

Discussion and Conclusion. Physical therapy was effective in the management of chronic spine disorders in participants with the greatest propensity for receiving physical therapy. When the entire sample was considered, differences in the

amount of improvement between the intervention and control groups were not clinically relevant. [Freburger JK, Carey TS, Holmes GM. Effectiveness of physical therapy for the management of chronic spine disorders: a propensity score approach.

160)
Physiotherapist-directed exercise, advice, or both for subacute low back pain: a randomized trial.
Royal College of Surgeons of England, London, United Kingdom.
Abstract
BACKGROUND: Advice and exercise are widely recommended for subacute low back pain, but the effectiveness of these interventions is unclear.
OBJECTIVE: To investigate the effectiveness of physiotherapist-prescribed exercise, advice, or both for subacute low back pain.
DESIGN: Factorial randomized, placebo-controlled trial.
SETTING: 7 university hospitals and primary care clinics in Australia and New Zealand.
PATIENTS: 259 persons with subacute low back pain (>6 weeks and <3 months in duration).
INTERVENTION: Participants received 12 physiotherapist-directed exercise or sham exercise sessions and 3 physiotherapist-directed advice or sham advice sessions over 6 weeks.
MEASUREMENTS: Primary outcomes were average pain over the past week (scale, 0 to 10), function (Patient-Specific Functional Scale), and global perceived effect (11-point scale) at 6 weeks and 12 months. Secondary outcomes were disability (Roland-Morris Disability Questionnaire), number of health care contacts, and depression (Depression Anxiety Stress Scales-21).
RESULTS: Exercise and advice were each slightly more effective than placebo at 6 weeks but not at 12 months. The effect of advice on the pain scale was -0.7 point (95% CI, -1.2 to -0.2 point; P = 0.011) at 6 weeks and -0.4 point (CI, -1.0 to 0.3 point; P = 0.27) at 12 months, whereas the effect of exercise was -0.8 point (CI, -1.3 to -0.3 point; P = 0.004) at 6 weeks and -0.5 point (CI, -1.1 to 0.2 point; P = 0.14) at 12 months. The effect of advice on the function scale was 0.7 point (CI, 0.1 to 1.3 points; P = 0.014) at 6 weeks and 0.6 point (CI, 0.1 to 1.2 points; P = 0.023) at 12 months, and the effect of exercise was 0.4 point (CI, -0.2 to 1.0 point; P = 0.174) at 6 weeks and 0.5 point (CI, -0.1 to 1.0 point; P = 0.094) at 12 months. The effect of advice on the global perceived effect scale was 0.8 point (CI, 0.3 to 1.2 points; P < 0.001) at 6 weeks and 0.3 point (CI, -0.2 to 0.9 point; P = 0.24) at 12 months, and the effect of exercise was 0.5 point (CI, 0.1 to 1.0 point; P = 0.017) at 6 weeks and 0.4 point (CI, -0.1 to 1.0 point; P = 0.134) at 12 months. When administered together, exercise and advice had larger effects on all outcomes at 6 weeks (effect on pain, -1.5 [CI -2.2 to -0.7 point; P = 0.001], with similar results for other primary outcomes); however, by 12 months, there was a statistically significant effect only for function (effect, 1.1 points [CI, 0.3 to 1.8 points]; P = 0.005).
LIMITATION: Physiotherapists were not blinded.
Physical conditioning programs for improving work outcomes in workers *with l*
Schaafsma F, Schonstein E, Whelan KM, Ulvestad E, Kenny DT, Verbeek JH

161)
Cochrane Reviews

Summary
Physical conditioning program for improving work outcomes in workers with back pain

The main goal of physical conditioning programs, sometimes called work conditioning, work hardening or functional restoration/exercise programs, is to return injured or disabled workers to work or improve the work status for workers performing modified duties. Such programs either simulate or duplicate work, functional tasks, or both, in a safe, supervised environment. These tasks are structured and progressively graded to increase psychological, physical and emotional tolerance and improve endurance and work feasibility. In such environments, injured workers learn appropriate job performance skills in addition to improving their physical condition, through an exercise program aimed at increasing strength, endurance, flexibility, and cardiovascular fitness. Work hardening programs are individualized, work-oriented activities that involve clients in simulated or actual work tasks. Work conditioning is a program with an emphasis on physical conditioning that addresses the issues of strength, endurance, flexibility, motor control, and cardiopulmonary function. Functional restoration refers to any intervention aimed at restoring a reasonable functional level for daily living, including work.

Based on 23 included studies, we analyzed eight comparisons of physical conditioning programs versus care as usual or other types of interventions, such as standard exercise therapy for different durations of back pain and follow-up times. We divided physical conditioning programs into a light or an intense program depending on its intensity and duration. Results showed that light physical conditioning programs have no significant effect on sickness absence duration for workers with subacute or chronic back pain. We found conflicting results for intense physical conditioning programs for workers with subacute back pain. Further analysis suggested a positive effect on sick leave when the workplace was involved in the intervention. Physical conditioning programs probably have a small effect on return-to-work for workers with chronic back pain. We found conflicting results for intense physical conditioning programs compared to other exercise therapy in the first two years of sick leave. No difference in effect was found between a light or an intense physical conditioning program. We found that cognitive behavioral therapy probably has no value as an alternative therapy, or in addition to physical conditioning programs.

This is a Cochrane review abstract and plain language summary, prepared and maintained by The Cochrane Collaboration, currently published in The Cochrane Database of Systematic Reviews 2011 Issue 1, Copyright © 2011 The Cochrane Collaboration. Published by John Wiley and Sons, Ltd.. The full text of the review is available in *The Cochrane Library* (ISSN 1464-780X).

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F) Deficiencies in Medical Musculoskeletal Education

A survey of family practice physicians found 51 percent of respondents felt that they had insufficient training in orthopaedics. Furthermore, 56 percent of those surveyed claimed that medical school was their only source for formal musculoskeletal training (MSK). Similarly, in another study, pediatric residents said they had the least adequate training in orthopaedics. Graduating family practice residents felt significantly more confident in performing physical exams, evaluating radiographs, and diagnosing and treating non-MSK disorders than they did for MSK conditions.

162)
The adequacy of Medical School Education in Musculoskeletal Medicine
J. Bone and Joint Surgery 1998 (Oct); 80-A (10): 1421–1427
KEVIN B. FREEDMAN, M.D. and JOSEPH BERNSTEIN, M.D., M.S., PHILADELPHIA, PENNSYLVANIA
http://www.jbjs.org/article.aspx?Volume=80&page=1421
Given the high prevalence of orthopaedic problems that are encountered in clinical practice, the importance of basic competency in musculoskeletal medicine for all physicians cannot be disputed. Nevertheless, seventy (82 per cent) of eighty-five medical school graduates from thirty-seven different schools failed to demonstrate such competency on a validated examination of fundamental concepts.

Chiropractors pride themselves in their ability to diagnose and manage neuro-musculo-skeletal (NMS) complaints. According to all the surveys, this is their bread and butter, and no one is better trained to diagnose (locate) and treat (correct) neck, low back, or peripheral joint (knee, elbow etc) complaints.

Orthopedic surgeons are supposed to be the *gods* of medicine, the pinnacle of medical knowledge. First they become MDs, then rotate through a variety of specialties, and finally take residence in a highly competitive orthopedic program.

The following reflects the weakness of modern medical education. This series of articles were all mostly published in the prestigious *Journal of Bone and Joint Surgery*, the "Gold Standard" journal for orthopedic surgeons.

In 1998, two medical doctors at the University of Pennsylvania School of Medicine in Philadelphia, contacted all 157 chairpersons of orthopedic residency programs in the United States. Together they developed and validated a **basic-competency examination in musculoskeletal medicine** to give to the first year residents. The results were astounding, because **82% of the eighty-five medical school graduates failed this BASIC competency exam!**

Four years later they **redesigned the exam and again gave it to all the residents**. Even though the passing grade was LOWERED from 74% to 70%, **78% of them again failed the exam, with a mean test score average of 59.9 percent.**

To add insult to injury, **this exact same test was given to a group of 51 chiropractic students** during their last semester of schooling. The results? 70% of

the students passed the test. This is in contrast to an 80% failure rate for the MDs.

For clarity sake, you need appreciate the difference between the chiropractic and the medical participants in these studies.

- The chiropractic group were still JUST STUDENTS in their last undergrad year
- The medical group had already graduated medical school, been awarded their MD degrees, completed all their hospital rotations, and finally been accepted into highly competitive orthopedic residencies.

One would expect that, during their 5 years of medical training, followed by endless hours of hospital rotations and residency programs, that all these doctors *might have* picked up a little more musculoskeletal knowledge along the way. **Evidently this is NOT the case**.

These medical authors concluded that residents in orthopedic surgery programs are not provided with sufficient training in NMS analysis. The truth is, they are incompetent in musculoskeletal assessment or treatment. This situation was not corrected during the 4-year interim between the publication of the 1st and 2nd article, and still has not been corrected 13 years later.

Since that time there has been a storm brewing at medical schools, but in the 13 years since Dr. Freedman published his first paper, medical students still continue to fail on basic musculoskeletal exams, as documented by the following series of peer-reviewed studies. **This is a huge problem because:**

- **"conditions affecting the musculoskeletal system are the primary reason patients seek medical care from physicians, accounting for nearly 100 million office visits per year. [1]**
- **Furthermore, musculoskeletal conditions are the most common cause of long-term pain and physical disability. [2]"** [3]

What's the best solution? If you have spinal pain, seek care from someone who is properly trained to assess and manage your care. That person is a chiropractor.

163)
The Adequacy of Medical School Education in Musculoskeletal Medicine
Journal of Bone and Joint Surgery 1998 (Oct); 80-A (10): 1421–1427
http://www.chiro.org/ChiroZine/ABSTRACTS/Adequacy.shtml
This is the original article, which found that **82 per cent of medical school graduates failed a valid musculoskeletal competency examination.** They concluded that "we therefore believe that medical school preparation in musculoskeletal medicine is inadequate" and that medical students were inadequately trained to diagnose and treat musculoskeletal complaints.

164)
Educating Medical Students About Musculoskeletal Problems: Are Community Needs Reflected in the Curricula of Canadian Medical Schools?
Journal of Bone and Joint Surgery 2001 (Sept); 83-A (9): 1317–1320
http://www.jbjs.org/article.aspx?Volume=83&page=1317
Musculoskeletal problems are a common reason why patients present for medical treatment. The purpose of the present study was to review the curricula of

Canadian medical schools to determine whether they prepare their students for the demands of practice with respect to musculoskeletal problems. The curriculum analysis revealed that, on the average, medical schools in Canada devoted 2.26% (range, 0.61% to 4.81%) of their curriculum time to musculoskeletal education. **Our literature review and survey of local family physicians revealed that between 13.7% and 27.8% of North American patients presenting to a primary care physician have a chief symptom that is directly related to the musculoskeletal system.** (So they conclude:) There is a marked discrepancy between the musculoskeletal knowledge and skill requirements of a primary care physician and the time devoted to musculoskeletal education in Canadian medical schools.

165)
A Comparison of Chiropractic Student Knowledge Versus Medical Residents
Proceedings of the World Federation of Chiropractic Congress 2001 Pgs. 255
http://www.chiro.org/ChiroZine/ABSTRACTS/A_Comparison_of_Chiropractic_Student_Knowledge.shtml
A previously published knowledge questionnaire designed by chief orthopedic residents was given to a Chiropractic student group for comparison to the results of the medical resident group. Based on the marking scale determined by the chief residents, **the Chiropractic group (n = 51) showed statistically significant higher average grade than the orthopedic residents. Expressed in other terms, 70% of chiropractic students passed the knowledge questionnaire, compared to an 80% failure rate for the orthopedic residents.**

166
Educational Deficiencies in Musculoskeletal Medicine
Journal of Bone and Joint Surgery 2002 (Apr); 84–A (4): 604–608
http://www.jbjs.org/article.aspx?Volume=84&page=604
Four years later, according to the standard suggested by the program directors of internal medicine residency departments, a large majority of the examinees once again failed to demonstrate basic competency in musculoskeletal medicine on the examination. It is therefore reasonable to conclude that medical school preparation in musculoskeletal medicine is inadequate.

167)
Musculoskeletal Knowledge: How Do You Stack Up?
Physician and Sportsmedicine 2002 (Aug); 30 (8)
http://www.chiro.org/ChiroZine/ABSTRACTS/Musculoskeletal_Knowledge.shtml
One of every 4 or 5 primary care visits is for a musculoskeletal problem. **Yet undergraduate and graduate training for this burden of illness continues to constitute typically less than 5% of the medical curriculum. This is an area of clear concern**, but also one in which sports medicine practitioners can assume leadership.

168)
Musculoskeletal Curricula in Medical Education
Physician and Sportsmedicine 2004 (Nov); 32 (11)
http://www.chiro.org/ChiroZine/ABSTRACTS/Musculoskeletal_Knowledge.shtml
It's 8:00 pm on a Monday night. Just as you're getting ready to put your 5-year-old son to bed, he falls from a chair, landing on his wrist. It quickly swells, requiring a

visit to a nearby urgent care clinic. At the clinic, a pleasant young resident takes a history, performs a physical exam, and orders an x-ray to evaluate the injury. You are told that nothing is broken, and a wrist splint is placed. The following day, however, you receive a phone call from the clinic informing you that upon further review of the radiographs, a fracture was detected, and your son will need a cast for definitive treatment. This scenario, while fictitious, is not unusual. According to some studies, up to 10% of wrist fractures are missed at the initial evaluation.[1] While pediatric fractures are often difficult to detect, **this example highlights a problem that continues to plague medical education: inadequate instruction in musculoskeletal medicine in both medical school and residency training.**

169)
Adequacy of Education in Musculoskeletal Medicine
Journal of Bone and Joint Surgery Am 2005 (Feb); 87 (2): 310–314
http://www.chiro.org/ChiroZine/ABSTRACTS/Adequacy_of_Education.shtml
In this study, 334 medical students, residents and staff physicians, specializing in various fields of medicine, were asked to take a basic cognitive examination consisting of 25 short-answer questions - the same type of test administered in the original JBJS 1998 study. **The average score among medical doctors, students and residents who took the exam in 2005 was 2.7 points lower than those who took the exam in 1998.** Just over half of the staff physicians (52%) scored a passing grade or higher on the 2005 exam. Only 21% of the residents registered a passing grade, and only 5% of the medical students passed the exam. **Overall, Seventy-nine percent of the participants failed the basic musculoskeletal cognitive examination.**

170)
More Evidence of Educational Inadequacies in Musculoskeletal Medicine
Clin Orthop Relat Res 2005 (Aug); (437): 251–259
http://www.ncbi.nlm.nih.gov/pubmed/16056057
A modified version of an exam used to assess the competency of incoming interns at the University of Pennsylvania was used to assess the competency of medical students during various stages of their training at the University of Washington. Despite generally improved levels of competency with each year at medical school, **less than 50% of fourth-year students showed competency.** These results suggested that the curricular approach toward teaching musculoskeletal medicine at this medical school was insufficient and that competency increased when learning was reinforced during the clinical years.

171)
Doctors Likely to Encounter Children With Musculoskeletal Complaints Have Low Confidence in Their Clinical Skills
The Journal of Pediatrics 2009 (Feb); 154 (2): 267–271
http://www.ncbi.nlm.nih.gov/pubmed/18823907
Questionnaires, filled out by a broad spectrum of medical providers in England [Primary Care (n = 75), Pediatrics (n = 39), Emergency (n = 39), Orthopedics (n = 40), and experienced doctors in Primary Care (n = 93), and Pediatrics (n = 60).], revealed that **74% of them scored their personal confidence in pediatric musculoskeletal clinical assessment as "no" to "low"**.

172)
Orthopaedists' and Family Practitioners' Knowledge of Simple Low Back Pain Management
Spine 2009 (Jul 1); 34 (15): 1600–1603
http://www.chiro.org/ChiroZine/ABSTRACTS/Orthopaedists_and_Family_Practitioners.shtml
One hundred forty family practitioners and 253 orthopaedists responded to the questionnaire. The mean family practitioners' score (69.7) was significantly higher than the orthopaedists' score (44.3) ($P < 0.0001$). No relation was found between the results and physician demographic factors, including seniority. Most orthopaedists incorrectly responded that they would send their patients for radiologic evaluations. They would also preferentially prescribe cyclo-oxygenase-2-specific nonsteroidal anti-inflammatory drugs, despite the guidelines recommendations to use paracetamol or nonspecific nonsteroidal anti-inflammatory drugs.

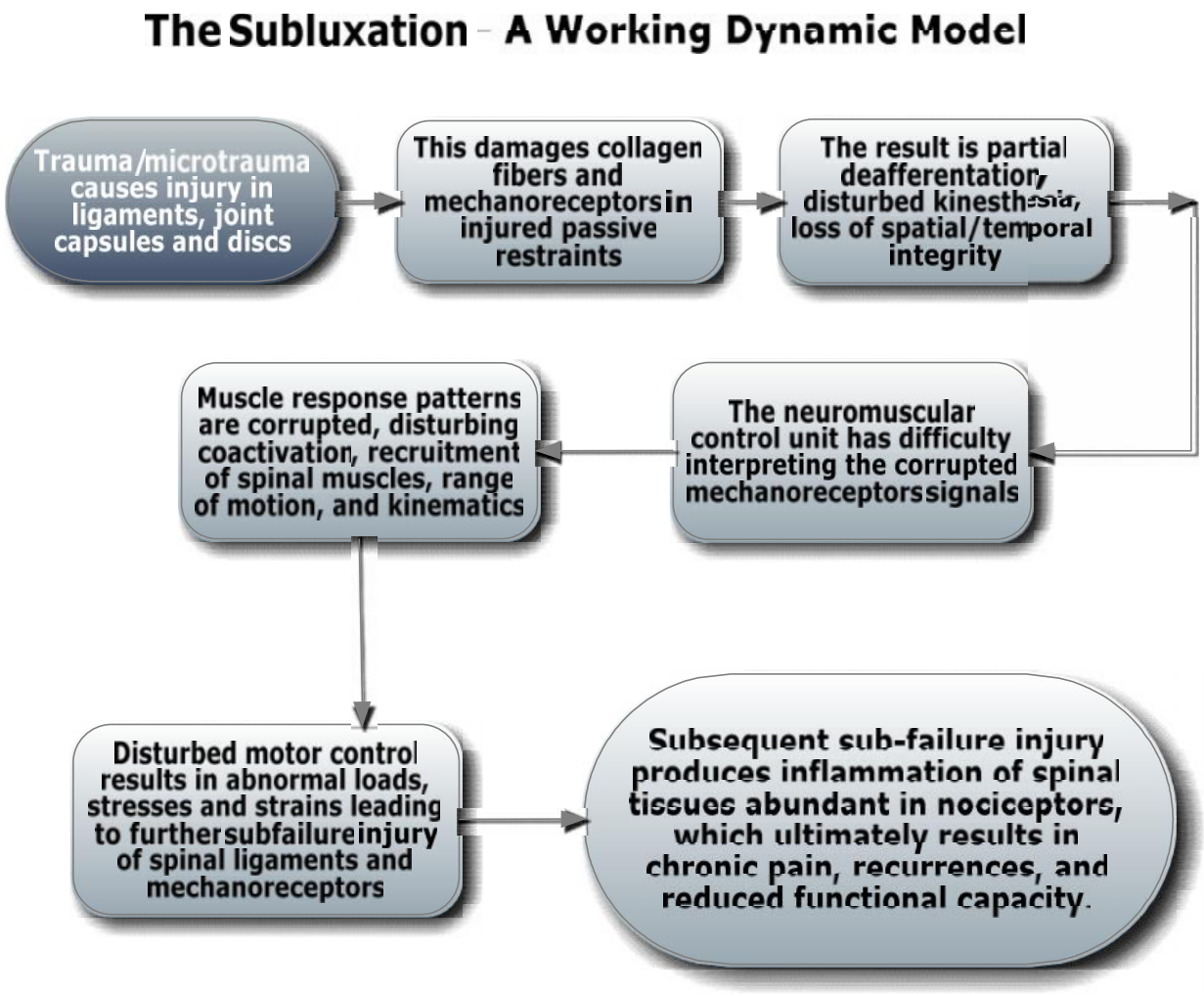
173)
The Inadequacy of Musculoskeletal Knowledge After Foundation Training in the United Kingdom
Journal of Bone and Joint Surgery Br 2009 (Nov); 91 (11): 1413–1418
http://www.ncbi.nlm.nih.gov/pubmed/19880882
The aim of this study was to determine whether the foundation programme for junior doctors, implemented across the United Kingdom in 2005, provides adequate training in musculoskeletal medicine. We recruited 112 doctors on completion of their foundation programme and assessed them using the Freedman and Bernstein musculoskeletal examination tool. **Only 8.9% passed the assessment**.

REFERENCES:
1. Musculoskeletal conditions in the United States. Rosemont, IL, American Academy of Orthopaedic Surgeons, 1999
2. Burden of major musculoskeletal conditions
Bull World Health Organ 2003; 81 (9): 646-656
3. Musculoskeletal Curricula in Medical Education
Physician and Sportsmedicine 2004 (Nov); 32 (11)

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a)Subluxation



174)
Subluxation Reviewed, Revisited, Revitalized
Dynamic Chiropractic – March 12, 2010, Vol. 28, Issue 06
By Malik Slosberg, DC, MS

Our understanding of the biomechanics and neurology of the subluxation continues to evolve as more research is published which helps explain the nature of this lesion. Historically, the subluxation has been at the heart of the identity and purpose of the chiropractic profession. Contemporary models provide new insights

into this elusive and sometimes mysterious problem which we attempt to find by various clinical means and correct by the application of high-velocity, low-amplitude thrusts. This review is of past models, but focuses primarily on the latest evidence concerning the subluxation

published in the recent scientific literature in order to improve our understanding, insight, and application of clinical interventions to improve patient outcomes with chiropractic care.

Older Models of Subluxation: Static Malposition and Pathology

Over the 115-year history of chiropractic, there have been many varied attempts to explain and clarify the subluxation. In the past, descriptions of this lesion were phrased in pathological terms and often included malposition, distortion of the intervertebral foramen and impingement of nerves as primary components. Henderson, et al.,[1] described early notions of subluxation as static mechanical lesions, a misalignment or a bone out of place, as seen on a neutral radiograph. The authors explain that this static model has been vigorously challenged in the scientific literature.

Lantz[2] raised concerns about the strictly static, structural interpretation of vertebral subluxation and introduced his own hierarchical model including kinesiopathology, neuropathology, myopathology, connective tissue pathology, vascular abnormalities, as well as inflammatory response, histopathology, and biochemical abnormalities. Similarly, Dishman[3] described the vertebral subluxation complex in terms of various pathologies including neuropathology, myopathology, kinesiopathology, histopathology, and biochemical abnormalities.

Newer Terminology: Functional Spinal Lesion, Joint Dysfunction With Hypomobility, Joint Complex Dysfunction

In 2001, the World Federation of Chiropractic Congress, in its consensus document, described the subluxation as a complex of functional and/or structural and/or pathological articular changes that compromise neural integrity and may influence organ system function and general health. Pickar[4] described two mechanistic models of the subluxation: 1) compression/traction of peripheral nerve in the vicinity of the intervertebral foramen; and 2) altered sensory input leading to central facilitation and altered somato-somato and/or somatovisceral reflexes. Triano[5] noted that the word *subluxation* has no consistent definition. In addition, he explained that the lesion is often treated as a syndrome, a clinical disorder, and suggests the term *functional spinal lesion* because it expresses a spine-related disorder involving function and does not imply pathomechanics, pathophysiology or symptomatology. Triano also noted that there is no method yet which can unequivocally detect and describe its presence. Its detection represents the art of the clinical practice, not its science.

In agreement, with Triano, Seaman[6] described the subluxation as a dysfunctional joint, not necessarily a pathological one, and suggested the term *joint complex dysfunction* to express this. Vernon and Mrozek[7] advocated for the term *joint dysfunction with hypomobility* to describe these dysfunctional joints as means to

achieve some consensus about the nature of this lesion, which has been variously described in terms of "fixation," "somatic dysfunction," "blockage," "loss of joint play," and "hard end feel" by various clinical professions including DCs, MDs, DOs, and PTs.

Vernon and Mrozek described a more contemporary model of a dynamic biomechanical lesion wherein an error of movement is present that may or may not be associated with misalignment. Gatterman[8] described subluxation as a joint with

impaired mobility with or without positional alteration. From her perspective, the subluxation is seen as a functional entity involving restricted vertebral movement. After all, she argues, it is the restriction of movement which responds to thrust procedures.

Recently, Panjabi[9] offered a unique model of joint dysfunction with disturbed kinematics, loss of spatial and temporal integrity of received receptor signals, and corrupted motor programs. This model provides a dynamic explanation which offers distinctive insights into the mechanism and progression of the lesion DCs commonly describe as a subluxation. According to Panjabi's paradigm, difficulties arise because trauma or cumulative microtrauma cause subfailure injury in passive restraints including ligaments, joint capsules, and discs. He described subfailure injury as caused by the stretching of tissue beyond its physiological limit, but less than its failure point. Panjabi[10-11] documented these injuries in simulated whiplash studies which used whole cervical sections of human cadaver spines.

Subfailure injury has been described by other researchers as a result of microruptures of collagen fibers,[12] or microdamage of collagen tissues.[13] With these overstretch injuries, not only are bonds in the connective tissue matrix disrupted, but mechanoreceptors within these structures are also damaged, resulting in partial de-afferentation. This sensory/neurological dimension of overstretching/sprain of passive ligamentous restraints was described by neurosurgeons Freeman and Wyke.[14] The authors documented that a traction injury to a ligament or joint capsule resulted in ruptures of nerve fibers as well as collagen fibers. Nerve fibers have lower tensile strength than the molecular bonds of the connective-tissue matrix. If there is enough tensile force to damage collagen fibers, nerve fibers have been damaged as well.

Loss of Spatial and Temporal Integrity

With this partial de-afferentation, Panjabi[15] explained, there is loss of spatial and temporal integrity of received transducer signals from mechanoreceptors in the damaged ligament or joint capsule. The disturbance in precise, continuous sensory input has been described by other researchers[16-17] as false kinesthetic perception, which introduces errors in the precision of movement and may result in injury. This aberrant feedback is transmitted to the neuromuscular control unit (motor cortex, basal ganglia, cerebellum, motor neurons), which has difficulty interpreting the corrupted transducer signals because there is a mismatch between normally expected signals and the corrupted signals actually received.

Corrupted Muscle Response Pattern

As a result, the muscle response pattern generated is corrupted, affecting coordination and activation of each spinal muscle. The corrupted muscle response pattern affects the choice of which spinal muscles to activate, the force of onset, intensity, and shut-off. As a consequence, changes in the coordination, sequencing, and recruitment of spinal muscles responsible for spinal stability, posture and motion become disrupted.[18]

The corrupted muscle response patterns result in abnormal stresses and strains in spinal components, leading to further subfailure injury of spinal ligaments, joint capsules, mechanoreceptors within them, and disturbed kinematics. Errors in onset

of muscle activation (delayed onset) and force production (reduced or excess force generation) may result in soft-tissue injury and explain acute low back pain where negligible loads are involved.[19] These changes can set up an inflammatory cascade, producing inflammation of spinal tissues abundant in nociceptors, resulting in chronic pain, recurrences, disturbed kinematics and reduced functional capacity.

Progressive Joint Complex Dysfunction

The process of progressive joint complex dysfunction involves many components including passive stabilizers (subfailure injury of ligaments, joint capsules, discs), somatosensory input (loss of spatial and temporal integrity, and false kinesthetic perception), and neuromotor control (corrupted motor programs, coactivation, sequencing, and recruitment). Disturbances in these systems combine to produce what may be catastrophic acute problems or, perhaps more commonly, a downward spiral of reduced functional capacity, increased risk of reinjury and chronicity.

This dynamic process of joint dysfunction offers an explanation which helps to clarify the clinical presentation of many of our patients and reinforce, with scientific evidence, the clinical observations chiropractors make in practice. The combination of clinical observations and scientific support can increase clinicians' confidence in and quality of our patient education, as well as the benefits we have to offer our patients.

References

1. Henderson C, Cramer G, Zhang Q, et al. Introducing the external link model for studying spine fixation and misalignment Part 1 - Need, rationale, and applications. *JMPT*, 2007;30:239-45.
2. Lantz CA. The vertebral subluxation complex Part 1. An introduction to the model & the kinesiological component. *Chiropractic Research Journal*, 1988;1:23-36.
3. Dishman RW. Static and dynamic components of the chiropractic subluxation complex: a literature review. *JMPT*, 1988;11:98-107.
4. Pickar J. Neurophysiological issues of the subluxation lesion. *Top Clin Chiro,* 2001;8:9-15.
5. Triano JJ. The subluxation complex: outcome measure of chiropractic diagnosis and treatment. *Chiro Tech*, 1990;2:114-20.
6. Seaman D. Joint complex dysfunction: a novel term to replace subluxation/subluxation

complex: etiological and treatment considerations. *JMPT*, 1997;20:634-44.
7. Vernon H, Mrozek J. A revised definition of manipulation. *JMPT*, 2005;28:68-72.
8. Gatterman M. *Foundations of Chiropractic: Subluxation. 2nd Edition*. Elsevier Science Health Science, 2005.
9. Panjabi MM. A hypothesis of chronic back pain: ligament subfailure injuries lead to muscle control dysfunction. *Eur Spine J*, 2006;15(5):668-76.
10. Panjabi MM, et al. Simulation of whiplash trauma using whole cervical spine specimens. *Spine*, 1998;23:17-24.
11. Panjabi MM, Pearson AM, Shigeki I, et al. Cervical spine ligament injury during simulated frontal impact. *Spine*, 2004;29(21):2395-403.
12. Le B, Davidson B, Solomonow D, et al. Neuromuscular control of lumbar instability following static work of various loads. *Muscle Nerve*, 2009;39(1):71-82.
13. Solomonow M. Sensory-motor control of ligaments and associated neuromuscular disorders. *J Electromyo Kinesiol*, 2006;16:549-67.
14. Freeman MAR, et al. The etiology and prevention of functional instability of the foot. *J Bone Joint Surg*, 1965;47B(4):678-85.
15. Panjabi MM. A hypothesis of chronic back pain. *Op Cit*.
16. Solomonow M, *Op Cit*.
17. Akuthota V, Ferreiro A, Moore T, et al. Core stability exercise principles. *Curr Sports Med Rep*, 2008;7:39-44.
18. Teyhen DS, et al. Fluoroscopic video to identify aberrant lumbar motion. *Spine*, 2007;32:E220-9.
19. Panjabi MM. The stabilizing system of the spine. Part I. *J Spinal Disorders,* 1992;5(4):383-9.

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The Rationale for Chiropractic Care.

Briefly, the premise of chiropractic therapy centers around the maintenance of appropriate movement of the spinal joints and optimizing biomechanics throughout the musculoskeletal system. The subluxation has typically been modeled as a localized spinal joint malfunction that impacts the neurology with both local and systemic consequences.

The Chiropractic "Adjustment"

A controlled input of force on a specific contact point in a specific vector-angle in order to overcome abnormal restrictive barriers in or around a joint that are limiting or confining its Range of Motion (ROM). The adjustive force takes the joint beyond its limited or restricted ROM back toward its full ROM, stimulating many populations of neurologic receptors in the process. The adjustive thrust may initiate protective muscular reflexes important in preventing joint degeneration & instability. The biomechanical and neurological effects of the adjustment help restore normal function, range of motion, sensorimotor coordination & control, pattern of motion, biomechanics, load distribution and joint neurology. This helps re-establish the normal biomechanical & neurologic segmental order, restoring smooth, harmonious function.

The chiropractic adjustment is a highly specific manipulation of a joint, primarily of the spine but, increasingly, of all joints of the body. It is described as "high-speed and low-amplitude". Very fast and shallow.

Today, the subluxation is understood to be an area of **HYPO-mobility**, or reduced movement. It is often simply called a **fixation** .
The significance of these fixations is that it has now been **scientifically proved** that two important things happen:

1. Measurable degenerative changes occur in the cartilage in the joint within 12 hours of subluxation.
2. Within 1 week proteoglycan loss can be detected. Proteoglycans enable joint cartilage to retain water and collagen to remain elastic.

These **progressive and permanent degenerative** changes within the joint are called **Immobilization Degeneration** . (ID)

SUBLUXATIONS

- **Chiropractic Subluxation**

A subluxation from the Chiropractic viewpoint, is a HYPO-mobile joint with DECREASED movement, but no instability due to ligamentous damage.
It is this loss of movement that causes Immobilization Arthritis.

- **Medical Subluxation**

A subluxation on the other hand, from a Medical viewpoint, is a **HYPER-mobile** joint as would occur in trauma, or interestingly in conditions such as Rheumatoid Arthritis. Ligamentous laxity allows for INCREASED movement.
In the Chiropractic model, mobilization and manipulation (or adjustment) is the treatment of choice. In the Medical model, it's strictly contraindicated.

Hypomobile joints cause INCREASED noxious stimuli entering the dorsal horn, and DECREASED inhibition of this nociceptor activity by mechanoreceptors in the dorsal horn. Initially, this is a silent process. There is no pain. That comes later. This increased nociceptor activity has been shown to have a cascading effect on the autonomic system, and general health.

RECEPTORS

- **Mechano-receptors (aka Proprio-receptors)**

Mechanoreceptors in ligaments, muscles, capsules and the skin (and other) record movement in the joint, amongst other things, giving the CNS vital information about position sense, and contributing to posture and balance. Interestingly, in the dorsal horn of the spinal cord they have an INHIBITORY effect on information relayed from Nociceptors.

- **Nociceptors**

Nociceptors do not carry pain sensation, but they inform the CNS about noxious

stimuli and other potentially harmful information from the body. In particular, chemosensitive nociceptors carry information about noxious stimuli to a nerve root, for example, that is being bathed in the toxic byproducts of joint cartilage nutrition. Normally such wastes would be dispersed, but in hypo-mobile joints, such wastes accumulate causing a noxious effect on the capsule, hyaline cartilage and adjacent

nerves.

Cell degeneration has been demonstrated within thirteen hours (in white mice) of artificial joint fixation. These degradation products set up an inflammatory cycle further adding to the dorsal horn bombardment by nociceptors.

ARTICULAR NEUROLOGY

Wyke points out that, with few exceptions, any type of adjustive or manipulative technique imposes static and dynamic forces across the joint or joints being treated. This is as true for soft-tissue massage as it is for dynamic thrusts. Thus, the general principles of receptor neurology must be recognized if diagnosis and therapy are to be directed in a scientific manner.

Receptor Types

The synovial joints of the body, including the apophyseal joints of the spinal column, are provided with four types of receptor terminals that have variable characteristics. The major features of articular receptor sensory systems are corpuscular proprioceptive mechanoreceptors that serve as organic transducers. They are stimulated by increased tissue tension such as that induced by any type of active or passive mobilization.

Characteristics of Joint Receptor Systems

Type I receptors are dynamic articular mechanoreceptors that have an extremely low threshold and are slowly adapting. They are found in the superficial fibrous layers of capsules and respond whenever the joint capsule is stretched; thus, they

are active almost continuously. These superficial receptors signal the direction, amplitude, and velocity of joint movement. The frequency of discharge is proportional to the forces applied to the capsule.

Type II receptors are also dynamic articular mechanoreceptors that have a low threshold, but they adapt faster than Type I receptors. They are found in the deep subsynovia of joint capsules. They are normally inactive in resting joints but respond whenever capsule tension is increased. The primary purpose of these deep receptors is merely to signal (by a brief burst of impulses) that joint movement has been initiated.

Type III receptors are commonly found in peripheral joint ligaments, but they are absent in paraspinal ligaments. They have a high threshold and adapt slowly, responding only when capsule tension is greatly increased.

Type IV receptors are widely dispersed pain-conducting nonproprioceptive bare nerve endings within many joint tissues that are normally inactive but become excited when exposed to a high degree of mechanical stress or chemical irritants. They are located in the superficial layers of joint capsules as fine plexuses, in the

collateral and intrinsic ligaments of a joint as a fine meshwork, and distributed within articular fat pads and vascular sheaths. Type IV receptors are not found within synovial lining, menisci, or articular cartilage.

Clinical Considerations

Knowledge of the function of the various types of joint receptors is important to any physician directing physical therapy because of the threefold effect produced when these mechanoreceptor impulses enter the spinal cord as the result of active motion, therapeutic mobilization, traction, or vibration.

Reflex Effects

Like the sensory fibers projecting from mechanoreceptors of the skin, the afferent impulses emanating from joint mechanoreceptors take a polysynaptic course. The primary fibers terminate with the fusimotor neurons (but not alpha neurons) in the motor neuron pool within the gray matter of the spinal cord. Thus, they contribute to monitoring muscle spindle activity such as muscle tone and stretch reflex excitability.

In addition, to this primary course, mechanoreceptor afferents also send collaterals that are distributed intersegmentally throughout the neuraxis. Because of this extensive intersegmental system of communication, any motion produced in one joint will tend to inhibit the motor-unit activity and facilitate the tone of the muscles near the joint and often some quite remote (even contralaterally) from the joint stimulated.

Pain Suppression

Unlike the sensory fibers from joint mechanoreceptors, impulses of the primary nociceptor afferents from Type IV receptors course to the alpha neurons in the motor neuron pool within the gray matter of the spinal cord. The effect is abnormal reflex activity in the muscles supplied segmentally.

Like the sensory fibers from joint mechanoreceptors, collaterals are given off in the spinal cord that synapse in the "gateway" of the basal nucleus of the gray matter, ascend via the anterolateral spinal tracts, and ultimately end in the limbic region of the cerebral cortex. However, this flow of pain-provoking impulses can be inhibited presynaptically in the substantia gelatinosa by superimposed impulses from the mechanoreceptors whether they originate from joint mechanoreceptors or cutaneous mechanoreceptors.

It is in this manner that Wyke and others believe joint-pain suppression is achieved by massage, vibration, stretching, traction, TENS, compression, mobilization, rocking, or mild exercise. This theory suggests that the degeneration of peripheral mechanoreceptor pathways commonly associated with the aging process might explain why physical therapy is less effective in relieving pain in the elderly than in the young.

If central input from all joint receptors is blocked, the effect would mimic joint-infiltration anesthesia and feature a diminished joint-pain threshold, absent kinesthetic sensations, postural abnormalities, movement impairments, and gait disturbances.

Conscious Perception

Mechanoreceptor afferents course polysynaptically in their upward ascent, via the posterior and posterolateral columns, to terminate in the paracentral and parietal cerebral cortex. Types I and III (but not Types II or IV) afferents are primarily responsible for initiating kinesthetic perceptions. For this reason, the decrease or loss of kinesthesia is one of the first symptoms to appear when joint disease blocks or destroys Types I and III mechanoreceptor afferents.

Pain may stubbornly persist, however, as long as Type IV impulses can reach the brain stem and cerebral cortex. Degenerative, inflammatory, and traumatic disorders of joints commonly result in a loss of Types I III mechanoreceptor input but not of Type IV nociceptor input.

Joint Complex Dysfunction has been described by DCs, physical therapists, MDs. All agree that reduced mobility promotes pathological changes in the structures that make up the joint complex & that pain, inflammation & stiffness are common manifestations of the lesion. Restoring mobility is often a primary objective of treatment. Muscle functional imbalances, such as tightening, shortening & trigger points are intimately associated with joint hypomobility/immobility & may be components of joint complex dysfunction. Muscles develop weakness or tightness in typical imbalance patterns which promote faulty movement patterns, an essential component of joint complex dysfunction.

It is likely that joint complex dysfunction develops before pain is generated.

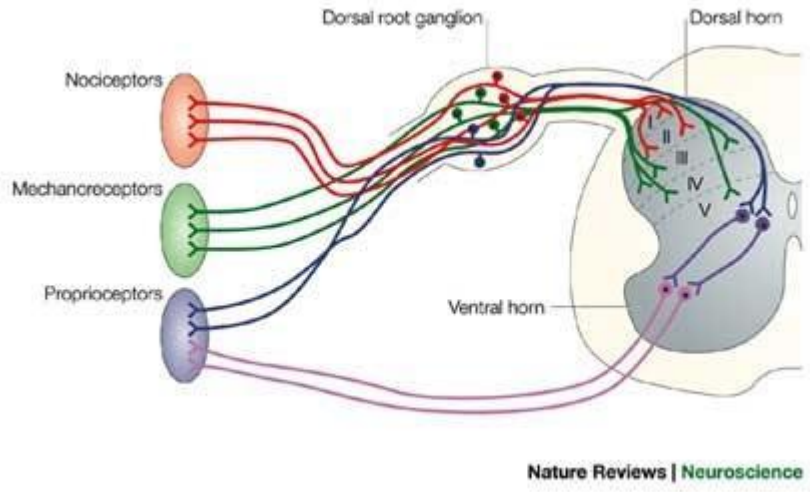
Connective tissue, disc & muscle pathology (degen & atrophy) without any symptoms can exist in asymptomatic and apparently healthy individuals. Muscles play a role in stabilizing the spinal column and muscle weakness may predispose the spine to injury. This suggests that the great majority of people suffer asymptomatic joint complex dysfunction before spinal tissue injury generates pain.

Once injury occurs, a new set of dynamics come into play, including inflammation, nociception and pain, all of which promote joint immobility and further development of joint complex dysfunction, including increased formation & deposition of fibrous tissue which further reduces mobility & promotes joint complex dysfunction.

Neurological Effects of Hypomobility

Loss of normal motion within a joint results in changes in every structural component of the joint; subchondral bone to the synovium, from meninges to the

ligamentum flavum.



Notice the tracts from **proprioceptors** (bottom left) within the joint capsule - those that feed into the **Ventral Horn**, and thence via tracts within the cord to the Dorsal Horn. These tracts have an INHIBITORY effect on the Dorsal Horn.

1. **HYPOMOBILITY >>> DECREASED PROPRIOCEPTOR activity >>> DECREASED IBHIBITION OF THE PAIN (and other) NOCICEPTOR ACTIVITY firing via C fibres into the Dorsal Horn.**
   Simultaneously,
2. **BREAKING DOWN OF CELLS in the Hypomobile Joint >>> INCREASED firing of SPINAL CHEMOSENSITIVE NOCICEPTORS >>> Inflammation AND Increased input into the Dorsal Horn.**
3. Increased noxious input into the dorsal horn + Decreased inhibition from Proprioceptors = **Greatly increased input into the Spinal Thalamic Tract >>> Thalamus >>> Parietal brain where pain is perceived.**

Biomechanical Effects of Hypomobility

- Altered intersegmental movement patterns
- Results in compensatory changes in motor patterns, etc.
- Creates cellular damage in sites of biomechanical stresses
- Immobilization Arthritis

Current orthopedic literature recognizes that changes in the pattern of forces transmitted through joints, which occurs during the immobilization process, is universally recognized as contributing to connective tissue degeneration and local changes in the chemical composition of that tissue.We also know that mechanical failure of ligaments, discs, capsules and other connective tissue can result from local variations in chemical composition.

The purpose of the chiropractic therapy (the "adjustment") is to restore normal movement and resolve the resultant biomechanical, physiological and neurological effects of segmental hypomobility.

References:

- Amiel D, et al. Acta Ortho Scand, 1982
- Palmoski M, et al. Arth Rheum, 1979
- Paine & Haung. J Neurosurgery, 1972
- Lantz C. Chiro Res J, 1988
- Enneking & Horowitz. J Bone Joint Surg, 1972
- Evans EB, et al. J Bone Joint Surg, 1960

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J Manipulative Physiol Ther 1998; 21 (4) May: 267-280

Dysafferentation: A Novel Term to Describe the Neuropathophysiological Effects of Joint Complex Dysfunction. A Look at Likely Mechanisms of Symptom Generation

By: David R. Seaman, D.C. and James F. Winterstein, D.C.

Abstract:

Background and Objectives: Since the founding of the chiropractic profession, very few efforts have been made to thoroughly explain the mechanism(s) by which joint complex dysfunction generates symptoms. Save for a few papers, only vague and physiologically inconsistent descriptions have been offered. The purpose of this article is to propose a precise and physiologically sound mechanism by which symptoms may be generated by joint complex dysfunction.

Data Sources: The data was accumulated over a period of years by reviewing contemporary articles and books, and subsequently retrieving relevant papers. Articles were also selected from volumes 1-4 of the Chiropractic Research Archives Collection. *The Nexus,* published by the David D. Palmer Health Sciences Library, and *In Touch,* published by Logan College of Chiropractic Library, were reviewed and relevant articles were retrieved. Medline searches were found to be ineffective because appropriate key indexing terms were difficult to identify.

Data Synthesis: The symptoms generated by joint complex dysfunction, such as pain, nausea and vertigo, are probably caused by increased nociceptive input and/or reduced mechanoreceptive input.

Conclusions: Joint complex dysfunction should be included in the differential diagnosis of pain and visceral symptoms because joint complex dysfunction can often generate symptoms which are similar to those produced by true visceral disease.

Key Indexing Terms: Allodynia; Central Sensitization; Dysafferentation; Joint Complex Dysfunction; Mechanoreception; Nociception; Nociceptor Sensitization

INTRODUCTION

In a recent article, the term joint complex dysfunction was suggested as a replacement for subluxation complex [1]. Joint complex dysfunction refers to pathological and functional changes that occur in joint complex structures including (a) the negative effects of hypomobility/immobility, (b) functional imbalances such as muscle tightening or shortening and (c) myofascial trigger points. In short, the

article demonstrated how the term joint complex dysfunction allows for a more descriptive and pathophysiologically precise discussion of spinal dysfunction compared with the term subluxation/subluxation complex. The author also proposed that the chiropractic profession adopt the term "dysafferentation" to describe the neuropathophysiological effects of joint complex dysfunction that act to generate symptoms [1].

The topic of symptom generation remains a source for debate within the chiropractic profession. For example, B. J. Palmer, who was often referred to as the "developer" of chiropractic, maintained "a peculiar belief in the perfection of the incoming (afferent) sensory system" [2]. In his writings, Palmer indicated that subluxations only affected efferent pathways and not the afferent system [2]. Many modern-day chiropractors still promote this notion. They believe that subluxations impinge upon spinal nerves at the level of the intervertebral foramina and interfere with the conduction of impulses innately generated within the brain and which subsequently pass through neural tissue, with the result that tissue supplied by the affected nerves could suffer some form of functional insult [3].

Another popular notion is that upper cervical subluxations or misalignments can somehow impinge upon the medulla and interfere with the transmission of "the mental impulse life force" [4]. To our knowledge, at the present time, there is no evidence to support such opinions about this type of relationship between joint complex dysfunction and efferent nerve function. However, as will be discussed in this article, a great deal of information suggests that joint complex dysfunction affects the afferent system by altering the function of nociceptors and mechanoreceptors found within the structures of the joint complex. The purpose of this article is to describe the sensory receptors and their relationship to afferent input and to describe possible symptoms that can develop in response to enhanced nociceptor input and reduced mechanoreceptor input, which has been referred to previously as dysafferentation [1]. We should mention that much confusion exists regarding sensory receptor terminology [5]. Consequently, a discussion about receptors and their function can lead to unnecessary arguments [6, 7]. For this reason and for the sake of clarity in general, pertinent terminology will be discussed in appropriate sections of this article.

DISCUSSION

Afferentation and Deafferentation

Afferentation refers to the transmission of afferent nerve impulses; deafferentation is defined as the elimination or interruption of afferent nerve impulses, as by destruction of the afferent pathway [8]. In neurological literature, the word "deafferentation" is typically reserved for conditions in which peripheral nerves are either damaged, completely severed or avulsed [9-11]. Because joint complex

dysfunction is very rarely associated with peripheral nerve injury, it is not

appropriate to use the word deafferentation.

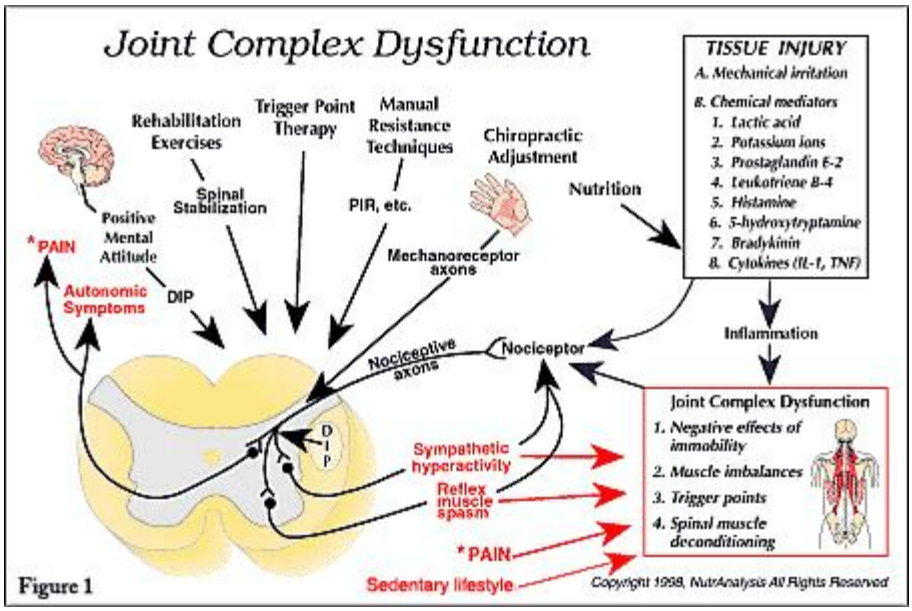
Dysafferentation

Dysafferentation refers to an imbalance in afferent input such that there is an increase in nociceptor input and a reduction in mechanoreceptor input [1]. Notice that proprioceptors are not mentioned; this is because contemporary texts do not consider proprioceptors a category of receptor. A recent article explained why 'proprioceptor' is actually an obsolete, inaccurate word [5].

According to standard texts in neurology, there are two categories of somatic receptors: nociceptors and mechanoreceptors [5, 12-14]. At the present time, an emerging body of research indicates that abnormal joint complex function can alter the activity of nociceptors [15-19] and mechanoreceptors [20-23], such that nociceptive activity increases and mechanoreceptive activity decreases. Many authors and researchers involved in joint adjusting and manipulation realize this and use the terms "altered afferent input," "abnormal afferent input" or similar terms when discussing the neuropathophysiological component of joint complex dysfunction [24-32]. For example, Peterson stated that, "somatic dysfunction and/or joint dysfunction induce persistent nociceptive input and altered proprioceptive input" [26]. Peterson and Bergmann described vertebral joint dysfunctions and their associated mechanical alterations, pain and potential local inflammation as lesions capable of inducing chronically altered nociceptive and proprioceptive input" [27]. Hooshmand illustrated how restricted joint mobility results in decreased firing of large diameter mechanoreceptor axons (A-beta fibers) and increased firing of nociceptive axons (A-delta and C fibers) [20]. Henderson used the term "altered somatic afferent input theory" to classify a neurophysiologic theory of chiropractic subluxation [28]. He proposed that chiropractic adjustment might normalize articular afferent input to the nervous system, which reestablishes normal nociceptive and kinesthetic reflex thresholds.

The information in the previous paragraph demonstrates that researchers in different professions have acknowledged the fact that compromised joint function will alter afferent input, such that nociception is enhanced and mechanoreception is reduced. In the biomedical literature, the prefix "dys" is used to describe activity that is abnormal, bad, difficult or disordered [33]. For this reason, we propose that the chiropractic profession adopt the word 'dysafferentation' to describe the abnormal afferent input associated with joint complex dysfunction [1].

The remainder of this article will discuss potential symptoms that may develop as a consequence of dysafferent input (i.e., increased nociception and reduced mechanoreception). To accomplish this task, both the neuroanatomy and physiology related to nociceptors and mechanoreceptors will be discussed and then related to symptom generation.



Nociceptors

Neuroanatomy. Many believe that spinal tissue nociceptors can be found in:

- skin,
- subcutaneous and adipose tissue,
- fibrous capsules of the apophyseal and sacroiliac joints,
- spinal ligaments,
- the periosteum covering vertebral bodies and arches (and attached fascia, tendons and aponeurosis),
- the dura mater and epidural fibro-adipose tissue,
- the walls of blood vessels supplying the spinal joints, sacroiliac joints and the vertebral cancellous bone,
- the walls of epidural and paravertebral veins and
- the walls of intramuscular arteries and at least the outer third of the annulus fibrosis [34-41].

Wyke provides the most vivid anatomical description of the nociceptive receptor system [41]. He described interstitial nociceptors as "a continuous tri-dimensional plexus of unmyelinated nerve fibers that weaves (like chicken-wire) in all directions throughout the tissue." A similar plexus of unmyelinated nerve fibers is embedded in the adventitial sheath and encircles each blood vessel. Commenting on nociceptive C fiber innervation, Charman stated that the "network of each C fibre innervates a three-dimensional receptive field of between 6 and 15 mm in diameter and of variable depth with extensive field overlapping between adjacent C-fibers" [37]. Thus, we can envision the presence of an almost unending meshwork of nociceptors within the various tissues described earlier.

Nociceptors are classified as mechanical nociceptors, mechanothermal nociceptors and polymodal nociceptors, depending on the type of energy used to activate them in the nociceptive range. Polymodal nociceptors are activated by noxious mechanical and thermal stimulation, as well as by chemical mediators released

from the injured tissues [42].

Recent research has demonstrated the presence of articular nociceptors with thresholds so high that they cannot be excited by acute noxious stimulation, for example, mechanical injury to the joint [17-19, 43]. Thus, these nociceptors are normally *mechano-insensitive* and have been characterized as solely chemosensitive [43]. This special category of nociceptors is called silent or sleeping nociceptors. Sleeping nociceptors are thought to awaken in the presence of chemical mediators released from injured tissues [17, 18, 43], at which time they become mechanosensitive. It is thought that the activation of these afferents may not only represent an extra source of nociceptive input but may also be important in promoting central sensitization [43].

Generally speaking, mechanical and mechanothermal nociceptors are innervated by A-delta axons, whereas polymodal and silent nociceptors receive their innervation from C fibers. Within the spinal cord, nociceptive afferents send collaterals to supra- and infra-adjacent segments. For example, A-delta fibers spread collaterals three to six segments rostrally and an equal number caudally, whereas C fibers spread two to three (or possibly more) segments above and below the level of entry [44].

A recent review by Charman provides a vivid description of the central connections of nociceptive afferents [37]. Nociceptive afferents travel up the anterolateral system and ultimately terminate in the spinal cord, a variety of brainstem nuclei, the limbic system, frontal lobes, parietal lobes, insula cortex and temporal lobes.

Peripheral nociceptive sensitization.

Nociceptors have high thresholds of activation, which means that, under normal circumstances, only stimuli that are either potentially or overtly tissue-damaging can depolarize a nociceptor [45, 46]. Normally, light touch and normal joint motion cannot depolarize a nociceptor [5].

Although nociceptors normally have high thresholds, certain physiological environments can result in the lowering of nociceptive thresholds, such that light touch and normal movement patterns can cause nociceptor depolarization and excitation of nociceptive afferent pathways. Peripheral sensitization is the term used to describe the process by which nociceptor thresholds are lowered [47], thus enhancing the transmission of nociceptive impulses into the spinal cord. The driving force behind the sensitization process seems to be the chemical mediators released after tissue injury. Prostaglandin E-2, leukotriene B-4, bradykinin, histamine and 5-hydroxytryptamine are thought to be the main chemical mediators that can sensitize nociceptors [10, 47]. Local tissue acidity is also thought to be capable of participating in the sensitization process [47 49].
Recent research suggests that norepinephrine release from sympathetic terminals into the area of tissue injury can also sensitize nociceptors [47, 50-52]. The exact mechanism by which this occurs is not well understood. It is possible that norepinephrine released from sympathetic terminals activates alpha-1-adrenergic

receptors found on the nociceptor membrane [50]. It is also possible that sympathetic discharge into the area of tissue injury promotes the release of prostaglandins [53].

It is not clear whether Substance P is directly involved in the sensitization process [10, 47, 54]. We know that substance P is produced in the dorsal root ganglion cells and then transmitted to the spinal cord and to the nociceptor. Substance P is released from nociceptors after they are activated by noxious input. The activity of substance P in this local environment can cause further accumulation of bradykinin and the release of histamine from mast cells and 5-hydroxytryptamine from platelets, all of which can promote the sensitization of local nociceptors [10].

It is thought that chemical mediators depolarize and/or sensitize a nociceptor through their interaction with chemosensitive receptors on the membrane of the nociceptor, which influences the flow of sodium, calcium and potassium ions Some of the chemical mediators have receptors linked directly to ion channels, whereas the receptors for other mediators are linked to second messenger systems that modulate ion channels. For more details, see Rang et al. [53].

It is important to consider the degree to which nociceptor sensitization can influence the activity of the associated afferent fibers and the spinal cord. Hanesch et al. provide a vivid example of afferent fiber function after nociceptor sensitization [17]. They studied the medial articular nerve in cats and discovered that, in normal joints, the afferent volley during a simple flexion movement comprises approximately 4,400 impulses per 30 seconds, including resting discharges. During inflammation, which promotes nociceptor sensitization, the afferent volley comprises some 30,900 impulses per 30 seconds, which represents about a sevenfold increase compared with normal conditions. They indicated that, "in individual afferents that have been studied consecutively under both normal and inflamed conditions, the afferent discharges sometimes increased more than 100-fold."

It is thought that an increased nociceptive barrage caused by sensitized nociceptors plays a role in the development of central nociceptive sensitization. Researchers have yet to discover all of the details about central sensitization. Nonetheless, we will attempt to provide the most relevant data in the next section.

Central nociceptive sensitization.

After tissue injury, nociceptors exhibit spontaneous activity, lowered thresholds and increased responsiveness to noxious stimuli, which leads to hyperexcitability and altered neuronal processing in the spinal cord and brain [55]. The term 'central sensitization' refers to this increased excitability of nociceptive neurons in the central nervous system (CNS) [56]. Of importance to the chiropractic profession is the fact that joint nociceptors, as with nociceptors in other tissues, can be sensitized [57]. In addition, joint and muscle nociceptors are much more capable of producing central nociceptive sensitization than cutaneous nociceptors [58].

In 1942, Denslow and Hassett reviewed the literature and demonstrated that the concept of spinal cord hyperexcitability had been around since at least the 1930s [30]. At that time, the term central excitatory state was used to describe central sensitization. Denslow and Hassett were the first to suggest and demonstrate that spinal dysfunction (i.e., joint complex dysfunction) was associated with central sensitization. They credited Charles Sherrington for developing the concept of the central excitatory state. They state that the evocation of additional activity by a stimulus which, in the normal would be ineffective, is explained by Sherrington's concept of a motoneuron pool in which there is an enduring subliminal central excitatory state (CES) created by sub-threshold stimuli [30].

In 1947, Denslow et al. used the terms facilitation and central facilitation in an effort to describe what is now referred to as central sensitization [59]. Recently, Patterson indicated that Irvin Korr is credited with coining the term facilitated segment [60], about which Korr wrote numerous articles [61 -67].

In 1983, and apparently without knowledge of the work by Denslow et al., Woolf hypothesized and then experimentally demonstrated the presence of a hyperexcitable central component in post-injury pain hypersensitivity [68]. In 1987, Woolf provided a clear explanation of central sensitization: "C fiber input to the spinal cord, in addition to producing input concerning the onset, location and duration of the peripheral noxious stimuli, also produces a prolonged increase in the excitability of the spinal cord" [58]. Research demonstrated that brief conditioning stimuli of nociceptive C -fibers (up to 20 sec) at low frequencies (1 Hz) can produce a prolonged excitation (up to 90 minutes) of the spinal cord. Additionally, it was shown that C fibers innervating deep structures, such as joints or muscles, can more readily produce central facilitation than can cutaneous C fibers - [58]. The activation of nociceptive C afferents can also produce profound changes in the receptive field properties of dorsal horn neurons, such as an expansion of the receptive field size, an increase in spontaneous activity, and an increase in response to innocuous stimuli [58].

Since Woolf's initial article in 1983, a great deal of research has been devoted to understanding the process of central sensitization [55, 56, 69-81]. Most authors now agree that central sensitization manifests in CNS neurons as increased spontaneous activity, reduced thresholds or increased responsiveness to afferent inputs, which are prolonged after discharge from repeated stimulation, and expanded receptive fields of -dorsal horn neurons [56]. Many think that these CNS changes are caused by an increase in excitatory inputs and/or a loss of inhibitory inputs, which result in a net excitation of the dorsal horn [69].

At the present time, an emerging impression is that spinal cord plasticity is responsible for the development of central sensitization [55, 56, 69-71, 82]. In general, plasticity refers to an adaptation of the nervous system in response to changes in the associated internal or external environment [83]. Kandel states-that plasticity is a "change in the effectiveness of specific synaptic connections" [84]. Research suggests that the physiological basis of plasticity involves an increase in gene expression, particularly intermediate-early genes, such as *c-fos* and *c-jun* [70,

85]. With respect to central sensitization, plastic changes begin after the release of various excitatory transmitter substances from nociceptive afferents, such as substance P, calcitonin gene-related peptide, aspartate and glutamate, and their

subsequent action at N-methyl-D-aspartate receptor sites. Dubner and Ruda provide a review of this proposed mechanism [70].
It is thought that central sensitization extends to neurons in the dorsal and anterior horns of the spinal cord, the thalamus and even higher centers [56, 86, 87]. In other words, noxious input leads to the hyperexcitability of alpha-motoneurons, preganglionic sympathetic neurons, spinal cord nociceptive projection neurons, thalamic projection neurons and other neurons in the brain. A variety of symptoms and conditions can develop in response to these changes. For example, it is known that nociceptor sensitization and central nociceptive sensitization of projection neurons causes increased pain [55]. From a clinical perspective, chiropractors routinely encounter pain associated with a sensitized nociceptive system. It is common to discover that gentle or normal palpation of spinal tissues results in the experience of pain. The word allodynia is used to describe this state, in which normally painless stimuli result in pain [47].

Considering the fact that nociceptive input reaches subcortical areas, such as the brainstem hypothalamus [37], it is also likely that -a wide variety of neuro-endocrine responses and seemingly unrelated symptoms could develop in response to a sensitized nociceptive system. The following two sections discuss these relationships in some detail.

Neuro-endocrine responses caused by nociceptive input to subcortical centers.

We know that nociceptive afferent input travels up the anterolateral pathway, which contains the spinoreticular and spinothalamic tracts. -Bonica provides a succinct explanation of the neuroendocrine responses associated with such activity [87]:

Suprasegmental reflex responses result from nociceptive induced stimulation of medullary centers of ventilation and circulation, -hypothalamic (predominantly sympathetic) centers of neuroendocrine function and some limbic structures. These responses consist of hyperventilation, increased hypothalamic neural sympathetic tone and increased secretion of catecholamines and other catabolic hormones. The increased neural sympathetic tone and catecholamine secretion add to the effects of spinal reflexes and further increase cardiac output, peripheral resistance, blood pressure, cardiac workload and myocardial oxygen consumption. In addition to catecholamine release, there is an increased secretion of cortisol, adrenocorticotrophic hormone, glucagon, cyclic AMP, antidiuretic hormone, growth hormone, renin and other catabolically acting hormones, with a concomitant decrease in the anabolically acting hormones insulin and testosterone.--- Cortical responses, in addition to and including the perception of pain as an unpleasant sensation and negative emotion, initiate the psychodynamic mechanisms of anxiety, apprehension and fear. These, in turn, produce cortically mediated increases in blood viscosity, clotting time, fibrinolysis and platelet aggregation.

Indeed, cortisol and catecholamine responses to anxiety usually exceed the hypothalamic response that is provoked directly by nociceptive impulses reaching the hypothalamus.

Bonica demonstrates the degree to which nociceptive input can metabolically compromise the host. As implied above, subcortical responses can occur with or without the experience of pain. Perhaps such asymptomatic neuroendocrine responses, induced by nociceptive input, play a role in the pathogenesis of degenerative diseases, such as cardiovascular disease, cancer, diabetes, -arthritis and Alzheimer' 5 disease. We need more research in this area, which becomes more obvious when the devastating effects of hypercortisolemia are considered.

Cortisol levels are increased by nociception, pain, inflammation, trauma, anxiety, fear, apprehension, prolonged and strenuous exercise and hypoglycemia [87, 88].

When stressors are present for protracted periods of time, feedback suppressibility of cortisol can be impaired [88].

The damaging effects of excess endogenous cortisol are as jeopardizing as those associated with exogenous intake in the form of medication. Such a relationship can be better appreciated when we understand that -cortisol secretion can rise 20-fold when the adrenal gland is chronically stimulated [88].

Excess cortisol produces a continuous drain on body protein stores, most notably in muscle, bone, connective tissue and skin. Hypercortisolemia causes a variety of tissue-specific changes, including a reduction in rapid-eye-movement sleep; a reduction of cell-mediated immunity by inhibiting the production of interleukin- 1, interleukin-2 and gamma-interferon; a decrease in the proliferation of osteoblasts; and a reduction in collagen synthesis. We know cortisol antagonizes the action of insulin, which results in decreased glucose use. Cortisol stimulates lipogenesis in specific body locations, including the abdomen, trunk and face [88].

Chronic hypercortisolemia may play a role in spinal muscle degeneration. We know that cortisol preferentially reduces the ratio of slow oxidative type I muscle fibers to fast glycolytic type Il-B -fibers [88]. This may enhance the deconditioning -of spinal muscles that occurs as a consequence of sedentary living and aging and may promote spinal injury and chronic joint complex dysfunction.

There are also a number of diseases that are driven by hypercortisolemia. Dilman and Dean actually characterize hypercortisolemia as a disease [89]. They coined the term hyperadaptosis to describe a state characterized in its latent stage -by an excessive and -prolonged elevation of cortisol levels in response to stressors, and in its overt stage by an elevation of basal cortisol levels in the absence of apparent stressors. Several conditions are known to develop as a consequence of hypercortisolemia, including heart disease, various cancers, hypertension, depression, obesity and diabetes [89].

Symptoms caused by nociceptive input to subcortical centers.

Feinstein et al. were the first to clearly describe some symptoms associated with noxious irritation of spinal tissues [90]. They injected hypertonic saline into interspinous tissues and paraspinal muscles of normal volunteers for the purpose of characterizing local and referred pain patterns that might -develop. What they discovered was surprising:

The pain elicited from muscles was accompanied by a characteristic group of phenomena which indicated involvement of other than segmental somatic mechanisms. . . . The manifestations were pallor, sweating bradycardia, fall in blood pressure, subjective 'faintness," and nausea, but vomiting was not observed. Syncope occurred in two early procedures in the series of paravertebral injections and was subsequently avoided by quickly depressing the subject's head or by having him lie down at the first sign of faintness. These features were not proportional to the severity of or to the extent of radiation; on the contrary, they seemed to doimnate the experience of subjects who complained of little pain, but who were overwhelmed by this distressing complex of symptoms.

Feinstein et al. -referred to these symptoms as autonomic concomitants [90]. It is likely that these autonomic concomitants were caused by nociceptive stimulation of autonomic centers in the brainstem, particularly the medulla [87]. Fein stein et al. indicate that "this is an example of the ability of deep noxious stimulation to activate generalized autonomic responses independently of the relay of pain to conscious levels" [90]. In other words, pain may not be the symptomatic outcome of nociceptive stimulation of spinal structures. Such a conclusion has profound implications for the chiropractic profession. Clearly, patients do not need to be in pain to be candidates for spinal adjustments.

Nansel and Szlazak published the most recent article devoted to autonomic concomitants associated with nociceptive input - [91]. They explained -that it is now well-established that nociceptive input from somatic and visceral structures "converges on common pools of interneurons within the spinal cord and brainstem." As -a consequence, nociceptive input from somatic structures can "create complex patterns of signs and symptoms -that can often be virtually identical to and, therefore, easily mistaken for those induced by primary visceral disease." They have collected more than 200 scientific articles that deal with various somatic visceral disease mimicry syndromes.

In summary, there are many neuroendocrine and symptomatic presentations that can occur in response to nociceptive input. It is very likely that no two patients will present in the exact same fashion, even if joint complex dysfunction exists in the same spinal location. The symptomatic picture can become even more complex when the consequences of reduce mechanoreception -are considered.

Mechanoreceptors

Mechanoreceptors are located in the skin, muscles, joint structures and

theintervertebral disc [13, 14, 92]. Examples of mechanoreceptors include muscle spindles, golgi tendon organs (GTOs) and a variety of corpuscular mechanoreceptors, such as Ruffini endings, Merkel cell complexes, Meissner's corpuscles, Pacinian corpuscles and many others [14].

Many believe that, as a group, mechanoreceptors respond only to weak mechanical stimuli, such as touch and joint movement, and not to nociceptive stimuli with higher frequencies [l8, 19, 42, 93]. -As would be expected, several authors suggest that reduced joint movement results in less mechanoreceptor activation [20-23]; however, the degree to which mechanoreceptor input would be compromised by joint hypomobility is unknown at the present time. Although it may be difficult to quantify such mechanoreceptor deficits in the laboratory, research suggests that a reduction in mechanoreceptor afferent input can result in the development of symptoms that can be identified in the clinical setting. For example, de Jong et al. injected human subjects with lidocaine in the area halfway between the mastoid process and carotid tuberde at the level of the second and third cervical vertebrae [94]. Injections were made unilaterally. Immediately after injection, symptoms of dysequilibrium began to appear. Symptoms included ataxia, hypotonia of the ipsilateral arm and leg and a strong sensation if ipsilateral falling or tilting. The symptoms were more pronounced on the side of injection and lasted for about an hour. The authors suggested that the injection of local anesthetics interrupts the flow of afferent information from neck and muscle receptors," which can affect vestibular nuclei function and promote a variety of vestibular symptoms [94].

Presumably, the receptor types to which de Jong et al. refer include corpuscular mechanoreceptors, muscle spindles and GTOs.

A brief review of mechanoreceptor subtypes, their basic functions and the neuroanatomical pathways associated with mechanoreceptors will help to outline potential symptoms that may develop because of joint complex dysfunction.

Corpuscular mechanoreceptors.

Corpuscular mechanoreceptors are found in the skin, joint structures and muscles [14, 21, 95]. in general, -people believe that corpuscular mechanoreceptors are associated with A-beta fibers [12, 13].

Mechanoreceptor afferents (A-beta fibers) influence the nervous system in many ways. For example, at the spinal cord level, mechanoreceptor input can inhibit nociception [14, 20, 96-99]. Thus, it is very likely that reduced mechanoreceptive activity will enhance the nociceptive input associated with joint complex dysfunction. Also, mechanoreceptor afferents can reduce sympathetic hyperactivity [20, 99, 100]. Thus, it is reasonable to suggest that reduced mechanoreception will enhance segmental sympathetic hyperactivity and somatomotor output.

Clearly, mechanoreceptor afferents have important functions in the CNS. It seems that it would be ideal to have an abundance of mechanoreceptors functioning at an optimal level at all times. Unfortunately, it also seems that there are relatively few

corpuscular mechanoreceptors compared with nociceptors.

The precise concentration of corpuscular mechanoreceptors in somatic tissues is unknown. Recent research suggests that the concentration of nociceptors far exceeds that of corpuscular mechanoreceptors. Schmidt et al. discusses the percentage of fiber types in the medial articular nerve and posterior articular nerve of the cat [19]. Only 9% of the fibers in the medial articular nerve and 26% in the posterior articular nerve were mechanoreceptive. Such a low percentage of mechanoreceptive afferents suggests that maintaining proper joint mobility is very important.

Muscle spindles.

Muscle spindles are classically described as receptors that send information into the CNS about muscle length or the rate of change of muscle length. It is generally believed that muscle spindles lie parallel to extrafusal fibers in the center of a muscle. Muscle spindles have primary endings associated with a group Ia afferent fiber and secondary endings associated with a group II afferent fiber. Both group Ia and II fibers are thought to have numerous connections within the spinal cord.

Group Ia afferents are involved in several cord reflexes that modulate extrafusal muscle function, such as the stretch reflex, recurrent inhibition, reciprocal inhibition and the cross extensor reflex [101]. All of these reflexes are very important for promoting smooth and controlled movements. Group II afferents are not as well described as Ia afferents. It is generally believed that group II afferents primarily affect the static component of the stretch reflex.

In general, the greatest concentration of muscle spindles are located in muscles involved in fine movements and posture, whereas the lowest concentration is found in muscles involved in gross movement [102]. Research has demonstrated that the digits and neck contain the greatest density of muscle spindles. Indeed, it has been stated that the neck muscles contain a "bewildering number of muscle spindles" [103]. Dvorak and Dvorak indicate that, per gram of muscle tissue, the rectus femoris contains 50 muscle spindles, whereas the suboccipital muscles contain approximately 150-200 muscle spindles and the intertransverse muscles in the cervical spine contain between 200-500 muscle spindles [99]. Some have suggested that the intertransverse muscles of the neck and lower back may actually function as mechanoreceptors and not as muscles [104].

The distribution of muscle spindles within muscles is far more varied and complex than the classic description. Richmond et al. indicated that muscle spindles can be associated with one another in several ways, including:

(a) paired associations, in which two or more spindles lie side-by-side, (b) parallel associations, in which two or more intrafusal fiber bundles are contained within a common capsule for some part of their -length and (c) tandem associations, in which two or more spindle units are linked in series by a common intrafusal fiber that runs through each spindle unit in succession."

It is not uncommon to find muscle spindles linked in complex arrays that span the length of an intervertebral muscle. Some spindles are also found in close contact with Paciniform corpuscles and GTOs [103].

GTOs.

GTOs are usually described as muscle tension receptors. Many believe that GTOs lie in series with extrafusal fibers. In other words, GTOs are found at the junction of a muscle and its tendon.

GTOs are stimulated when muscle contraction generates tension in a muscle. The frequency of firings increase in proportion to the increasing muscle tension [103]. GTOs are innervated by a group lb afferent fiber. The lb afferent enters the cord and excites an interneuron located in the intermediate region of spinal cord gray matter. This so-called lb inhibitory interneuron serves to inhibit the alpiha-motoneuron that innervates the same muscle that was contracted and created the tension. It should be mentioned that the lb inhibitory intemeuron receives convergent input from -Ia afferents from muscle spindles and A-beta afferents from cutaneous and joint receptors [100, 105].

GTOs are highly concentrated in neck muscles. Their distribution tends to be nonuniform. They are found along internal aponeurosis and where muscles attach to the vertebral process. In both the deep and more superficial neck muscles, spindles and GTOs are often clustered in complex receptor arrays [103].

In recent years. it has been shown the GTOs have a dynamic sensitivity and are more suited to signaling rapidly changing tensions rather than static levels of tension. Research has shown that GTOs respond to forces as low as 4 mg.

Supraspinal connections.

We know that afferent input from corpuscular mechanoreceptors, muscle spindles and GTOs can influence brain -function. Researchers have stated that mechanoreceptive input is partially responsible for proprioception [14, 96] and suprasegmental motor control [106]. Indeed, it seems that many supraspinal centers depend on afferent input, including the cerebellum and cerebral cortex. For example, Carpenter states that afferent fiber input to the cerebellum exceeds efferent fibers by a ratio of-approximately 40:1, which demonstrates the degree to which afferent input is needed by the CNS [107]. With this information in mind, it is important to consider -the probability that joint complex dysfunction is associated with the degeneration, atrophy and deconditioning of mechanoreceptor rich tissues, such as muscles and joint structures [1, 107-109].

The following sections describe the main afferent and subsequent efferent connections of the cerebellum and cerebral cortex. Based on these connections and related research findings, a variety of potential symptoms that may manifest in response to the reduced mechanoreceptive input associated with joint dysfunction

will be described.

Cerebellum.

Brodal provides a detailed description of mechanoreceptive input to the cerebellum

[95]. Afferents enter the cerebellum through all three cerebellar peduncles. Whereas the superior peduncle contains mostly efferent fibers and some afferent fibers, the middle peduncle contains only afferent fibers and the inferior peduncle contains mostly afferent fibers and some efferent fibers. The discussion that follows focuses on afferent information that travels through the middle and inferior peduncles.

Afferents entering the middle cerebellar peduncle come from the cerebral cortex via the corticopontocerebellar tract, which contains some 20 million fibers [95]. The majority of these fibers project to the lateral cortex of the cerebellum, which is involved in the coordination and regulation of sequential and volitional motor activities initiated by the cerebral cortex [95, 110]. Clearly, without afferent input, the lateral cortex could not properly modulate motor control.

The lateral cortex is often called the cerebrocerebellum because it receives input exclusively from the cerebral cortex by way of the pontine nuclei [111]. The heaviest projections come from the primary motor area (Brodmann area 4), the primary sensory area (Brodmann areas 3, 1 and 2), a somatosensory association area (Brodmann area 5) and from parts of the visual areas related to the peripheral visual field [95]. Areas 3, 1 and 2, the primary sensory area, each receive afferents from specific receptors [107]. Group Ia muscle spindle afferents project to area 3a. Cutaneous afferents project to area 3b. Joint afferents project to area 2. Area 1 receives input from both cutaneous and deep tissue receptors. This information makes it clear that a significant level of mechanoreceptor afferent input indirectly reaches the cerebellum by way of the cerebral cortex.

The inferior peduncle contains some 0.5 million fibers [95], most of which originate from receptors in axial and appendicular structures. Afferents from spinal structures end in the cerebellar vermis, whereas afferents from the extremities end in the intermediate cortex, which is also referred to as the paravermal region. It is important to note that this input is somatotopically organized. Nolte indicates that the principal sources of afferent input to the vermis and intermediate cortex come via the -spinal cord from mechanoreceptors in the skin, muscles and joints [110]. For this reason, the vermis and intermediate cortex are often referred to as the spinocerebellum. It should be mentioned that both the vermis and intermediate cortex also receive afferent input from the motor cortex by way of the corticopontocerebellar tract. This input is somatotopically organized so that the cortical fibers end in the same pattern as those from mechanoreceptor afferents [1-10].
As far back as 1960, researchers determined that the dorsal spinocerebellar tract conveys information to the vermis and intermediate cortex from muscle spindles, GTOs and corpuscular mechanoreceptors in the skin. Later, it was determined that

the dorsal spinocerebellar tract also conveys information from joint receptors [95]. We know that the dorsal spinocerebellar tract conveys mechanoreceptive information from the lower half of the body and the cuneocerebellar tract relays mechanoreceptor afferent input from the upper half [95, 107]. The importance of the spinocerebellar pathways is demonstrated by the conduction velocity of its component fibers. We know that impulses are transmitted at velocities up to 120 rn/sec for the purpose of instantaneously apprising the cerebellum of peripheral movements [12]. Additional afferents that travel through the inferior cerebellar peduncle to end in the spinocerebellum arise from the inferior olive and central-cervical nucleus.

The inferior olive also provides input to the cerebellum from mechanoreceptor afferents that end somatotopically in the olive [95]. Carpenter [107] indicated that afferents from cutaneous receptors and lb afferents from GTOs contribute to the spino-olivary tract. Proske indicated that the principal supraspinal site of termination for OTO afferents is the cerebellum [105]. The major -projection is from the spinocerebellar tracts and the secondary projection comes from the inferior olive via the spino-olivary tract [105]. If the spino-olivary tract fis consistent with other ascending mechanoreceptive tracts, it is likely that all types of mechanoreceptor afferents project to the inferior olive. Brodal states that "the quantitatively most important contingents of afferents mediate spinal impulses" [95].

The inferior olive is a very important structure and far too complex to discuss in this article. In brief, we know that the inferior olive projects to all parts of the cerebellar cortex and all deep cerebellar nuclei (i.e., the dentate, globus, emboliform (nucleus interpositus) and fastigial). There are even reciprocal connections between each cerebellar nucleus and the olive. In addition to mechanoreceptor afferents, the inferior olive also receives -input from the cerebral cortex (chiefly the motor cortex), red nucleus, mesencephalic reticular formation, superior colliculus and pretectum [95]. The symptoms associated with experimental oblation of the inferior olive are similar to those associated with destruction of the entire contralateral cerebellum [110].

The central cervical nucleus (CCN), located in lamina VII of the first four cervical segments, projects to the cerebellar vermis [95]. Originally, the CCN was thought to receive only upper cervical mechanoreceptor afferents [95, 112]. Recent

research suggests that the CCN may receive mechanoreceptor afferents from as low as the lumbar spine [113]. However, there is evidence to suggest that the CCN is most powerfully influenced by receptors in deep neck muscles [114].
The vermis functions to control equilibrium, posture, muscle tone and locomotion [12, 95, 107]. Ghez states that the vermis is involved in axial and proximal motor control [111]. It must be remembered that, without proper afferent input, these functions would be compromised.
Assuming that the vermis receives sufficient mechanoreceptive input, it will modulate motor function by projecting to a variety of nuclei. The vermis projects somatotopically organized information to the fastigial nucleus, which then projects

bilaterally to the lateral vestibular nucleu and reticular formation nuclei [111], particularly the nucleus reticularis pontis caudalis and the nucleus reticularis gigantocellularis [95]. The tracts associated with these nuclei include the lateral vestibulospinal tract, the medial reticulospinal tract and the lateral reticulospinal tract. respectively. We know the fastigial nucleus also projects to the thalamus and, ultimately, to the motor cortex [95, 111].

The intermediate cortex mainly coordinates the actions of the distal extremities [95, 107, 111]. It accomplishes this task by projecting to nucleus interpositus, which projects mainly to the red nucleus and motor cortex, affecting the rubrospinal tract and corticospinal tract, respectively. Many believe that the intermediate cortex compares commands emanating from the motor cortex with the actual position and velocity of the moving part (it receives this information from mechanoreceptors); then, by way of the nucleus interpositus, the intermediate cortex issues correcting signals [110]. Without adequate mechanoreceptor input, the ability of the intermediate cortex to modulate motor control would be compromised.

Thus far, both the cerebrocerebellum and spinocerebellum have been discussed. The third division of the cerebellum is known as the vestibulocerebellum, so named because it receives afferent input from the vestibular nerve and vestibular nuclei. The flocculonodular lobe is the specific area of the cerebellum referred to as the vestibulocerebellum. Afferents to the vestibulocerebellum also travel through the inferior cerebellar peduncle.

Most texts indicate that only vestibular afferents end in the flocculonodular lobe [11, 110, 111]; however, this is not the case. Guyton alluded to the fact that mechanoreceptor afferents from the neck also gain access to the flocculonodular lobe [12]. He explains that mechanoreceptors from the neck and body transmit information directly into the vestibular nuclei and indirectly, by way of the cerebellum, into the flocculonodular lobe. Apparently, mechanoreceptor input from the neck transmits signals that oppose the signals from the vestibular apparatus, which prevents a person from developing dysequilibrium when the head is laterally flexed or rotated. Guyton further stated that, "by far the most important proprioceptive information needed for the maintenance of equilibrium is that derived from the joint receptors of the neck" [12]. Although not described by Guyton, several other authors describe a specific relay nucleus by which mechanoreceptor afferents gain access to the vestibulocerebellum [95, 113, 114].

Brodal states that mechanoreceptor afferents project to the flocculonodular lobe via the group X nucleus located in the region of the vestibular nuclei [95]. Bakker and Abrahams explain that the neurons of group X seem to serve as a primary relay for cervical mechanoreceptor afferent input to the cerebellum [114]. Research also suggests that thoracic and lumbar mechanoreceptor afferents project to group X [113].
In summary, the flocculonodular lobe receives input from the vestibular apparatus in the inner ear and mechanoreceptor afferents, and then projects ipsilaterally to the middle, superior and inferior vestibular nuclei. Relatively few fibers project to

the lateral vestibular nucleus [95]

Most authors agree that the medial vestibulospinal tract originates in the medial vestibular nucleus and descends bilaterally into the cervical and perhaps upper thoracic cord [95, 110, 111]. Ghez stated that, "this tract participates in the reflex control of neck movements so that the position of the head can be maintained accurately and is correlated with eye movements" [111].

The medial longitudinal fasciculus (MLF) is believed to originate in the superior and medial vestibular nuclei. Fibers in the MLF project to abducens. trochlear and oculomotor nuclei. which allow a person 5 gaze to stay fixed on an object while the head is moving [110]. This is known as the vestibulo-ocular reflex; Maeda has demonstrated that the cervical spine mechanoreceptors participate in this reflex by projecting to the group X nucleus [115].

The MLF also projects to the interstitial nucleus of Cajal [95]. It is thought that this nucleus probably plays an important role in mediating the effects of optic and vestibular impulses on the neck and body musculature and may also influence certain central effects on the autonomic system [95].

The vestibular nuclei also project to the cerebral cortex via both direct and indirect pathways. Animal experiments have revealed that within the facial region of the primary sensory area, there is a marked convergence of vestibular and somatosensory impulses arising from muscle spindles and from mechanoreceptors in the skin and joints [95]. These connections may exist in humans; Nolte indicates that each superior vestibular nucleus sends projections bilaterally to the facial region of the primary sensory area [110]. Through these connections, it is likely that the vestibular nuclei play a role in the conscious appreciation of body position [95, 110].

The vestibular nuclei also have extensive reciprocal connections with the reticular formation. "The vestibuloreticular connections are presumably involved in vomiting and cardiovascular reactions observed on vestibular irritation" [95].

In a classic sense, the vestibulocerebellum is primarily thought to play a role in equilibrium. This is because lesions to the flocculonodular lobe can result in general dysequilibrium and vertigo [110]. However, the vestibular nuclei have widespread connections; therefore, lesions within the vestibulocerebellum may also result in conditions such as nystagmus and a variety of autonomic concomitants [95]. It is quite possible that similar symptoms could develop when -adequate mechanoreceptive input does not reach the vestibular nuclei and flocculonodular lobe.

Cerebral cortex.

As mentioned in the cerebellum section, each area in the primary somatosensory region receives afferents from specific receptors [107]. Group Ia muscle spindle afferents project to area 3a. Cutaneous afferents project to area 3b. Joint afferents project to area 2. Area 1 receives input from both cutaneous and deep tissue receptors. It is well-known that the dorsal columns and medial lemniscus carry this

mechanoreceptive information. The importance of such mechanoreceptor afferent input to the cerebral cortex is described by many neuroanatomists.

Carpenter states that although impulses generated in-neurons in the primary motor area (M I), the premotor area, and in the supplementary motor area (M -II) are responsible for movement, motor control, changes in muscle tone and maintenance of posture, these motor activities are initiated by inputs that arise from the thalamus, other cortical areas and peripheral receptors [107].

According to Masdeu and Brazis, sensorimotor control is carried out by various thalamic nuclei, such as the ventrolateral nucleus, which predominantly coordinate the finer distal motor movements -[106]: "The ventrolateral nucleus integrates input -from the cerebellum, basal ganglia and mechanoreceptors from the musculoskeletal system; it projects to the pericentral cortex or primary motor cortex (area 4). " Wyke maintained that Type I joint receptors, which are similar to Ruffini spray endings, excite the paracentral and parietal regions of the cerebral cortex and make a significant contribution to the perceptual experiences of postural sensation and kinesthesis [96]. Clearly, appropriate mechanoreceptor afferent input is required by the cerebral cortex to perform a host of conscious and subconscious motor functions.

Other authors indicate that afferent input plays a role that extends beyond that of motor control. Both Guyton [12] and Nolte [110] indicated that if afferent signals are eliminated, the cerebrum would be incapable of functioning in a conscious manner and would actually approach a permanent state of coma.

A more precise anatomical look at the cerebral cortex reveals that somatosensory input plays an additional role in human function, such that mechanoreceptor input is actually needed to help us function as humans. The human neocortex accounts for more than 90% of the total cortical area [110] and is divided into six separate layers [107]. Layer 1, the molecular layer, is the most external. Layer II is the external granular layer. Layer III is the external pyramidal layer. Layer IV is the internal granular layer. Layer V is the internal pyramidal layer. Layer VI, the deepest layer, is known as the multiform layer.

Generally speaking, layers II and IV receive afferent input and layers III and V receive mainly efferent data [112]. Layer II receives cortical afferents and, depending on the location in the neocortex, layer IV receives afferents from somatosensory receptors, the medial geniculate body for audition and the lateral geniculate body for vision (see discussion below on primary sensory areas). Layer III projects ipsilaterally and contralaterally to other areas of the cerebral cortex via association fibers and commissural fibers. Layer V gives rise to corticostriate fibers, corticopontine fibers, corticobulbar fibers and corticospinal fibers [107]. Layer VI is also thought to be largely -efferent and to mainly project fibers to the thalamus. Cortical interneurons allow the various layers in a specific area to communicate with one another [112].

The term 'great sensory pathways' has often been used to describe the

somatosensory, optic-and acoustic systems [95]. Each has an individual primary sensory area in the cerebral cortex. Area 17 in the occipital lobe is for-vision. Area 41 in the temporal lobe is for audition, and areas 3,1 and 2 in the parietal lobe are for sornatosensory input. Once afferent input is received in a specific primary

sensory area, the information is integrated and then communicated to other parts of the brain via commissural and association fibers. The great majority of commissural fibers travel in the corpus callosum, which is thought to contain about 180 million fibers. The projections between homotopic regions are thought to be very precise. For example, the commissural connections of the primary and secondary sensory areas seem to be extremely specific [95].

Association fibers are -ipsilateral, and four main fiber pathways are typically described. One passes through the cingulate gyms and is known as the cingulum. The superior longitudinal fasciculus connects the frontal lobe to the occipital lobe. The inferior longitudinal fasciculus connects the occipital lobe to the temporal lobe. The uncinate fasciculus passes from the temporal lobe to the frontal lobe [95, 110]. It should be understood that none of the association pathways are discrete, point-to-point pathways. Fibers freely enter and leave along the course of the pathways [110]. Thus, the association pathways allow for an almost unimaginable number of connections. We know that the primary sensory areas (for somatosensory input, vision and audition) all communicate in various association areas, such as the parieto-occipital-temporal association area and the prefrontal association area, via the commissural and association pathways [95, 112].

The prefrontal association area also receives input from the limbic system; thu-s, this association area receives information about all sensory modalities as well as information regarding motivational and emotional states [112]. All of this input is integrated, which allows one to appropriately engage a given environmental situation. A reduction in limbic input, visual input, auditory input or somatosensory input would necessarily compromise--one's ability to function.

Janse provided a most elegant commentary on the importance of mechanoreceptor afferent input [116]: Numerically, the somatic sensory factors comprise by far the major activating vehicle of the nervous system, and the overtones of the body's conduct are significantly conditioned and controlled by their input." Regarding the total sensorial experience of humans, which includes mechanoreceptive, nociceptive and special senses, Janse stated that humans are provided "with sentiencies [sic] of emotional, mental and spiritual affectivities that defy total comprehension." Janse suggested that an divergence in the totality of sensory input could ultimately result in pathology, or symptoms of pathology, in seemingly unrelated tissues and organs [116].

Symptoms associated with reduced mechanoreceptor input.

Mechanoreceptive information reaches numerous centers in the CNS. Consequently, a reduction in mechanoreceptor input caused by joint complex dysfunction has the potential to promote numerous symptoms that could mimic lesions of the vestibular nuclei, cerebellum, cerebral cortex and basal ganglia. Although much more research

is still needed in this area, evidence exists to support this contention. For example, as early as 1845, "Longet reported that surgical damage of neck muscles in a wide range of species led to generalized but transient motor disturbances characterized by an ataxia similar to that which followed cerebellectomy" [103]. More recently, a study of patients with soft tissue injuries in the neck led the authors to conclude that oculomotor abnormalities may be caused by abnormal mechanoreceptor input [117].

Fitz-Ritson found that 112 of 235 patients with cervical spine trauma experienced cervical vertigo [118]. The definition of vertigo used in this study included both "subjective vertigo, i.e., the patient feels that he/she is rotating, [and] objective vertigo, i.e., the feeling that the room or environment is rotating." After 18 treatments, which involved chiropractic adjustments to restore mobility to restricted joints, 101 of the 112 patients (90.2%) were symptom-free. This finding is consistent with the findings of Lewit, who stated that manipulation is very effective for reducing vertigo and dizziness [119].

It seems that symptoms of enhanced nociception often accompany symptoms associated with reduced mechanoreception. For example, Weeks and Travell demonstrated that a clinical syndrome characterized by postural vertigo or dizziness, imbalance and, usually, headache may be caused by dysfunction of the sternocleidomastoid muscle [120]. Gray reported on a series of case histories that described how injured cervical muscles can play a role in the production of vertigo, pain, nausea and tinnitus [121].

In a article titled *Cervical Vertigo,* Wing and HargraveWilson described 80 patients, all of whom had some form of vertigo, varying from the severe rotary type to generalized unsteadiness [122]. All patients had a thorough examination of the ears, nose and throat, and the results were normal in 96% of the cases. Electronystagmographic abnormalities were found in all patients. Some 69% of the patients also had either occipital headaches or cervical pain. All patients had "tender muscle guarding" in the upper cervical region, which was thought to exist because of "partial fixation of the involved vertebra." The authors stated that manipulation was a "bastion" of treatment. After treatment, lectronystagmographic recordings were significantly improved in 73% of the patients. A total of 53% of patients had complete relief of symptoms, and 36% had significant improvement to the point where they required no medication and could return to normal activities.

Several additional authors have discussed the relationship between a dysfunctional cervical spine and symptoms of pain, vertigo and dizziness [123-126]. Research also suggests that joint complex dysfunction in the lumbar spine can affect equilibrium [127].

Reduced mechanoreception may also impact the nonmotor functions of the cerebellum. In 1978, Watson explained how traditional concepts of cerebellar physiology emphasize motor control functions; however, he also points out that an emerging body of literature demonstrates a relationship between the cerebellum

and psychological processes [128].

Specifically, data have suggested that this brain structure may participate in sensory integration activities, motor skills learning, visual and auditory discrimination performance, emotion and motivation control, and reinforcement processes [128].

Many articles have discussed the cerebellum's participation in emotional expression [128-132]. The most dramatic work was completed by Heath during the 1970s [132].

Through experimentation, Heath demonstrated that brain sites for emotional expression are anatomically connected and functionally related to sensory relay nuclei for all modalities and also to sites involved in facial expression and motor coordination [132]. His research demonstrated that efferent pathways from the vermis/fastigial nucleus could stimulate pleasure centers located in the septal nuclei of the hypothalamus and corticomedial amygdala, and simultaneously inhibit adversive emotion centers located in the hippocampus and dorsolateral amygdala. Heath applied electrical stimulation to the vermis to activate this pathway in his treatment of psychiatric patients. To access the cerebellum, suboccipital craniotomy was performed and 2-mm electrodes were implanted subtentorially over the rostral vermal and paravermal regions of the cerebellum. A pace-making device delivered a stimulus at selected time intervals. Heath used this method on 11 patients with intractable psychiatric illness, all of whom were pronounced incurable by at least two physicians. The length of illness varied from 6 to 23 yr. Of the 11 patients, four had uncontrollable violence-aggression (two with no demonstrable organic brain disease and two with brain pathology), five were schizophrenics, and two had lifetime patterns of severe neurosis. After treatment, 10 of the 11 patients were out of the hospital and functioning without medication or other treatment [except for cerebellar stimulationT. Some were symptom-free, and others demonstrated significant improvements. The one patient who failed to respond had an adhesion between the tentorium and the rostral vermis that extended 2.5 cm to either side of midline, which apparently damaged the targeted cerebellar neurons.

Heath's work is important for chiropractors because the rostral vermal and paravermal neurons of the cerebellum receive axial and appendicular mechanoreceptor input from all levels of the spinal cord (see earlier discussion on the cerebellum). Although this does not prove that dysafferentation caused by joint complex dysfunction is a cause of psychiatric illness, it is clear that interesting implications do exist and should be investigated.

CONCLUSION

The information presented in this article demonstrates that the CNS is greatly influenced by somatosensory input. Numerous, seemingly unrelated symptoms can be generated when nociceptive input is enhanced and mechanoreceptive input is reduced. Research evidence leads us to believe that such dysafferent input is associated with joint complex dysfunction, which explains why so many seemingly bizarre symptoms respond to chiropractic care.

As stated earlier, according to classic neuroanatomy, the great sensory systems include the visual system, the auditory system and the somatosensory system. At the present time, there are specialists devoted to -the visual and auditory systems. As of yet, no profession has effectively stepped forward to specialize in treating somatosensory system dysfunction (i.e., dysafferentation induced by joint complex dysfunction). That chiropractic has not assumed such a role is surprising. Indeed, it seems that Janse envisioned chiropractors filling this role [116].

Apparently, Janse was so convinced that the chiropractic profession would pursue research in the field of somatosensory neurology that he wrote, "Let us be a trifle bold and quite foolish; let us try to imagine what a symposium on Principles of Sensory Communication might be like in 10 or 15 years hence" [116]. Janse went on to discuss numerous aspects of somatosensory function that could have served as research topics for chiropractors. Unfortunately, save for a few scattered articles, the idea that chiropractors should be the doctors or care takers of one of the great sensory systems has not been pursued. Janse warned future generations of chiropractors about neglecting the somatosensory system. He stated:

It is not to be forgotten that essentially man is a sensorial organism. Re ftinctions by virtue of the inputs he experiences via the cutaneum, the subdermal, the myofascial planes, the dianthrodial complexes of the musculoskeletal system, especially the spine; the related proprioceptive phenomena [116].

Suggestions for Chiropractic Education

At the present time, the basic sciences in most chiropractic colleges are taught in the same fashion as in medical school. Students are taught to view anatomy, physiology and diagnosis based solely on a pathology model. In other words, a differential diagnosis involves ruling out pathological changes in anatomical structures and metabolic pathways. This approach should not be abandoned; however, joint complex dysfunction and dysafferentation must be included in every differential diagnosis whenever it is determined that nociceptive and mechanoreceptive input can directly or indirectly influence the structures from which the symptoms are generated. This demands that students and practitioners be well versed in the details of the central connections of the many neuroanatomical pathways related to nociceptive and mechanoreceptive input.

Without this knowledge, it will be impossible for students and doctors to understand and explain how joint complex dysfunction can affect the many conditions that afflict the human body.

At the present time, only a few articles explain how to include joint complex dysfunction in the differential diagnosis, all of which focus on the topic of dizziness and vertigo [99, 118, 133, 134]. This must change if chiropractic is to ever become a truly mainstream profession that reaches a majority of the population.

REFERENCES:

- Seaman D. Joint complex dysfunction, a novel term to replace subluxation/subluxation complex: Etiological and treatment considerations J Manipulative Physiol Ther 1997; 20:634-44.
- Waagen G, Strang V. Origin and development of traditional chiropractic philosophy. In: Haldeman S,

editor. Principles and practice of chiropractic. 2nd ed. Norwalk: Appleton & Lange;1992. p.29-43.
- Practice guidelines for straight chiropractic. Proceedings of the International Straight Chiropractic Consensus Conference. Chandler (AZ): World Chiropractic Alliance; 1992. p.98.
- Kale Clinic & Research Center. Houston control (patient pamphlet). Spartanburg: South Carolina; 1993.
- Seaman D. Proprioceptor: an obsolete, inaccurate word. J Manipulative Physiol Ther 1997; 20:279-84.
- Seaman D. Letter to the editor. Top Clin Chiropr 1997; 4(1)
- Cramer G, Darby S. Letter to the editor. Top Clin Chiropr 1997;4(1):viii-xi.
- Deafferentation. Dorland's Medical Dictionary. 25th ed. Philadelphia: WB Saunders; 1974. p.409.
- Burchiel K. Deafferentation syndromes and dorsal root entry zone lesions. In: Fields H, editor. Pain syndromes in neurology. Boston: Butterworth-Heinemann; 1990. p.201-22.
- Fields H. Pain. New York: McGraw-Hill; 1987.
- Tasker R. Management of nociceptive, deafferentation and central pain by surgical intervention. In: Fields H, editor. Pain syndrome in neurology. Boston: Butterworth-Heinemann; 1990. p.143-200.
- Guyton A. Basic neuroscience. 2nd ed. Philadelphia: WB Saunders; 1991.
- Martin J, Jessell T. Modality coding in the somatic sensory system. In: Kandel E, Schwartz J, Jessell T, eds. Principles of neural science. 3rd ed. New York: Elsevier; 1991. p.341-52.
- Willis W, Coggeshall R. Sensory mechanisms of the spinal cord. 2nd ed. New York: Plenum Press; 1991.
- Schaible H, Schmidt R. Direct observation of the sensitization of articular afferents during an experimental arthritis. In: Dubner R, Gebhart G, Bond M, editors. Proceedings of the Fifth World Congress on Pain: 1987 Aug 2-7; Hamburg, Germany. New York: Elsevier; 1988. p.44-SO.
- Guilbaud G. Peripheral and central electrophysiological mechanisms of joint muscle pain. In: Dubner R, Gebhart G, Bond M, editors. Proceedings of the Fifth World Congress on Pain; 1987 Aug 2-7; Hamburg, Germany. New York: Elsevier; 1988. p. 201-15.
- Hanesch U, Heppelmann B, Messlinger K, Schmidt R. Noci-ception in normal and arthritic joints: structural and functional aspects. In: Willis W, editor. Hyperalgesia and allodynia. New York: Raven Press; 1992. p.81-106.
- Schaible H, Grubb B. Afferent and spinal mechanisms of joint pain. Pain 1993; 55:5-54.
- Schmidt R, Schaible H Messlinger K. Heppelmann B, Hanesch U, Pawlak M. Silent and active nociceptors: structure, functions, and clinical implications. In: Gebhart G, Hammond T, Jensen T, editors. Proceedings of the 7th World Congress on Pain:
- Progress in Pain Research and Management; 1993; Paris, France. Seattle: IASP Press; 1994. p.213-SO.
- Hooshmand H. Chronic pain: reflex sympathetic dystrophy, prevention and management. Boca Raton (FL): CRC Press; 1993. p.33-55.
- Jozsa L, Balint J, Kannus P, Jarvinen M, Lehto M. Mechanoreceptors in human myotendinous junction. Muscle Nerve 1993; 16:453-7.
- Lephart S. Reestablishing proprioception, kinesthesia, joint p0sition sense, and neuromuscular control in rehabilitation. In: Prentice W, ed. Rehabilitation techniques in sports medicine. 2nd ed. St. Louis: Mosby; 1994. p.118-37.
- Parkhurst T, Burnett C. Injury and proprioception in the lower back. J Orthop Sports Phys Ther 1994; 19:282-95.
- Slosberg M. Effects of altered afferent input on sensation, proprioception, muscle tone and sympathetic reflex response. J Manipulative Physiol Ther 1988; 11:400-8.
- Jones M, Christensen N, Carr J. Clinical reasoning in orthopedic manual therapy. In: Grant R, editor. Physical therapy of cervical and thoracic spine. 2nd ed. New York: Churchill-Livingstone; 1994. p.89-108.
- Peterson D. Principles of adjustive technique. In: Bergmann T, Peterson D, Lawrence D, editors. Chiropractic technique. New York: Churchill-Livingstone; 1993. p.123-95.
- Peterson D, Bergrnann T. Joint assessment principles and procedures. In: Bergmann T, Peterson D, Lawrence D, editors. Chiropractic technique. New York: Churchill Livingstone; 1993. p.51-121.
- Henderson C. Three neurophysiologic theories on the chiropractic subluxation. In: Gatterman M, editor. Foundations of chiropractic-subluxation. St. Louis: Mosby; 1995. p.225-33.
- Murphy D. The locomotor system: Korr's "primary machinery of life." J Manipulative Physiol Ther 1994; 17:562-4.
- Denslow J, Hassett C. The central excitatory state associated with postural abnormalities. J Neurophysiol 1942; 5:393-402.
- Korr I. The neural basis of the osteopathic lesion. J Am Osteopath Assoc 1947; 47:191-7.
- Patterson M. A model mechanism for spinal segmental facilitation. J Am Osteopath Assoc 1976; 76:62-72.
- Miller B, Keane C, editors. Encyclopedia and dictionary of medicine, nursing and allied health. Philadelphia: WB Saunders; 1987. p.383-8.
- Bogduk N. Innervation patterns of the cervical spine. In: Grant R, editor. Physical therapy of the cervical and thoracic spine. 2nd ed. New York: Churchill-Livingstone; 1994. p.65-76.
- Bogduk N, Valencia F. Innervation patterns of the thoracic spine. In: Grant R, editor. Physical therapy of the cervical and thoracic spine. 2nd ed. New York: Churchill-Livingstone; 1994. p.77-87.
- Bogduk N. Innervation, pain patterns, and mechanisms of pain production. In: Twomey L, Taylor J, editors. Physical therapy of the low back. 2nd ed. New York: Churchill-Livingstone; 1994. p.93-109.
- Charman R. Pain and nociception: mechanisms and modulation in sensory context. In: Boyling J, Palastanga N, editors. Grieve's modern manual therapy: the vertebral column. 2nd ed. New York:

Churchill-Livingstone; 1994. p.253-70.
- Grieve G. Common vertebral joint problems. 2nd ed. New York: Churchill-Livingstone; 1988. p.51-2.
- Haldeman S. The neurophysiology of pain. In: Haldeman S, editor. Principles and practice of chiropractic. 2nd ed. Norwalk (CT): Appleton-Century-Crofts; 1992. p.165-84.
- Wyke B. The neurological basis of thoracic pain. Rheumatol Phys Med 1970; 10:356-67.
- Wyke B. Neurological aspects of pain therapy. In: Swerdlow M, editor. The therapy of pain. Philadelphia: JB Lippincott; 1980. p.1-30.
- Price D. Psychological and neural mechanisms of pain. New York: Raven Press; 1988. p.76-99.
- McMahon S, Koltzenburg M. Novel classes of nociceptors: beyond Sherrington. Trends Neurosci 1990; 13:199-201.
- Bonica J. Anatomic and physiologic basis of nociception and pain. In: Bonica J, editor. Management of pain. 2nd ed. Philadelphia: Lea & Febiger; 1990. p.28-94.
- Bonica J. Definitions and taxonomy of pain. In: Bonica J, editor. The management of pain. 2nd ed. Philadelphia: Lea & Febiger; 1990. p.18-27.
- Maciewicz R. Organization of pain pathways. In: Ashbury A, McKhann G, McDonald W, editors. Diseases of the nervous system: clinical neurobiology. Philadelphia: WB Saunders; 1992. p.849-57
- Casey K. Nociceptors and their sensitization: overview. In: Willis W, editor. Hyperalgesia and allodynia. New York: Raven Press; 1992. p.13-S.
- Randwerker H, Peeh P. Nociceptors: chemosensitivity and sensitization by chemical agents. In: Willis W, editor. Hyperalgesia and allodynia. New York: Raven Press; 1992. p.107-iS.
- Steen KH, Reeh PW, Anton F, Handwerker HO. Protons selectively induce lasting excitation and sensitization to mechanical stimulation of nociceptors in rat skin, *in vitro.* J Neurosci 1992; 12:86-95.
- Campbell J, Meyer R, Davis K, Raja S. Sympathetically maintained pain: a unifying hypothesis. In: Willis W, editor. Hyperalgesia and allodynia. New York: Raven Press; 1992. p.141-9.
- Levine J, Coderre T, Basbaum A. The peripheral nervous system and the inflammatory process. In: Dubner R, Gebhart 0, Bond M, editors. Proceedings of the Fifth World Congress on Pain; 1987 Aug 2-7; Hamburg, Germany. New York: Elsevier; 1987. p.33-43.
- Levine J, Taiwo Y, Heller P. Hyperalgesic pain: inflammatory and neuropathic. In: Willis W, editor. Hyperalgesia and allodynia. New York: Raven Press; 1992. p.117-23.
- Rang H, Bevan S, Dray A. Chemical activation of nociceptive peripheral neurones. Br Med Bull 1991; 47:534-48.
- Reeh P. Chemical excitation and sensitization of nociceptors. In: Urban L, editor. Cellular mechanisms of sensory processing. Berlin: Springer-Verlag; 1994. p.119-31.
- Dubner R. Spinal cord neuronal plasticity: mechanisms of persistent pain following tissue damage and nerve injury. In: Vecchiet D, Albe-Fessard D, Lindbolm U, Giamberardino M, editors. New trends in referred pain and hyperalgesia. New York: Elsevier; 1993. p.109-17.
- Coderre T, Katz J, Vaccarino A, Melzack R. Contribution of central neuroplasticity to pathological pain: review of clinical and experimental evidence. Pain 1993; 52:259-85.
- Light A. The initial processing of pain and its descending control: spinal and trigeminal systems. New York: Karger; 1992. p.28.
- Woolf C. Physiological, inflammatory and neuropathic pain. Adv Tech Stand Neurosurg 1987; 15:39-62.
- Denslow 1, Korr I, Krems A. Quantitative studies of chronic facilitation in human motoneurons. Am J Physiol 1947; 150: 229-38.
- Patterson M. The spinal cord: participant in disorder. Spinal Manipulation 1993; 9(3):2-11.
- Korr I. Symposium on the functional implications of segmental facilitation: a research report. J Am Osteopath Assoc 1955; 54:265-82.
- Korr I. The facilitated segment: a factor in injury to the body framework. Osteopath Ann 1973; 1:10-12, 17-18.
- Korr I. Andrew Taylor Still memorial lecture: research and practice-a century later. J Am Osteopath Assoc 1974; 73:362-70.
- Korr I. Proprioceptors and somatic dysfunction. I Am Osteopath Assoc 1975; 74:638-50.
- Korr I. Sustained sympathicotonia as a factor in disease. In: Korr I, editor. The neurobiologic mechanisms in manipulative therapy. New York: Plenum Press; 1978. p.229-68.
- Korr I. Somatic dysfunction, osteopathic manipulative treatment, and the nervous system: a few facts, some theories, many questions. I Am Osteopath Assoc 1986; 86:109-14.
- Korr I. Osteopathic research: the needed paradigm shift. I Am Osteopath Assoc 1991; 91:156-71.
- Woolf C. Evidence for a central component of post-injury pain hypersensitivity. Nature 1983; 306:686-8.
- Dubner R. Neuronal plasticity in the spinal and medullary dorsal horns: a possible role in central pain mechanisms. In: Casey K. Pain and central nervous system disease: the central pain syndromes. New York: Raven Press; 1991. p.143-55.
- Dubner R, Ruda M. Activity-dependent neuronal plasticity following tissue injury and inflammation. Trends Neurosci 1992; 15:96-103.
- Dubner R, Basbaum A. Spinal cord plasticity following tissue or nerve injury. In: Wall R, Melzack R, editors. Textbook of pain. 3rd ed. New York: Churchill-Livingstone; 1994. p.225-41.
- Hoheisel U, Mense S. Long-term changes in discharge behavior of cat dorsal horn neurones following noxious stimulation of deep tissues. Pain 1989; 36:239-47.

- Ren K, Rylden 3, Williams G, Ruda M, Dubner R. The effects of a non-competitive NMDA receptor antagonist, MK-801, on behavioral hyperalgesia and dorsal horn neuronal activity in rats with unilateral inflammation. Pain 1992; 50:331-44.
- Richmond C, Bromley L, Woolf C. Preoperative morphine pre-empts postoperative pain. Lancet 1993; 342:73-5.
- Roberts W. A hypothesis on the physiological basis for causalgia and related pains. Pain 1986; 24:297-311.
- Wall P, Woolf C. Muscle but not cutaneous C-afferent input produces prolonged increases in the excitability of the flexion reflex in the rat. I Physiol 1984; 356:443-58.
- Woolf C. Long term alterations in the excitability of the flexion reflex produced by peripheral tissue injury in the chronic decerebrate rat. Pain 1984; 18:325-43.
- Woolf C. Generation of acute pain: central mechanisms. Br Med Bull 1991; 47:523-33.
- Woolf C. Excitability changes in central neurons following peripheral damage: role of central sensitization in the pathogenesis of pain. In: Willis W, editor. Hyperalgesia and allodynia. New York: Raven Press; 1992. p.221-243.
- Woolf C. The dorsal horn: state-dependent sensory processing and the generation of pain. In: Wall P, Melzack R, editors. The textbook of pain. 3rd ed. New York: Churchill-Livingstone; 1994. p.101-12.
- Simone D. Neural mechanisms of hyperalgesia. Curr Opin Neurobiol 1992; 2:479-83.
- Gillette R. Spinal cord mechanisms of referred pain and related neuroplasticity. In: Gatterman M, editor. Foundations of chiropractic: subluxation. St. Louis: Mosby; 1995. p.279-301.
- Huttenlocher P. Neural plasticity. In: Ashbury A, McKhann G, McDonald W, editors. Diseases of the nervous system: clinical neurobiology. Philadelphia: WB Saunders; 1992. p.63-71.
- Kandel E. Cellular mechanisms of learning and the biological basis of individually. In: Kandel E, Schwartz I, Jessell T, editors. Principles of neural science. 3rd ed. New York:Elsevier; 1991. p.1009-31.
- Teyler T, Grover L. Forms of long-term potentiation induced by NMDA and non-NMDA receptor activation. In: Baudry M, Thompson R, Davis I, editors. Synaptic plasticity: molecular, cellular aspects. Cambridge (MA): MIT Press; 1993. p.73-86.
- Bonica I. Introduction: semantic, epidemiologic, and educational issues. In: Casey K, editor. Pain and central nervous system disease: the central pain syndromes. New York: Raven Press; 1991. p.13-29.
- Bonica 3. Clinical importance of hyperalgesia. In: Willis W, editor. Hyperalgesia and Allodynia. New York: Raven Press; 1992. p.17-43.
- Berne R, Matthew L. Physiology. 3rd ed. St. Louis: Mosby Year Book; 1993. p.949-79.
- Dilman V, Dean W. The neuroendocrine theory of aging and degenerative disease. Pensacola: The Center for Bio-Gerontology; 1992. p.23-30.
- Feinstein B, Langton I, Iameson R, Schiller F. Experiments on pain referred from deep somatic tissues. I Bone loint Surg Am 1954; 36:981-97.
- Nansel D, Szlazak M. Somatic dysfunction and the phenomenon of visceral disease simulation: a probable explanation for the apparent effectiveness of somatic therapy in patients presumed to be suffering from true visceral disease. I Manipulative Physiol Ther 1995; 18:379-97
- Mendel T, Wink C, Zimny M. Neural elements in human cervical intervertebral discs. Spine 1992; 17:132-5.
- Willis W. Central plastic responses to pain. In: Gebhart G, Hammond D, Iensen T, editors. Proceedings of the 7th World Congress on Pain; 1993; Paris, France. Seattle: IASP Press; 1994. p.301-24.
- De long P, de long I, Cohen B, Jongkees L. Ataxia and nystagmus induced by injection of local anesthetics in the neck. Ann Neurol 1977; 1:240-6.
- Brodal A. Neurological anatomy. 3rd ed. New York: Oxford University Press; 1981.
- Wyke B. Articular neurology and manipulative therapy. In: Glasgow E, Twomey L, Scull E, Kleynhans A, Idczak R, editors. Aspects of manipulative therapy. 2nd ed. New York: Churchill-Livingstone; 1985. p.72-7.
- Gillette R. Potential antinociceptive effects of high level somatic stimulation- chiropractic manipulation therapy may coactivate both tonic and phasic analgesic systems. Some recent evidence. Trans Pac Consortium Res 1986; 1:A4(1)-A4(9).
- Woolf C. Segmental afferent fibre-mediated analgesia: transcutaneous electrical nerve stimulation (TENS) and vibration. In:Wall P, Melzack R, editors. Textbook of pain. 2nd ed. New York: Churchill-Livingstone; 1989. p.884-96.
- Dvorak I, Dvorak V. Manual medicine: diagnostics. 2nd ed. New York: Thieme Medical Publishers; 1990.
- Gordon I. Spinal mechanisms of motor coordination. In: Kandel E, Schwartz I, lessell T. editors. Principles of neural science. 3rd ed. New York: Elsevier; 1991. p.581-95.
- Sato A. Spinal reflex physiology. In: Haldeman S, editor. Principles and practice of chiropractic. 2nd ed. Norwalk (CT): Appleton & Lange; 1992. p.87-103.
- Fitz-Ritson D. The anatomy and physiology of the muscle spindle, and its role in posture and movement: review. ICCA 1982; 26:144-50.
- Richmond F, Bakker D, Stacey M. The sensorium: receptors of neck muscles and joints. In: Peterson B, Richmond F, editors. Control of head movement. New York: Oxford University Press; 1988. p.49-62.
- Bogduk N, Twomey L. Clinical anatomy of the lumbar spine. 2nd ed. New York: Churchill-Livingstone; 1991. p.86.

- Proske U. The golgi tendon organ. In: Dyck P, Thomas P, Griffin I, Low P, Podusko I, editors. Peripheral neuropathy. 3rd ed. Philadelphia: WB Saunders; 1993. p.141-8.
- Masdeu I, Brazis P. The anatomic localization of lesions in the thalamus. In: Brazis P, Masdeu I, Biller I, editors. Localization in clinical neurology. 2nd ed. Boston: Little, Brown and Company; 1990. p.319-43.
- Carpenter M. Core text of neuroanatomy. 4th ed. Baltimore: Williams & Wilkins; 1991. p.224-49.
- Lantz C. The vertebral subluxation complex. ICA Rev Chiropr 1989:37-61.
- Lantz C. The vertebral subluxation complex. In: Gatterman M, editor. Foundations of chiropractic: subluxation. St. Louis: Mosby; 1995. p. 149-74.
- Nolte 3. The human brain. 3rd ed. St. Louis: Mosby; 1993. p. 337-59.
- Ghez C. The cerebellum. In: Kandel E, Schwartz 3, Jessell T, editors. Principles of neural science. 3rd ed. New York: Elsevier; 1991. p. 626-46.
- Brodal P. The central nervous system: structure and function. New York: Oxford University Press; 1992.
- Fitz-Ritson D. Neuroanatomy and neurophysiology of the upper cervical spine. In: Vernon H, editor. Upper cervical spine: chiropractic diagnosis and treatment. Baltimore: Williams & Wilkins; 1988. p.48-85.
- Bakker D, Abrahams V. Central projections from nuchal afferent systems. In: Peterson B, Richmond F, editors. Control of head movement. New York: Oxford University Press; 1988. p. 63-89.
- Maeda M. Neck influences on the vestibulo-ocular reflex arc and the vestibulocerebellum. Prog Brain Res 1979; 50:551-9.
- Janse 3. The integrative purpose and function of the nervous system: a review of classical literature. 3 Manipulative Physiol Ther 1978; 1:182-91.
- Hildingsson C, Wenngren B, Toolanen G. Eye motility after soft-tissue injury of the cervical spine: a controlled, prospective study of 38 patients. Acta Orthop Scand 1993; 64:129-32.
- Fitz-Ritson D. Cervicogenic vertigo. 3 Manipulative Physiol Ther 1991; 14:193-8.
- Lewit K. Manipulative therapy in rehabilitation of the locomotor system. 2nd ed. Boston: Butterworth Heinemann; 1991. p.18.
- Weeks V, Travell 3. Postural vertigo due to trigger areas in the sternocleidomastoid muscle. 3 Pediatr 1957; 47:315-27.
- Gray L. Extra labyrinthine vertigo due to cervical muscle lesions. 3 Laryngol Otol 1956; 70:352-61.
- Wing L, Hargrave-Wilson W. Cervical vertigo. Aust N Z 3 Surg 1974; 44(3):275-7.
- Caranasos G, Israel R. Gait disorders in the elderly. Hosp Pract 1991:67-94.
- Revel M, Andre-Deshays C, Minguet M. Cervicocephalic kinesthetic sensibility in patients with cervical pain. Arch Phys Med Rehabil 1991; 72:288-91.
- Revel M, Minguet M, Gergory P, Vaillant 3, Manuel 3. Changes in cervicocephalic kinesthesia after a proprioceptive rehabilitation program of in patients with neck pain: a randomized controlled study. Arch Phys Med Rehabil 1994; 75:895-9.
- Hulse M. Disequilibrium, caused by a functional disturbance in the upper cervical spine: clinical aspects and differential diagnosis. Man Med 1983; 1:18-22.
- Hinoki M, Ushio N. Lumbomuscular proprioceptive reflexes in body equilibrium. Acta Otolaryngol Suppl (Stockh) 1975; 330: 197-210.
- Watson P. Nonmotor functions of the cerebellum. Psychol Rev 1978; 85:944-67.
- Courchesne E, Yeung-Courchesne R, Press G, Hesselink J, Jernigan T. Hypoplasia of cerebellar vermal lobules VI and VII in autism. N Engl 3 Med 1988; 318:1349-54.
- Gutzmann H, Kuhl K. Emotion control and cerebellar atrophy in senile dementia. Arch Gerontal Geriatr 1987; 6:61-71.
- Lalonde R, Botez M. The cerebellum and learning processes in animals. Brain Res Rev 1990; 15:325-32.
- Heath R. Modulation of emotion with a brain pacemaker. 3 Nerv Ment Dis 1977; 165:30047.Douglas F. The dizzy patient: strategic approach to history, examination, diagnosis, and treatment. Chiropr Technique 1993; 5:5-14.Schimp D. A diagnostic algorithm for the dizzy patient. Chiropr Technique 1994; 6:123-37.

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The Vertebral Subluxation Complex (Part I): An Introduction to the Modeland Kinesiological Component

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INTRODUCTION

The concept of subluxation has been a cornerstone of the theory and practice of chiropractic since its founding by D. D. Palmer [1] in 1895. It is one of the most controversial concepts in health care today, and finds its supporters and critics both within and outside the chiropractic profession. The original concept of the

subluxation was that of a slightly misaligned vertebra, not sufficient to be qualified as a true luxation or dislocation but substantial enough to impinge on the segmental nerves associated with it [1]. While this original concept requires some modification in light of current research findings, there has been a wealth of knowledge accumulated in the past two decades that supports the concept of vertebral subluxations as a real entity [2-9]. It must be stressed that from the contemporary, scientific chiropractic point of view, the subluxation is a dynamic process, involving several tissue levels and integrative components.

Currently, there appears to be a lack of consensus in chiropractic concerning the exact nature of the subluxation [5, 10] and opinions vary widely as to its existence. Although the term subluxation is in wide use in general chiropractic practice, in the scientific community it is generally agreed that the term is much too imprecise. However, common to all definitions currently in use within the chiropractic profession is the notion of a structural and/or functional disrelationship with some form of neurological involvement. What has been missing from the subluxation concept is the substantive evidence to support the idea of dynamic dysfunction.

It has been suggested that the term "Vertebral Subluxation Complex" (VSC) [11] or "Chiropractic Subluxation Complex" [5] be used in place of the simple noun subluxation. Dr. Luedtke, past-president of the ACA, has recently made a strong statement supporting the VSC concept [11]. In this article we support Dr. Luedtke's recommendation, as do other authors [2, 5] as a means of broadening the idea to encompass all possible etiologies and ramifications of the subluxation concept. What is lacking, however is an organizational structure which relates current knowledge and experience to a common central conceptual model of subluxation.

It is the purpose of this article to provide a model of the subluxation which is relevant to the theory and practice of chiropractic and consistent with chiropractic clinical experience. Support for the model and the contribution of the individual components to the overall subluxation behavior has been drawn from the scientific, chiropractic, medical and osteopathic literature.

BACKGROUND

In the initial conception of vertebral subluxation, it was felt that nerve impingement resulting from a subluxated vertebra would "shut off" the vital nerve energy flow from the central nervous system to the periphery. In this regard, the intervertebral foramen (IVF) through which the spinal nerves pass on their way out to the periphery were seen to serve somewhat the function of a gate (not the same as the gates of the Melzak/Wall model of pain [12]) which by physically widening or narrowing would influence the flow of nervous information from the CNS. In these"compression models" of subluxation [2], it is the mechanical compression of the segmental nerves which is believed to interfere with neurological function.

The initial view of the subluxation was supported largely by roentgenological evidence, although most modern chiropractic techniques do not base the definition of subluxation on x-rays. Roentgenological evidence can demonstrate both static

and dynamic malpositioning and is often the basis for a medical diagnosis of subluxation. Because of the medical-chiropractic overlap in the use of x-rays and the use of the word "subluxation", there is often a tendency to restrict the chiropractic interpretation to a medical standard [10]. Subluxation would be categorized medically as an arthrosis [13], a physiological imbalance or joint failure, in which mechanical factors play a role. However, a strictly static, structural interpretation of a vertebral subluxation, i.e. an incomplete or partial dislocation [14], based solely on radiologic evidence of osseous displacement is inconsistent with modern chiropractic concepts, which extend the notion of subluxation beyond strictly positional considerations into all areas relating to mechanics and neurology.

The professional associations in chiropractic have recognized the above problems and have offered definitions aimed at clarification. The International Chiropractor's Association has adopted the following definition of subluxation [15]: "Any alteration of the bio-mechanical and physiological dynamics of the contiguous spinal structures which can cause neuronal disturbances." The American Chiropractic Association definition goes even further: "An aberrant relationship between two adjacent structures that may have functional or pathological sequelae, causing an alteration in the biomechanical and/or neurophysiological reflections of these articular structures, their proximal structures, and/or other body systems that may be directly or indirectly affected by them [16]."

Others suggest doing away with the term "subluxation" entirely, substituting instead names such as the "chiropractic lesion", interarticular dyskinesia [7], spinal articular dysfunction, manipulable lesion [10], chiropractic subluxation complex [5] and vertebral subluxation complex [11]. Terms such as "prespondylosis" [17], "facet syndrome" [18], "cervical syndrome" [9] and "lumbar disc syndrome" [19] attempt to define the same entity in a medical context. The "osteopathic lesion", currently referred to as "somatic dysfunction", represents another aspect of this problem [20] and, like the subluxation, has fallen under sharp criticism from the medical community.

The criterion of neurological involvement is central to the idea of subluxation and is a point of significant controversy. Yet, clinical experience appears to support such a concept; most obviously in the success of chiropractic care in reducing pain in low-back syndrome and sciatica [21]. More subtle manifestations of this phenomenon continue to strike heated controversy, again from within and outside the profession.

However, the central issues of chiropractic and "manual medicine" [3] today concern the specific details of the neurological involvement of subluxation and NOT whether it exists [2-4]. A rather extensive review of the concept of subluxation from a chiropractic standpoint is given by Leach [2] who discusses not only the central role of the neurophysiological component of the subluxation, but also addresses the complexity of the issue in superb detail. The model proposed in the present work is unique in providing an organizational hierarchy which describes the inter- relatedness of the various components in an attempt to place them in proper perspective.

THE VERTEBRAL SUBLUXATION COMPLEX (VSC)

It is widely accepted in chiropractic that a subluxation is not merely a bone out of place; the general consensus being that there must, of necessity, be some sort of neurological involvement. But it would be short-sighted to neglect the contribution of associated muscles, which effect movement; ligaments, which not only hold the bones together, but place certain constraints on their movement; or vascular compromise which can be a major or contributing factor in the pathology and degeneration of spinal articulations. Dishman [7], referring to the chiropractic subluxation complex describes five generalized components as shown in Table 1.

TABLE 1.

Five Component Model of the Chiropractic Subluxation Complex [7]

1) kinesiopathology
2) neuropathology
3) myopathology
4) histopathology
5) biochemical abnormalities

Felicia refers to the same components, attributing their origin to Homewood and Janse [22]. While the five categories of the previous model encompass most of the acknowledged aspects of the chiropractic subluxation, there is need of a more refined development. For example, all components of this model are given equal status, and there is no suggestion of how or to what extent the various components are related. Also, the connective tissue components are not explicitly recognized in this model; instead they are included within the histopathological component [5]. Figure 1 is a schematic representation of the hierarchical organization of the Vertebral Subluxation Complex (VSC) as proposed in this article. In concert with the model proposed by Dishman [7], the VSC is seen as consisting of several major components. The model proposed in this article, however includes several additional components not explicitly stated in the original and reflects the interrelatedness of the various components.

OVERVIEW OF THE VSC MODEL

Kinesiopathology is a functional component which is the end product of the synergistic activity of the various tissue level components. The tissue level components are presented in Figure 1 as supporting structures for kinesiological functions. Bones provide the structural rigidity required for the efficient transmission of forces generated by muscles. Fibrous connective tissue allows the formation of joints which permit movement while the circulatory system nourishes and cleanses the tissues. The nervous system, through its action on the muscles controls movement.

The inflammatory response is a process common to all tissues and is a critical factor in tissue remodeling after injury. Histopathology represents the cellular description of the degenerative process. Each tissue component is recognized by its

own characteristic histology, and degenerative processes are described by their patterns of histopathology. The dorsal root ganglia (DRG), for example, have a unique and distinctive histological appearance. Wallerian degeneration on the other hand is the histopathological description of injured nerve fibers. Descriptions of

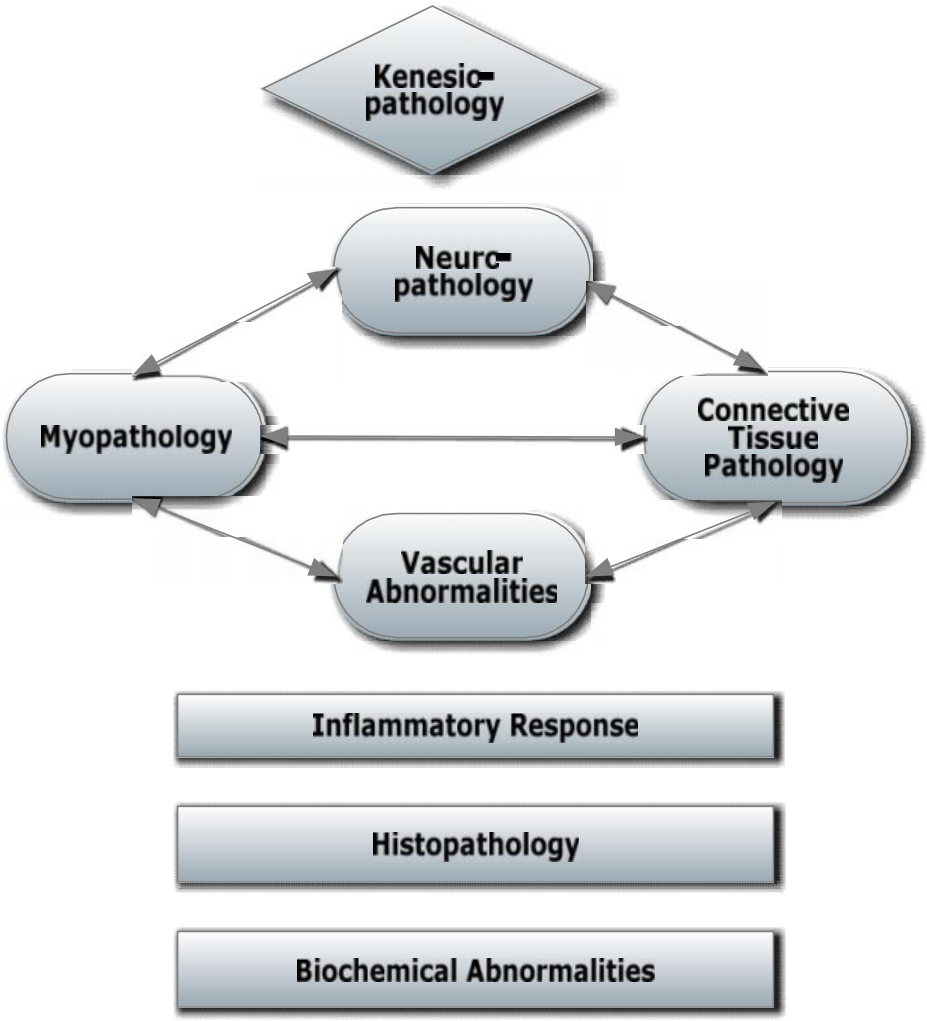


FIGURE 1

nerve degeneration must be included in any complete description of subluxation as should a thorough understanding of normal cellular structure and architecture. In previous descriptions of the VSC, however, the term histopathology has been reserved exclusively for connective tissue.

Biochemistry is fundamental to all life processes and any complete description of subluxations must address biochemical mechanisms. This is found primarily in the biochemical dynamics of connective tissue and the biochemistry of inflammation [23]. Other aspects of biochemistry are involved as well, such as nutrition [24], certain aspects of drug usage [25] and neurohumoral elements such as trophic substances and neurotransmitters [26]. Recent investigations into the effects of

chiropractic adjustments on hormonal responses [27] also bring endocrinological aspects of biochemistry into the realm of chiropractic theory.

Each major component of the VSC will be discussed individually in the remainder of this series in order to establish the concept of subluxations as a dynamic and functional model for the theory and practice of chiropractic. It is not possible, in a brief article such as this, to present an exhaustive description of each of the components of the model. Each is presented in sufficient detail, however, to provide definition and direction for the reader and to allow for integration of the various components into the more generalized model of subluxations.

ELEMENTS OF THE MODEL

KINESIOPATHOLOGY

Kinesiology is the study of human movement, and kinesiopathology would represent any alteration from normal movement. It is a common adage that movement is life, and a corollary of that would be that the lack of movement is death. It is well known that the lack of movement in a joint leads initially to joint stiffness (loss of flexibility) [28, 29], with associated pain [29]. This is followed by degeneration of the joint [6], and ultimate fusion by bony ankylosis [30]. Videman states [31] "All situations that lead to immobilization can cause some degree of degenerative change in the musculoskeletal system. Early mobilization, traction and continuous passive motion overcome the harmful effects of immobilization." The idea that joint restriction or "fixation" is an integral component of subluxations was first proposed by Smith et al. [32]. More recently, the basic concepts of the diagnosis of spinal fixations by motion palpation of the spine were formalized by Gillet [33] and organized by Faye [34] and others into a system of joint palpation called motion palpation of the spine and extremities. This represents but one of many palpation systems used in chiropractic today, including scanning palpation of the cervical spine [35].

In the movement of any joint, there is a range of active physiological motion which is under voluntary control. The passive range of movement adds an additional increment of motion beyond the active range which can be reached only with ssistance, as provided by an examiner or a doctor. At the end of this passive range of motion there exists a resistance to further movement which is referred to as the elastic barrier. It is at this barrier that an examiner begins to experience what is referred to as joint play, a springiness and rebound in the joint movement.

Beyond this barrier is an additional space in which movement can occur, and this is referred to as the paraphysiological space. As described by Sandoz [36] movement into this space is accomplished by the chiropractic adjustment which he defines as: "a passive, manual manoeuvre during which an articular element is suddenly carried beyond the usual, physiological limit of movement without, however, exceeding the boundaries of anatomical integrity. The usual but not obligate characteristic of an adjustment is the thrust which is a brief, sudden and carefully dosed impulsion at the end of the normal passive range of movement and which is

usually accompanied by a cracking noise."

The boundaries of anatomical integrity, referred to by Sandoz, are found at the end of the paraphysiological space. Movement of a joint beyond this barrier will result in sprain, strain and dislocation (luxation) accompanied by stretching and/or tearing of the associated ligamentous and capsular structures.

The above description does not apply to all types of adjustments nor to other less conventional chiropractic procedures, but it does represent a well-defined and widely used procedure in the practice of chiropractic. It should be pointed out here that the delivery of an adjustment is an art which is developed through years of practice. Although the basic mechanics of delivery are simple, the analysis of where and when to deliver an adjustment can be complex and subtle. It should also be pointed out that improper administration of an adjustment can be harmful [37, 38] and in extreme cases, fatal [39].

MOTION SEGMENT

The basic unit of spinal mobility is the motion segment [40], previously known as the spinal motor unit [41], motor segment [42], functional spinal unit [43] or basic spinal unit [44]. The term motor unit was often confused with the neurological motor unit, consisting of a single motor neuron and all muscle fiber bundles innervated by it [45]. The term motion segment avoids this confusion and is recommended whenever the motion of adjacent vertebrae is described. The motion segment consists of two adjacent vertebrae joined by an intervertebral disc (IVD), two posterior articulations and a number of ligaments [44], including capsules, intraspinous ligaments and intertransverse ligaments. Parke [42] also includes the muscles and segmental contents of the vertebral canal and the intervertebral foramen (IVF).

Functionally, the motion segment is viewed as a three-joint complex [46], but may be considered as a single, compound joint with three articulations [18], analogous to the wrist. Limitation of the motion segment to these basic elements is a necessary simplification for biomechanical studies. For chiropractic applications, such as those suggested by the work of Sato and Swenson [47], a broader concept of the spinal unit is needed.

The term Integrated Segmental Unit (ISU) refers to the basic motion segment along with associated spinal structures, such as the segmental nerves, nerve roots and dorsal root ganglion, sinu- vertebral nerves, muscles, and vascular structures, such as the radicular arteries and veins. It would also include meningeal structures, such as the dural funnel, and segmental spinal circuitry and reflex arcs. It must be recognized, too, that regional differences exist in the spine. In the cervical spine, for example, the ISU would include the vertebral arteries, and the joints of Lushka, while in the thoracic spine, it would include the costal articulations, capsules and associated ligaments.

Joint movement is a complicated phenomenon, and more so in the spine than in

any other organ system [48]. In addition to the three planes of physiological movement: flexion/extension, lateral flexion & rotation, there are also long axis traction and joint play, a springiness in the joint when it is taken to tension.

It is difficult to discuss the kinesiology of joints, or kinesiopathology, without considering the role played by ligaments, capsules and muscle/tendon systems. In the spine, the dural sac, along with its contents, may also be considered as structural components that impact on the kinetics of movement [49-50]. The spine is further complicated in its kinesiology in that it responds as an integral unit in which restrictions of movement at one level can lead to compensatory hypermobility in other areas [51-52]. The most succinct statement of this interrelatedness is found in Rothman & Simeone's "The Spine" [42] in which it is stated that no disorder of a single major component of a segmental unit can exist without affecting first the functions of the other components of the same unit and then the functions of other levels of the spine.

As an example, with degeneration of the IVD, paraspinal ligamentous laxity occurs which predisposes the spinal articulations to degeneration [53]. In other situations, spasticity can lead to joint contracture which can, in turn, increase the degree of spasticity and muscle contracture, thereby creating a vicious cycle [54]. To prevent the development of this cycle, it is essential to maintain the full range of motion of all joints [54]. Similarly, immobilization of a joint can lead to contracture [55]. Another related aspect of this problem is the clinical observation that in athletes there is an increased tendency to re-injure extremities that have been previously immobilized due to injury [56].

It has been conclusively shown that when a joint is immobilized it undergoes a degenerative process which ultimately leads to bony ankylosis [57-63]. The extent and progress of degeneration, however, are dependent upon the position in which the joint is immobilized [57, 64, 65]. Whereas most of these observations were made on extremities and on experimental animals, clinical studies suggest the same process occurs in the human spine [36, 76, 77, 52, 66]. Patients with tuberculosis of the spine underwent vertebral fusion by discectomy, thereby effectively eliminating movement between the two vertebrae [67]. Within six months, fusion of the zygapophyseal joints was also observed in these same patients. While this is an extreme example of spinal immobilization, it can be inferred from studies in animals that complete immobilization is not required for the degenerative process to occur [57]. It would appear, in fact, that any alteration of the range of motion of a joint, either restriction or facilitation, is accommodated for by alteration of the structure and composition of the connective tissues of the joint.

The other side of this issue is the restoration of motion to joints which leads to a restoration of normal joint function and physiology. While the degenerative effects of immobilization may be completely reversed upon remobilization [63, 68, 69], the extent of recovery and the time for maximum recovery are dependent upon the duration of immobilization [70]. In extreme cases of immobilization to the point of fibro-fatty consolidation of the synovial fluid, remobilization of the joint will result in the formation of a new joint cleft and articular cartilage with the histological

architecture of an otherwise normal joint [68]. This constitutes some of the strongest evidence available supporting a physiological basis for the effectiveness of chiropractic adjustive procedures. There appears, however, to be a threshold beyond which the degenerative process becomes irreversible, regardless of the cause [71]. Early mobilization in joint trauma is gaining a foot-hold in medical

treatment of whiplash [72] and knee surgery [73], conditions which, in the recent past, were treated with braces and casts. Revitalization of the joint following joint remobilization has been documented in every aspect of joint function and structure [6]. Forced motion causes physical disruption of the adhesions between gross structures, such as capsule to cartilage, and leads to a disruption of the intermolecular crossbridging of collagen [60]. It is presumed that intermolecular crosslinking interferes with joint extensibility by inhibiting free gliding of fibers in the nylon hose weave model of the connective tissue matrix [74]. In contrast to these findings, it has been shown in dogs that irreversible degenerative changes occur in the spinal apophyseal joints within two months of traction immobilization using a Harrington rod [75]. In this study, the animals were allowed free movement and activity after removal of the fixation device, but no form of mobilization or adjustment was administered to them.

It is a far simpler matter to evaluate the ranges of motion of the elbow, shoulder or knee than that of the cervical or lumbar spine, and even more difficult to evaluate the movement between adjacent vertebral segments [48, 52]. In studies of the effect of restriction of joint motion on the integrity of the joint, virtually all research is performed on the extremities [6]. Studies on the spine are few [67, 76, 77] and tend to be more clinical than experimental. Animal research is also grossly lacking in this area [75, 78], but the single study of the effect of internal fixation on the zygapophyseal joints in dogs showed that degeneration occurred within two months of immobilization [75]. The mechanisms involved with the degeneration of spinal articulations are qualitatively similar to those in the more movable joints [79] This suggests that certain conclusions made from extremity studies may, by inference, be extended to spinal joint response.

ANALYSIS OF SPINAL MOTION

Kinesiological studies of the spine are extremely difficult, since restrictions of movement in one area can be compensated for by increased movement [52, 47] or degenerative changes [80] in other areas. Since it is difficult to localize specific joints and measure their precise movement [81], the analysis of dysfunction is further complicated. In the clinical setting, spinal movement has been evaluated by goniometry, which evaluates the gross movement of a region of the spine [82]. For example, flexion and extension of the head can be measured in degrees and restrictions noted based on population averages or the patient's prior response. In this analysis, however, we obtain only regional and indirect information regarding the site at which restriction may be occuring.
X-ray analysis is often used in chiropractic [83] and in medicine [84] to evaluate abnormal spinal movement. While there are inherent limitations to plane x-ray analysis of spinal biomechanical abnormalities [77, 85], it is still widely used for

such purposes. Modern advances in x-ray technology have led to the development of biplanar radiographic analysis of intervertebral motion [52]. While these techniques still suffer the inherent limitations of static x-ray, they do allow a more precise evaluation of changes in vertebral position. Such studies have shown clearly that the facet joints on opposite sides of the motion segment may behave differently in the same patient [52]. Such asymmetric behavior of the components of the motion segment is consistent with the idea that localized, unilateral splinting by the paraspinal musculature may occur.

One of the newest tools in chiropractic for the analysis of movement between two adjacent spinal segments is videofluoroscopy [86]. It can be used in clinical practice as well as in the laboratory to evaluate a motion segment for hypomobility, hypermobility or abnormal motion [87]. In at least one study, positive findings by videofluoroscopy have been correlated with positive clinical findings and corroborated by magnetic resonance imaging [88]. It has also been shown that fluoroscopic procedures can demonstrate abnormal motion in segments when conventional static radiographs failed to do so [89]. While the applications of videofluoroscopy are just gaining momentum in chiropractic, it promises to be an extremely useful procedure for the analysis and evaluation of specific spinal segmental mobility.

Palpation is the most widely used method for the evaluation of spinal motion in chiropractic. As developed by Gillet [33] and presented by Faye [34] it offers the potential for a highly specific and extremely informative analysis system. A skilled palpator can identify specific vertebral levels of involvement [70]. Additionally, left or right sides of the vertebral joint can be evaluated independently [90] and each spinal articulation can be evaluated clinically for movement in six cardinal directions plus joint play [34].

While the system is a highly refined art of motion palpation, it lacks the rigorous evaluation and analysis necessary to make it an objective science. Clinical trials of spinal palpation are often disappointing [90-93], with intra-examiner reliability relatively high and inter-examiner reliability characteristically low. Some studies, however, provide promising results, and even high inter-examiner reliability [94].While this is by no means meant to discount motion or static palpation, it does point out a need for more in-depth research into this clinical phenomenon.

Not all chiropractors use spinal motion as a criterion for patient treatment. Chiropractors who practice upper cervical techniques may use plain x-ray film analysis exclusively for location of the subluxation and the determination of specific techniques required for its reduction. For these practitioners, the kinesiological component of the subluxation complex is less significant clinically than for others who use some form of motion analysis. Although studies by Harrison [95], Suh [96] and Schram and Hosek [85] suggest that the errors inherent in plain radiographic analysis are substantial, the procedures remain prevalent. While this issue continues to strike heated debate within the profession, a critical and objective analysis of the procedures appears to be far from publication. It should be noted,however, that many upper cervical practitioners do use some form of motion

analysis [35]. By and large, it appears that the greater majority of chiropractic practitioners use some form of motion or movement analysis in their evaluation of the patient's need for care.

SUMMARY OF PART I

This article introduces a model of subluxations based on fundamental principles of anatomy, physiology and biochemistry. Building upon the previous 5-component model, the proposed 8-component model of the vertebral subluxation complex

provides a framework in which to discuss the "chiropractic lesion" and to develop a more complete theoretical basis of chiropractic. The basic model (See Figure 1) consists of two functional components (kinesiopathology and the inflammatory response), four tissue- level components (neuropathology, myopathology, connective tissue pathology and vascular abnormalities), a structural component (histopathology) and a biochemical component (biochemical abnormalities). While these represent rather broad categories, the specific aspects of each component which are most relevant to chiropractic theory and practice are discussed. In this first article of the series an overview of the model is presented followed by a description of the kinesiopathological component. The second article will discuss neuropathology and myopathology; the third will present the remainder of the components and the fourth will discuss the relevance of the model and propose several directions for research into chiropractic phenomena.

The central concept of the proposed model is immobilization degeneration; when a joint is immobilized every component of the joint undergoes degeneration. This includes muscle, tendon, cartilage, ligaments, articular capsule and bone, to name a few. These changes are reflected in the Kinesiopathological component of the VSC. The scientific literature supporting this concept is reviewed here. It has also been demonstrated that remobilization of a previously immobilized joint can reverse the degenerative process and restore vitality to the tissues of the joint. This provides some of the strongest evidence supporting the clinical practice of chiropractic.

It is the opinion of this author that the kinesiological component of the VSC is the major clinical focus of chiropractic practice and the target of chiropractic treatment. The treatment procedure, invented and developed to a highly refined state by chiropractic, is the adjustive procedure or adjustment [36]. One type of adjustment can be described as an osseous maneuver in which an articulation is manipulated to its limit of functional mobility, i.e. limit of range of motion. When the joint is appropriately stressed, a thrust of high velocity and low amplitude is delivered into the joint. This is often (but not necessarily always) accompanied by a cracking or popping noise. The primary effect, on the body, of this type of chiropractic adjustment is a restoration of movement to restricted or fixated articulations.

While chiropractors employ other therapeutic modalities as well, it is the adjustive procedure which distinguishes the chiropractic profession from all others. This treatment procedure is implicit in the concept of subluxation, since the subluxation

itself is presumed to be a manipulable lesion. Indeed, chiropractors have developed elaborate systems of adjustive procedures to correct or forestall the development of subluxations.

REFERENCES:

1. Palmer, D. D .The Science, Art and Philosophy of Chiropractic 1910 Portland Printing House, Portland, Oregon
2. Leach, R.A. The Chiropractic Theories. A Synopsis of Scientific Research 2nd Ed. 1986 Williams & Wilkins Baltimore
3. Dvorak , J. & Dvorak, V., Manual Medicine: Diagnostics. 1984, George Thieme Verlag, Pub. Thieme-Stratton Inc., New York
4. Wyke,B. The Neurology of Low Back Pain. In:M.Jayson,Ed. The Lumbar Spine and Low Back Pain. 1980 Pitman Medical Pub., N.Y.
5. Dishman, R.W. Static and Dynamic Components of the Chiropractic Subluxation Complex: A Literature Review. J Manip Physiol Therap 1988; 11(2):98-107
6. Lantz, C.A. Immobilization Degeneration and the Fixation Hypothesis of Chiropractic Subluxation. Chiro Res J 1988; 1:21-46
7. Dishman, R. Review of the Literature Supporting a Scientific Basis for the Chiropractic Subluxation Complex. J Manipul & Physiol Therap, 1985; 8:163-174.
8. Sandoz, R. Newer trends in the pathogenesis of spinal di sorders. Ann Swiss Chiro Assoc 1971; 5:93-180
9. Jackson, R. The Cervical Syndrome. 1977 Charles C. Thomas, Pub., Springfield, Ill.
10. Brantingham, J.W. A Critical Look at the Subluxation Hypothesis. J Manipulative Physiol Ther 1988; 11(2)130-2
11. Luedtke, K.L. Chirorpactic Definition Goes to World Organization. ACA J Chiropractic 1988; 25(6):5
12. Melzak, R. & Wall, P.D Pain mechanisms: a new theory. Science 1965; 150:971
13. Radin, E.L. & Rose, R.M. Role of Subchondral Bone in the Inititation and Progression of Cartilage Damage. Clin Orthop & Related Res, 1986; 213:34-40.
14. Dorland's Medical Dictionary, 24th Ed. 1965, W. B. Saunders Co., Philadelphia
15. ICA Definition of Subluxation Nov. 1987 ICA, 1901 L Stre et, NW, Suite 800, Washington, D. C. 20036
16. Index Synopsis of ACA Policies on Public Health and Related Matters. p 18 American Chiropractic Association, 1701 Clarendon Blvd., Arlington, Virginia 22029
17. Gunn, C.C. ÒPrespondylosisÓ and Some Pain Syndromes Following Denervation Supersensitivity. Spine 1980; 5(2): 185-192
18. Mooney.V & Robertson, J. The Facet Syndrome. Clin Ortho 1976; 115:149-156
19. Paine, K.W.E. & Haung, P.W.H. Lumbar Disc Syndrome. J Neurosurgery, 1972; 37: 75-82.
20. Kimberly, P. Formulating a Prescription for Osteopathic Manipulative Treatment. J Amer Osteopath Assoc 1980; 79(8):506-513
21. Cox, J.M. Low Back Pain: Mechanism, Diagnosis and Treatment. Williams & Wilkins, Eds 1985 Baltimore
22. Felicia, J. Renissance Seminar Notes. 1235 Lake Plaza Drive. Suites 125-130. Colarado Springs, Co. 80906.
23. Narayanan, A., Engel, L. & Page, R. The Effect of Chronic Inflammation on the Composition of Collagen Types in Human Connecti ve Tissue. Collagen Rel Res 1983; 3:323-334
24. Silberberg, R. & Hasler, M. The Effects of Diets Enriched with Corn Oil on the Ultrastructure of Articular Date Chondrocytes. Anat Rec 179:163-188
25. Themann, P., Havemann, U. & Kuschinsky, K. On the Mechanisms of the Development of Tolerance to the Muscular Rigidity Produced by Morphine in Rats. J Exp Pharm 1986, 129:315-321
26. Drachman, D. Trophic Actions of the Neuron: An Introduction. Ann N Y Acad Sci 228:3-5
27. Vernon, H.T., Dhami, M.S., Howley, T.P. & Annett, R. Spinal Manipulation and Beta-Endorphin: A Contrrolled Study of the Effect of Spinal Manipulation on Plasma Beta- Endorphin Levels in Normal Males. J Manipulative Physiol Ther 1986; 9(2):115-123
28. Akeson, W.H. An Experimental Study of Joint Stiffness. J Bone Joint Surg 1961; 43A:1022-1034
29. Hills, W. & Byrd, R. Effects of Immobilization in the Human Forearm. Arch Phys Med Rehab 1973; 54:87-90
30. Enneking, W.F. & Horowitz, M. The Intra-Articular Effects of Immobilization on the Human Knee. J Bone Joint Surg 1972; 54-A:973-985
31. Videman, T. Connective Tissue and Immobilization. Clin Ortho 1987, 221:26-32
32. Smith, O.G., Langworthy, S.M. & Paxson, M.C. Modernized Chiropractic. 1906 La urence Press, Cedar Rapids Missouri.
33. Gillet, H. & Liekens, M. Belgian Chiropractic Research Notes. Motion Palpation Inst., Pub., Huntington Beach, Calif.
34. Faye, J. Motion Palpation Institute Course Notes. 1987 Motion Palpation Instit ute 21541 Surveyor Cir. Huntington Beach Calif.
35. Sweat, R., Robinson, K., Lantz, C., & Weaver, M. Scanning palpation of the cervical spine interexaminer reliability study. Digest Chir Econ 1988; Jan/Feb:14-18
36. Sandoz, R. Some Physical Mech anisms and Effects of Spinal Adjustments. Ann Swiss Chir Assoc 1976; 6:91-141
37. Weintraub, M. Dormant Foramen Magnum Meningioma 'Activated' by Chiropractic Manipulation. N Y State J

Med 1983; July-Aug:1039-1040
38. Horn, S. The ÓLocked-InÓ Sy ndrome Following Chiropractic Manipulation of the Cervical Spine. Annals Emer Med (983; 12(10):648-650
39. Gotlib, A. A Selected Annotated Bibliography of the Core Biomedical Literature Pertaining to Stroke, Cervical Spine, Manipulation and Head/Neck Movement. J Canad Chiro Assoc 1985; 29(2):80-89
40. Nachemson, A.F., Schultz, A.B. & Berkson, M.H. Mechanical Properties of Human Lumbar Spine Motion Segments; Influences of Age, Sex, Disc Level, and Degeneration. Spine 1979; 4(1):1-8
41. D rum, D. The Vertebral Motor Unit and Intervertebral Foramen. In: The Research Stat. of Spinal Manipulative Therapy, M. Goldstein, Ed. U.S. Dept. Health,Ed. & Welfare, NIH Bethesda, MD (1975)
42. Parke, W.W. Applied Anatomy of the Spine. In: Rot hman & Simeone Eds. The Spine. Ch. 2, 1982 W.B. Saunders Co., Philadelphia
43. Kenner, G.H., Precup, J.W., Gabrielson, E.W., Williams, W.S. & Park, J.B. Electrical modification of disuse osteoporosis using constant and pulsed stimulation. In: Electrical Properties of Bone and Cartilage: Experimental Effects and Clinical Applications. C.T. Brighton et al. Eds. 1979 Grune & Stratton, New York, Pub. pp 181-187
44. Roaf, R. A Study of the Mechanics of Spinal Injuries. J Bone Joint Surg 1960; 42B:810-823.
45. Guyton, A. Venous Circulation in: Textbook of Medical Physiology, 6th ed. W.B. Saunders Co. Phila. 1981
46. Farfan, H.J. Biomechanics of the Lumbar Spine. In Kirkaldy-Willis, Ed. Managing Low Back Paine. 1988; Ch 2, 9-21 Churchill-Livingstone, N Y
47. Sato, A. & Swenson, R. Sympathetic Nervous System Response to Mechanical Stress of the Spinal Column in Rats. J Manipulative Physiol Ther 1984; 7(3):141-147
48. Vanderby, R., Daniele, M., Pattwardhan, A. & Bunch, W. A Method for the Identification of In-Vivo Segmental Stiffness Properties of the Spine. J Biomech Engin 1986; 108:312-316
49. Lance, J.& Anthony, M. Neck-Tongue Syndrome on Sudden Turning of the Head. J Neuro Neurosurg Psych 1980; 43:97-101
50. Breig, A. Adverse Mechanical Tension in the Central Nervous System. 1978 John Wiley & Sons, New York
51. Jirout, J, Studies in the Dynamics of the Spine. Acta Radiol 1956; 46:55-60
52. Stokes, I., Wilder, D., Frymoyer, J. & Pope, M. A ssessment of Patients with Low-Back Pain by Biplanar Radiographic Measurement of Intervertebral Motion. Spine 1981; 6/3:233-240
53. Resnick, D. & Niwayama, G. Degenerative Disease of the Spine. In: Resnick, D. & Niwayama, G., eds. Diagnosis of Bon e and Joint Disorders. 1981 W. B. Saunders, Pub., Philadelphia
54. Stauffer, E.S. Rehabilitation of the Spinal Cord-Injured Patient. In: Rothman & Simeone Eds. The Spine. Ch. 19, 1982 W.B. Saunders Co., Philadelphia
55. Noyes, F.R. Funct ional properties of knee ligaments andalterations induced by immobilization: A correlative biomechanical and histological study in primates. Clin Orthop 1977;123:210-242
56. Gamble, J., Edwards, C. & Max, S. Enzymantic Adaptation in Ligaments During Immobilization. Am J Sports Med 1984; 12(3):221-228
57. Thaxter, T.H., Mann, R.A. & Anderson, C.E. Degeneration of Immobilized Knee Joints in Rats. J Bone Joint Surg 1965; 47-A:567-585
58. Davis, D. Respiratory Manifestations of Dorsal Spin e Radiculitis Simulating Cardiac Asthma. Ann Int Med 1950; 32:954-959
59. Troyer, H. The Effect of Short-term Immobilization on the Rabbit Knee Joint Cartilage. Clin Ortho Related Res. 1975; 107:249-257
60. Woo, S.L.-Y., Matthews, J.V., Akes on, W.H., Amiel, D. & Covery, F.R. Connective tissue response to immobility. Correlative study of biomechanical and biochemical measurements of normal and immobilized rabbit knees. Arth Rheum 1975; 18:257
61. Binkley, J.M. & Peat, M. The Ef fects of Immobilization on the Ultrastructure and Mechanical Properties of the Medial Collateral Ligament of Rats. Clin Orthop 1982; 203:301-308
62. Roy S. Ultrastructure of articular cartilage in experimental immobilization. Ann. rheum. Dis. 1970; 29:634
63. Palmoski, M., Pericone, E. & Brandt, K.D. Development and reversal of a proteoglycan aggregation defect in normal canine knee cartilage after immobilization. Arth Rheum 1979; 22:508-517
64. Moskowitz, R. Experimental Models of Degenerative Joint Disease. Seminars Arth Rheum 1972; 1:95-116
65. Morrison, R.I.G., Barrett, A.J., Dingle, J.T. & Prior, D. Cathespins B1 and D action on human cartilage proteoglycans. Biochim Biophys Acta 1973; 302:411-419
66. Lipson, S.J . & Muir, H. Experimental Intervertebral Disc Degeneration. Arthritis Rheumatism 1981; 24:12-21.
67. Tarlov, I.M.: Cysts (perineural) of the spinal roots. Another cause (removable) of sciatic pain. J Amer Med Assoc 1948; 138:740-744.
68. Evans, E.B., Eggers, G.W.N., Butler, J.K. & Blumel, J. Experimental Immobilization and Remobilization of Rat Knee Joints. J Bone Joint Surg 1960; 42-A:737-758.
69. St. Pierre, D. & Gardiner, P. F. The Effect of Immobilization and Exercise on Muscle F unction: A Review. Physiotherapy Canada 1987; 39:24-36.
70. Krusen, F.H. Handbook of Physical Medicine and Rehabilitation. 1971
71. Pita, J.C., Manicourt, D.H., Muller, F.J. & Howell, D.S. Studies on the Potential Reversibility of Osteoarthrit is in Some Experimental Animal Models. In: Articular Cartilage Biochemistry. K. Kuettner et al. Eds. Raven Press, N. Y. 1986, pp 349-363
72. Mealy, K., Brennan, H. & Fenelon, G.C.C. Early Mobilisation of Acute Whiplash Injuries. Brit Med J 1986; 292:656-657

73. Marwah, V., Gadegone, W.M. & Magarkar, D.S. The treatment of fractures of the tibial plateau by skeletal traction and early mobilization. Internat Orthop 1985; 9:217-221
74. Akeson, W., Amiel, D. & Woo, S. Immobility Effects on Synovial Joints. The Pathomechanics of Joint Contracture. Biorheology (1980) 17: 95-110
75. Kahanovitz, N., Arnoczky, S., Levine, D. & Otis, J. The Effects of Internal Fixation on the Articular Cartilage of Unfused Canine Facet Joint Cartilage. Spi ne 1984; 9(3):268-273
76. Lipson, S.J. & Muir, H. Proteoglycans in Experimental Intervertebral Disc Degeneration. Spine 1981; 6(3):194-210
77. Stokes, I. & Frymoyer, J. Segmental Motion and Instability. Spine 1987; 12(7):688-691
78. Deboer, K.F. An Attempt to Induce Vertebral Lesions in Rabbits by Mechanical Irritation. J Manipul Physiol Therap 1981; 4:119-127.
79. Sokoloff, L. & Hough, A.J. Pathology of Osteoarthritis. In: D. J. McCarth Arthrritis and Allied Conditions. A Te xtbook of Rheumatology. Lea & Febiger, Philadelphia, Pub. 1985
80. Taylor, T.K.F., Ghosh, P., Bushell, G.R. & Sutherland, J.M. Disc Metabolism in Scolisis. Zorab, P. A. Ed., 1977, Academic Press, London, 231-246.
81. Vanderby, R, Daniele, M, Patqardhan, A & Bunch, W. A method for the identification of in-vivo segmental stiffness properties of the spine. J Biomech Eng 1986; 108(4):312-6
82. Moll, J. & Wright, V. Measurement of Spinal Movement. In M. Jayson, Ed. The Lumbar Spine & Back Pain 2nd Ed. Chap. 7 1976, 1980 Pitman Medical Pub. Co.
83. Huslig, E.L. & Howe, R.W. Hyperflexion Sprain of the Cervical Spine: A Case Study. J Manipulative Physiol Ther 1986; 9:143-145
84. Monu, J., Bohrer, S.P. & Howard, G. Some Upper Cervical Spine Norms. Spine 1987; 12:515-519
85. Schram, S. & Hosek, R. Error Limitations in X-ray Kinematics of the Spine. J Manip Phys Ther 1982; 5(1):5-10
86. Report of the Quebec Task Force on Spinal Disorders. Spine 1987; 12(7):S1-S23
87. Kottke, F.J. & Mundale, M.O. Range of Mobility of the Cervical Spine. Arch Phys Med Rehab 1959; 40:379-382
88. Shippel, A. & Robinson, G. Radiological and Magnetic Resonance Imaging of Cervical Spine Instability: A Case Report. J Manip Phys Therap 1987; 10(6):316-323
89. Tasharski, C., Heinze, W. & Pugh, J. Dynamic Atlanto-Axial Aberration: A Case Study and Cinefluorographic Approach to Diagnosis. J Manip Phys Ther 1981; 4(2):65-68
90. Mior, S.A., King, R.S., McGregor, M. & Bernar d, M. Intra and Interexaminer Reliability of Motion Palpation in the Cervical Spine. J Canad Chiro Assoc 1985; 29(4):195-198
91. McConnell, D.G., Beal, M.C., Dinnar, U., Goodridge, J.P., Johnston, W.L., Karni, Z., Upledger, J.E. & Blum, G. Low Agreement of Findings in Neuromusculoskeletal Examinations by a Group of Osteopathic Physicians Using their Own Procedures. J Am Osteopath Assoc 1980; 79(7):59-68
92. Wiles, M.R. Reproducibility and Interexaminer Correlation of Motion Palpation Fi ndings of the Sacroiliac Joints. J Canad Chiro Assoc 1980; 24(2): 59-69
93. Russell, R. Diagnostic Palpation of the Spine: A Review of Procedures and Assessment of Their Reliability. J Manip Phys Therap 1983; 6(4):181-183
94. Bell, M.C., Goo dridge,J.P., Johnston, W.L. & McConnell,D.G. Interexaminer Agreement on Patient Improvement after Negotiated Selection of Tests. J Am Osteopath Assoc 1980; 79(7):45-53
95. Harrison, D.D. Chiropractic Biophysics, The Physics of Spinal Correction, Vol. II. (1986) Harrison Chiropractic Seminars, Inc., Sunnyvale, Calif.
96. Suh, C. Biomechanical Aspects of Subluxation. In: The Research Status of Spinal Manipulative Therapy (1975) Murray Goldstein Ed.; Nat'l Inst. of Health, Bethesda, MD

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The VertebralSubluxation Complex (Part II): The Neuropathological and Myopathological Components

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INTRODUCTION:

The concept of subluxation has been a cornerstone of the theory and practice of chiropractic since its founding by D.D. Palmer in 1895. It is one of the most controversial concepts in health care today, and finds its supporters and critics both within and outside the chiropractic profession. The original concept of subluxation was that of a slightly misaligned vertebra, not sufficient to be qualified as a true luxation or dislocation but substantial enough to impinge on the segmental nerves

associated with it. While this original concept requires some modification in light of current research findings, there has been a wealth of knowledge accumulated in the past two decades that supports the concept of vertebral subluxation as a real entity. It must be stressed that, from the contemporary, scientific chiropractic point of view, the subluxation is a dynamic process involving several tissue levels and integrative components.

AUTHOR'S COMMENTS RELATIVE TO THIS SERIES:

Currently, there appears to be a lack of consensus in chiropractic concerning the exact nature of the subluxation and opinions vary widely as to its existence.

Although the term subluxation is in wide use in general chiropractic practice, in the scientific community it is generally agreed that the term is much too imprecise. However, common to all definitions currently in use within the chiropractic profession is the notion of a structural and/or functional disrelationship with some form of neurological involvement. What has been missing from the subluxation concept is the substantive evidence to support the idea of dynamic dysfunction.

It has been suggested that the term "Vertebral Subluxation Concept" (VSC) or "Chiropractic Subluxation Complex" be used in place on the simple noun subluxation. We support this recommendation, as do others, as a means of broadening the idea to encompass all possible etiologies and ramifications of the subluxation concept. What is lacking, however us an organizational structure which relates current knowledge and experience to a common central conceptual model of subluxation.

It is the purpose of these articles to provide a model of the subluxation which is relevant to the theory and practice of chiropractic and consistent with chiropractic clinical experience. Support for the model and the contribution of the individual components to overall subluxation behavior has been drawn from the scientific, chiropractic, medical, and osteopathic literature.

NEUROPATHOLOGY

The neurological component of the Vertebral Subluxation Complex (VSC) is, for many, the cornerstone of chiropractic theory.[1] For those who see beyond the application of chiropractic and other manipulative procedures as merely a means of relieving headache and low back pain, the nervous system is the mediator of vitality and health to the individual organs and tissues. [2] Today, more than ever before, basic scientific and medical research supports this fundamental concept of chiropractic. [3–7]. In chiropractic clinical practice, the prominence of the nervous system is unquestionable. Pain is by far the most significant factor in a patient's seeking chiropractic care. [8] In the diagnostic evaluation, motor function, reflexes, altered sensation and pain responses are primary indicators in the physical examination [9], and are interpreted as clinical indications of neurological function. A weakened muscle or reflex action, for example, is interpreted as a loss of motor function. Spasticity or pain is indicative of neurological excess, that is a facilitation, or hyperactivity of nerve fibers, as due to irritation or inflammation.

It is safe to say that every aspect of the nervous system's organization and function

is relevant to the theory and practice of chiropractic. In this section we shall explore the more pertinent aspects of this relationship. An outline of the nervous sys tem from the chiropractic clinical perspective is given in Table I. Aspects of the neurological structure and function associated with the VSC are outlined in Table II. While it is beyond the scope of this article to deal with every aspect of this outli ne in detail, enough information is will be presented so that the astute reader can not only see the relevance and significance of the nervous system in the subluxation complex, but will also appreciate the many different levels of potential neurological involvement. The interested reader is referred to several excellent reviews on the neurological component of the VSC. [10–13].

TABLE I:

CLINICAL COMPONENTS OF NERVOUS SYSTEM INVOLVEMENT IN THE VERTEBRAL SUBLUXATION COMPLEX

I. Motor
- A. Visceromotor
  - 1. Sympathetic
  - 2. Parasympathetic
- B. Somatomotor
  - 1. Skeletomotor Alpha-motor Neurons
  - 2. Fusimotor Gamma-motor Neurons
- C. Neuroendocrine

II. Sensory
- A. Visceral Afferents
  - 1. Chemoceptors
  - 2. Baroceptors
- B. Proprioception
  - 1. Muscle Spindle Fibers
  - 2. Golgi Tendon Organs
- C. Mechanoreceptors
  - 1. Pacinian Corpuscles
  - 2. Ruffinian End Organs
- D. Special Sensory
  - 1. Vision
  - 2. Vestibular (Balance)

III. Pain
- A. Peripheral
  - 1. Radicular
- B. Spinal
- C. Cerebral
- D. Referred
- E. Ectopic
- F. Vascular
- G. Articular
- H. Phantom

IV. Internuncial Connections
- A. Reflexes
  - 1. Somatovisceral
  - 2. Viscerosomatic
  - 3. Somatosomatic
  - 4. Viscerovisceral
- B. Central Integration
  - 1. Craniocervical Coordination
  - 2. Vestibular Reflexes
  - 3. Visual-cervical Reflexes
- C. Spinal Pathways
  - 1. Descending Pathways
  - 2. Ascending Pathways

TABLE II:

ASPECTS OF NEUROLOGICAL INVOLVEMENT IN THE VERTEBRAL SUBLUXATION COMPLEX

I. Anatomical
- A. CNS
  1. Brain
  2. Brain stem
  3. Cord
     a. Tracks
     b. Zona
     c. Nuclei
  4. Mezinger
     a. Dura

- B. Neurological Organization
  1. Rootlets
  2. Roots
     a. Ventral
     b. Dorsal
     c. Dorsal Root Ganglion
  3. Spinal Nerves
     a. Sinuvertebral Nerve
  4. Primary Rami
     a. Anterior (Ventral)
     b. Posterior (Dorsal) Medial Branch
  5. Terminal Branches

- C. Associated Structures
  1. Intervertebral Canals
  2. Neural Investments

- D. Associated Structures
  1. Anatomical Anomalies

- E. Nerve Structures
  1. Soma
     a. Motor
     b. Sensory
     c. Internuncial
  2. Axons
     a. Myelin
  3. Synapses

II. Physiological
- A. Nerve Conduction
  1. Polarization
  2. Action Potentials
     a. Graded
     b. All-or-None
     c. Saltatory
  3. Axoplasmic Flow
  4. Fiber Diameter

- B. Inflammation
- C. Neuromodulation
  1. Neurohumoral Transmission
     a. Neurotransmitters
     b. Neuroendocrine Hormones
  2. Neurotrophism
     a. Neurochemical
     b. Neurofunctional
  3. Neuroimmunological
     a. Neuroendocrine
     b. Neuroinflammatory

- D. Blood/Nerve Diffusion Barriers
  1. Blood-Brain Barrier
  2. Blood-Nerve Barrier
  3. Blood-Ganglion Barrier
     a. Dorsal Root Ganglia
     b. Cranial Nerve Ganglia
     c. Autonomic Ganglia

III. Biochemical
- A. Neurotransmitter
- B. Nutrition
- C. Pharmacological Considerations
- D. Metabolic Effects

IV. Biomechanical
- A. Compression
- B. Tension/Stretching
- C. Avulsion
- D. Laceration
- E. Connective Tissue0

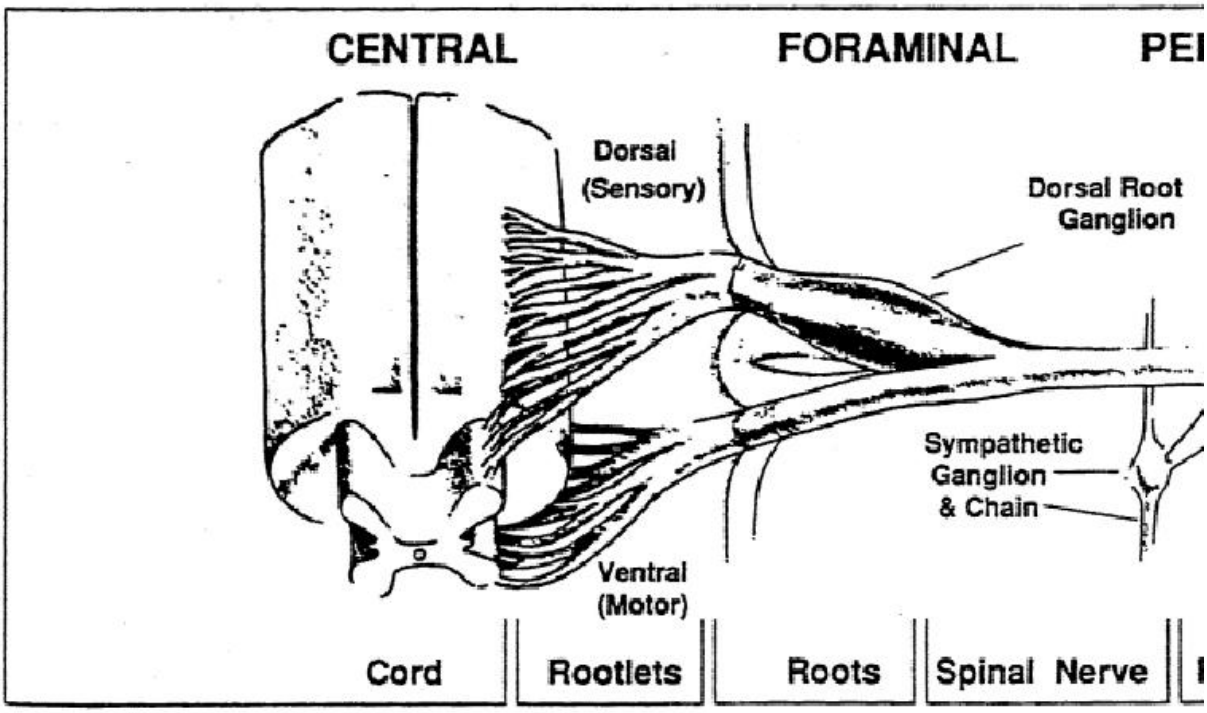
V. Integrative
- A. Neuroendocrine Relations
- B. Neuroimmunological Interactions
- C. Neurovascular Reflexes
- D. Neuroplanchnic Relationships
  1. Somatoautonomic
  2. Viscerosomatic
- E. Neurosomatic
  1. Somatosomatic
- F. Cerviocranial Reflexes
  1. Cervico-occular
  2. Cervico-auditory
  3. Cervico-vestibular

VI. Pathological
- A. Fibrosis
- B. Neuroma
- C. Tumors
- D. Wallerian Degeneration
- E. Infections
- F. Trauma

SPINAL NERVES

The segmental spinal nerve (Fig 1) is an integral component of each vertebral joint, consisting of the spinal zygapophyseal articulations (SZA) and the intervertebral discs (IVD), the pedicles, portions of the vertebral bodies and associated ligaments. It is reasonable to assume, therefore, that degeneration of the spinal articulations would have an effect on the associated spinal nerves. This is commonly recognized in the case of herniated discs which impinge on segmental nerves and roots [**14–15**] as well as spurs and osteophytes around the SZA and the joints of Luschka [**16**]. Nerve impingement due to hypertrophy of the SZA has also been well documented [**16**].

Figure 1.



Chiropractic has unequivocally established itself as preeminent in caring for such cases [17–20]. Not all patients who benefit from chiropractic, however, suffer from herniated discs, nor, do all patients with herniated discs suffer with clinical symptoms [21–23]. While cases of herniated discs provide dramatic evidence of the effectiveness of chiropractic treatment programs [24], we must search for more general mechanisms to explain the positive results obtained by chiropractic care. Chiropractic has also shown its value in treatment of facet syndrome [25], cervical syndrome [26], whiplash syndrome [27], cervical trauma [28] and the chiropractic subluxation complex [29], referred to medically as joint dysfunction and osteopathological as "somatic dysfunction" or "segmental dysfunction". Chiropractic has shown its effectiveness in treating infantile colic [30] hyperactivity [31] and may even be effective in the management of sudden cardiac death syndrome or

other cardiac related conditions [32] and headache [33].

DORSAL ROOT GANGLIA

The integral relationship between the spinal joints and the dorsal root ganglia

(DRG) necessitates that we evaluate the role these structures play in the VSC. An extensive review of this information was provided by Lantz [34], and several other excellent reviews describe more basic aspects of the structure and function of the DRG [35–36]. With the exception of the first two spinal nerves, all DRG lie within the intervertebral canals (IVC), in intimate association with the articular capsule of the SZA. The DRG contain the cell bodies of all sensory neurons, except for those found in the cranial nerves. Their location between adjacent pairs of vertebrae, makes them key elements in the etiology of subluxations, and the focus of chiropractic adjustive procedures.

It is widely postulated in medical literature that compression of DRG as well as nerve roots and spinal nerves can be the source of pain and discomfort. Compression has been documented as resulting from osseous impingement in the lateral recesses of the lumbar and sacral vertebrae [37], osseous constriction of the vertebral canal [38], protrusion of the IVD [37, 39–40], protrusions of the posterior longitudinal ligament [41], fibrosis and sclerosis of the root sleeve [42], or cystic invasion of the DRG with connective tissue hyperplasia or the meninges [43]. Compression or nerve root inflammation (radiculitis) has been described as giving rise to a spectrum of clinical symptoms including otological manifestations [44], claudication [45], spastic paraplegia [46], respiratory problems simulating cardiac asthma [47], renal pain [48], chest pain simulating coronary occlusion [49] and sexual impotence [50]. While most of the literature addresses the issue of nerve and nerve root compression, it is believed that chronic irritation [51], as is thought to occur with intervertebral subluxation, or traction of the nerve roots or DRG by fibrous adhesions [52] can lead to similar pathological profiles.

The ganglia appear to have no blood-nerve barrier; they are richly vascularized [39], but the permeability of ganglionic capillaries is far greater than those of the CNS or of the peripheral nerve [53]. This greater permeability in the ganglionic capillary bed has been implicated as a route of infection by virus and bacteria alike [54–57] and as a site of chemical irritation and inflammation by blood-borne agents [57]. Any compression or arterial sclerosis which might compromise the arterial supply to, or venous drainage from, the ganglia is likely to promote irritability, as has been described for peripheral nerves [58]. Ischemia is known to lead to hyperexcitability of neural tissue, and would likely have a similar effect in the ganglia.

Invasion of DRG by arachnoidal proliferations has been shown by Tarlov [59] to be a source of the radicular pain of sciatica in a significant portion of patients suffering from this condition. Smith [60] did a comprehensive study of the occurrence of such cyst-like formations in the spines of 100 consecutive cadavers, without regard to clinical manifestations. In 9% of these cases there were grossly observable

cysts. In all cases they were multiple and usually symmetrically distributed. On later evaluation of clinical records, none of the cases of cysts were associated with symptoms of nerve root compression. Tarlov [59] reported that about 17% of his cases of sciatica showed evidence of sacral cysts, but a casual relation was not established in these cases. Rexed [61] found 8 cases out of 13 (53%) had lumbar cysts, but did not address the issue of sacral cysts. The frequency of occurrence of the cysts increases with age.

DRG are far more sensitive to mechanical stimulation than peripheral nerves, and become even more so when inflamed. Howe et al. [62] demonstrate that "minimal acute compression" or chronic irritation of DRG or dorsal roots lead to periods of repetitive firing which last longer than the stimulus itself. Acute compression of peripheral nerves or nerves roots, on the other hand, does not lead to repetitive or prolonged firing. When inflamed, the ganglia become hyperexcitable, and will even give rise to spontaneous discharges [62]. Sharpless [63] reports that the roots are five time more sensitive to compressive forces than are the peripheral nerves. General consensus is that the roots and the peripheral nerves differ little in their responses to uniform radial compression [62], but this does not appear to be true for other types of irritation and stimulation, such as chemicals [64], eccentric compression [63], chronic irritation or mechanical stimulation [62].

When isolated from the periphery by transecting the ventral roots and the spinal nerve distal to the ganglia, the DRG give rise to spontaneous impulses [65]. It is obvious that afferent information can arise from the ganglion and this is almost certainly interpreted and integrated centrally as sensory input. Spontaneous impulses arising from the sensory neurons might play a physiological role in the maintenance of somatic or visceral tone. Aberrant impulses could lead to clinical signs and symptoms, the actual manifestations of which would depend upon the distribution of neurons within the ganglia, the site of existing lesions and the internal state of the tissue, e.g. normal, inflamed, fibrotic, and the projection of the involved neurons into the CNS.

NEUROTRANSMITTERS

It has long been known that nerves release chemicals, called neurotransmitters, at their synaptic termini and that these substances elicit immediate and dramatic effects in the organs supplied by these nerves. Some examples of neurotransmitters and the functions they mediate are acetylcholine, which stimulates muscle contraction, norepinephrine, which controls arterioles muscles and serotonia, which leads to uterine contraction [66].

The release of the same neurotransmitters in other tissues produce differing effects; acetylcholine in the heart suppresses the intrinsic rate of discharge of the heart's pacemaker, and noradrenalin in the lungs leads to bronchodilation following relaxation of the bronchial smooth muscle. Chemical transmitters are involved in the perception of pain as well as light and sound. A knowledge of the chemical ature of nervous function forms the basis of our understanding of the function of the nervous system and must be included in any comprehensive model of

subluxations. It is also the foundation for the use of medicines in the treatment ofnervous disorders. Many medicines work by mimicing or interfering with the function of these chemical messengers.

TROPHIC INFLUENCES

It is unclear, even today, whether trophic influences are due to the release of some chemical substances, to the rates of the electrical discharge of fibers, or to some other aspect of nerve function. [67,69]. Chemicals which perform such functions are called trophic substances, and Acetyl choline is often implicated as a primary

mediator of trophic influences [70–71]. Trophic influences stimulate more subtle responses in tissue than do neurotransmitters. Such responses include altered growth rate, and change in the characteristics of the people [74–75].

It is suggested that proper vitality, morphology and function of the target tissues is dependent on an adequate degree of trophic stimulation [68]. In muscle, for example, exchanging nerves between "white" muscle and "red" muscle led to white muscle transforming to red and vice versa [75]. This line of research gave considerable impetus to the compression models of subluxation [76]. Trophic substances are felt to be synthesized in the cell body and transported to the synapse by axoplasmic transport [77]. Thus, by compressing the nerve and shutting off the flow of these vital supportive substances, one could explain how the tissues might suffer from degeneration for lack of chemical stimulation.

The problem to this concept, however, is that the amount of force required to cut off axoplasmic flow would lead to serious neurological deficit which would far overshadow any subtle trophic changes predicted by compression models of subluxation. It remains to be seen, however, whether chronic irritation might lead to excessive release of trophic substances that could let to tissue hypertrophy or even pathological degeneration. Certainly there is a role for trophic substances in the pathodynamics of subluxations, but exactly what this may be is, at this time, speculative .

A more likely explanation might be altered rate of synthesis and/or transport of chemical mediators due to inflammatory or irritative stresses on the tissues, such as the DRG or the ventral horns of the spinal cord. these machines will be discussed in the section covering the inflammatory responses.

VISCERO-SOMATIC RELATIONSHIPS

Viscero- somatic relationship (VSR) are much more widely recognized, and correspondingly more readily characterized, than either trophic influences or somato-visceral relationships.These are the well known patterns of referred pain [78]. For example, pain associated with heart attack is often felt in the left shoulder and radiating down the left arm. Kidney degeneration will refer pain to the low back while pancreatic degeneration refers pain to the right shoulder. It has been further demonstrated in the osteopathic profession that skilled examiners can palpate

spinal soft tissue changes associated with ischemic heart disease,and even differentiate these changes from those associated with other abnormal heart conditions [78]. While the existence of such reflexes is unquestioned, the mechanism of such responses is completely unknown, and the clinical implications are widely disputed.

SOMATO-VISCERO RELATIONSHIPS

Somato-visceral relationships (SVR) are perhaps the key concept of chiropractic today. The central issue of SVR can be divided into two complementary aspects:

- 1) Can spinal or paraspinal neurological dysfunction lead to viscera degeneration in the organs supplied by the involved nerve? If so, under what conditions and which types of degenerative patterns are involved
- 2) Can chiropractic intervention prevent degeneration of visceral organs and reverse the degenerative process to restore vitality to degenerating tissues?

If so, for what conditions and how effectively? This is perhaps the more controversial issue in chiropractic theory. The evidence, however, tends to support such a concept.

Sato and Swenson [4] have shown that intervertebral movement can lead to sympathetic reflex responses which results in the discharge of adrenal and the renal sympathetic nerve fiber. The neuronal responses in the nerves to this organs was recorded after lateral flexion of a pair of vertebrae. The presumption is that the sensory component in this reflex arc is the proprioceptor population of the spinal ligaments. This follow from similar studies by Sato et al [79] on somato visceral reflexes involving the effect of stimulation of the articular nerve of the cat knee on cardiac sympathetic activity . The sympathetic response observed by Sato and Swenson was correlated in the rat with alterations in heart rate and blood pressure, but changes in the blood levels hormones known to be released from these organs was not investigated in their study. As these authors are quick to point out, the presence of those reflexes does not mean that abnormal stimulation would result in degenerative changes of the end organs: whether they do or not must be shown by experiment and cannot be left to conjecture.

Clinical studies tend to support these observations, however.In a randomized, controlled trial [7] it was shown that chiropractic adjustments were effective in reducing blood pressure in humans. In another human study [6] it was shown that chiropractic adjustment exert a definite influence on pupillary diameter, another visceral response. It has been shown in animals that sympathectomy of one side of the body leads to an increase in the development of tumors on the denervated side [80]. This suggest that interference with the sympathetic nervous system (SNS) can lead to a compromise of the body's immune system [81–82]. Conversely, an immunological response can alter the response pattern of the sympathetic nervous system. [83]

THE NEURODYSTROPHIC HYPOTHESIS

As presented by Leach [76] the neurodystrophic hypothesis proposes that neural dysfunction is stressful to the viscera and other body structures and leads to

"lowered tissue resistance" which can modify the non-specific and specific immune responses and alter the trophic function of the involved nerves. This has often been evoked by chiropractors as a mechanism to explain the positive results obtained in patients suffering from conditions of a more general nature than musculoskeletal pain , such as COPD [84], bronchial asthma, dysmenorrhea and hypertension [85]. Current research provides growing evidence of the presence of a dynamic interaction between the nervous system and the immune system.

In particular, it has been demonstrated that there is an intimate relationship between the SNS and the white blood cells of the immune system. Histological studies have shown that mast cells are innervated directly by sympathetic nerve fibers, and that this relationship appears to serve a regulatory role in immunological response [86]. These observations are consistent with those showing a reduction of norepinephrine in lymphoid tissue following an immunological challenge. [83] The evidence supports the hypothesis that sympathetic innervation exerts and inhibitory effect on the immune system and that changes in tissue levels of norepinephrine can affect immunological responsiveness.

Most of the work relating to neuro-immunological relationships are focused on the sychoneuroendocrine axis [87–88]. It is without question that interference with pituitary and other endocrine function can lead to a compromised immunological response. However, this work does not address the idea that subluxations would exert such an effect. This issue has been addressed in several investigative studies, both directly and indirectly. Chiropractic researchers have shown that spinal adjustments can lead to an increase in immunological response of the patient [89]. One must also consider the work of Sato and Swenson [4] in this regard. Certainly the adrenal gland is involved in the stress response, and the finding that specific spinal intersegmental movement leads to reflex sympathetic input into the adrenal gland and the kidney suggests a fundamental mechanism for chiropractic adjustment in modulating the stress response. We would support the conclusion reached by Leach [76] that there is overwhelming evidence to support the chiropractic neurodystrophic hypothesis. Although a causal connection has not been established, the evidence cited above suggests a plausible link between vertebral lesions (VSC) and immunological competence.

PAIN

The most common clinical characteristic of patients entering chiropractic offices is pain [8]. Due to the largely subjective nature of pain, its evaluation by clinical methods and objective measures is a challenge to clinicians of all professions [90–91]. For the whether or not there are objective clinical findings, and, as in the case of phantom pain[92], regardless of whether or not the body part is present.

There have been numerous theories proposed in the medical profession which attempt to explain pain. [93] One of the more widely discussed of these is the Gate Theory of Pain proposed by Melzak and Wall [94]. In this theory, specific internuncial neurons of the spinal cord control the perception of pain. These interneurons receive input from a large number of sensory (afferent) sources. If

input signals are numerous, then the interneuron becomes unresponsive, thereby shutting the gate of pain sensation. According to Melzak, the transmission of pain sensation through the gate is dependent upon the relative input of large (A-beta) and small (A-delta and C) fibers converging on the gate [93]. This is one of the major mechanisms evoked in modern theories of manipulative therapies [9, 95–96]. These and other ideas of pain and reflex mechanisms have been discussed in relation to chiropractic theory. [3, 11, 12, 97] Still, much research is needed in order to have a more complete understanding of the mechanism of effectiveness of chiropractic adjustments. Pain is known to be a significant aspect of cervical spinal degeneration [56] as well as in the lumbar spine and pelvis [91].

The mechanism for such pain is almost certainly related to mechanical or chemical irritation of the spinal nerves or their roots [56], or specific articular nerves [22,91]. Given the success of chiropractic procedures in reducing such pain, one must explore the role which spinal biomechanical factors play in normal neurological function.

ARTICULAR NEUROLOGY

The field of articular neurology is germane to the theory and practice of chiropractic. Wyke [98] has classified the spinal joint receptors into four groups, Types I-IV; three types of mechanoreceptors and the nociceptor (pain) receptor system. The role that each plays in degenerative processes, and particularly in pain [91], is the subject of intensive reserve. Gillet [10] has proposed that co-activation of the articular receptor system and other somatic receptors constitute a major component of the chiropractic adjustment. It is further known that the SZA are involved in the mechanism of referred pain (somato-somatic reflex), but the neurological mechanisms are not well understood [21–22]. Given the significance of the spinal articulations in chiropractic theory, we cannot minimized the importance of articular neurology in understanding the effectiveness of chiropractic procedures.

The afferent discharges derived from articular mechanoreceptors have a three-fold impact when they center the neuroaxis: 1) Reflexogenic effects: mobilization or manipulation at one level may have an impact on areas remote from the side of motion; 2) Perceptual effects: influence on postural and kinesthetic senses; 3) Pain Suppression: modulation of the pain gate trough changes in mechanoreceptors located in the joint capsules can result in abnormalities of posture and movement (including gait), impairment of postural and kinesthetic sensation [100] and an increase in pain perception [91].

There is a significant correlation between proprioceptive input from the cervical spine and coordination of the extremities [100]. Experimental studies on the knee joint have demonstrated the discharge of afferent fibers following passive movements of the leg [101]. The impulses were particularly prominent when the knee was subjected to noxious movements, such as twisting. It was proposed that this constituted a warning signal which stimulate motor reflex patterns designed to prevent joint damage. Studies performed on cats with inflamed knee joints [102] showed that joint inflammation sensitizes articular nociceptors to fire at rest during

normally non-noxious joint movements. The proportion of neurons displaying resting discharges was higher, the frequency of discharges was higher and the receptive field were larger in the inflamed joints than in normal controls.

Studies in humans [103] showed that distension of the joint capsule of the knee by gradual infusion of plasma into the joint led to reflex weakening of the quadriceps muscles. Injection of saline into the lumbar facets resulted in pain and significant increases in the myoelectric activity of the quadriceps [21]. These responses were abolished by injection of local anesthetic. Traction or passive movement of the posterior elements of the vertebrae or of the limbs with the concomitant stimulation of the mechanoreceptors of the joint capsule, can inhibit nociceptor activity or central integration and can thereby significantly reduce the perception of pain by means of the gating mechanism of presynaptic inhibition [91]. These procedures are known to reduce the patient's need for analgesic drugs, thereby avoiding their undesirable and unpleasant side effects. While these studies demonstrate unequivocally the involvement of joint receptors in the generation of clinical symptoms, much more information is needed to integrate these processes in a comprehensive theory of chiropractic.

MYOPATHOLOGY

As with all of the components, there is considerable interaction between this and other components in the model. It is often difficult to distinguish aberrations in muscle function from neuropathology, and muscle degeneration will almost invariably involve alterations in tendon function. However, special situations arise clinically or can be created experimentally which allow us to differentiate the contribution of muscle to joint pathology as distinguished from other components, such as neurological factors [104–107]. Tendons will be considered here in conjunction with muscle function, but will be discussed elsewhere in this series in the context of connective tissue. Similarly, the connective tissue stroma must be considered as an integral component of muscle, contributing to both structure and function [108], but the treatment of connective tissue elements elsewhere [109] applies with equal strength to the muscle stroma.

DISUSE ATROPHY

It is widely known that joint immobilization leads to muscle atrophy [105,110–111], often referred to as "disuse atrophy" [112]. But the changes that follow immobilization, or joint fixation, differ significantly from those of other disuse models [113–114]. The details of this process have been extensively studied [115], but the precise role that changes in muscle structure and function play in joint degeneration is not well understood. In some cases muscle changes are secondary to immobilization [116], or as a reflex response to painful joints [117], but in turn contribute to joint degeneration [118].

In other instances muscle degeneration or pathology can be primary and might also contribute to joint degeneration. Among these are trauma to muscle, congenital anomalies or diseases which affect muscles, such as polio and muscular dystrophy.

In some situations, it is not possible to discern the role of muscle in joint, especially spinal joint, pathology. In particular, scoliosis poses an enigma. While muscles tend to differ on the concave versus convex sides of the scoliotic curve [119–123], their contribution to the development of the curve is not understood in the vast majority of cases of scoliosis [124]. Muscular changes in idiopathic scoliosis are considered to be secondary, not causal to the spinal deformity [119]. Therapy with TENS units uses stimulation of muscle activity on the convex side of the curve in an attempt to draw the spine back to a more erect posture [125]. Current trends in scoliosis theory lean toward the idea that there is a loss of unilateral regional control of muscle tone or loss of coordination of the righting (postural) response in the spinal musculature [126–127]. Needless to say, any complete theory of vertebral subluxations must include the spinal musculature as an integral component. Virtually every major aspect of muscle structure and function has been evaluated in the context of degenerative changes following immobilization, and a partial list with references is given in Table III.

In studies on immobilization of the knee it has been shown that in the early stages of joint degeneration, restricted joint mobility was due almost exclusively to the muscle/tendon component [128]. Cutting the muscle away restored movement to normal ranges. This was not true of later stages in joint degeneration where joint mobility appears to be restricted due to capsular and ligamentous stricture [129–

130] followed by intra-articular adhesions [131] and ending in bony ankylosis. While the changes in muscle function are often completely reversible [114, 116, 132], the time required for complete restoration of muscle function depends upon the duration of immobilization [114, 116]. These findings are complicated by the different responses to immobilization by different muscle types [112–114, 133–136], as well as by differences in degenerative response related to the position of the joint, and thereby the length of the muscle in the immobilized state [108, 113, 116, 134].

TABLE III

Alterations of Muscle Structure and Function following Immobilization

Aspect	References
Gross Structure	
Weight	[112, 113, 134, 165, 166]
Length	[134]
Volume	[167]
Cross-section	[134, 167]
Morphology	
Sacromere number	[116, 160]
Sacromere length	[116]
Fiber number	[164, 168]

Fiber type	[164]
Fiber cross-section	[136, 166]
Metabolism	
Glycolysis/Krebs	[136, 166]
Glycogen	[132]
Cytochrome activity	[166]
NAD-diaphorase activity	[136]
Protein concentration	[132]
Myoglobin content	[136, 166]
Myosin ATPase	[136]
Protein metabolism	[134]
Daily urinary loss	[165]
Calcium balance	[165]
Protein content	[132, 166]
Lysosome function	[169]
Connective tissue	
Collagen content	
Collagen cross-linkages	[133]
Tendon length	[133]
Collagen organization	[108]
	[159]
Biomechanical properties	
Ultimate tensile strength	
Tangent Modulus	
Maximum strain	[133]
Extensibility	[133]
	[133]
Contractile Properties	[112, 160]
Maximal shortening velocity	
Peak tetanic tension	
Peak twitch tension	[114, 136]
Active twitch tension	[111, 114, 136]
Maximal isometric tension	[112]
Isometric twitch duration	[112, 136]
Contraction time	[132]
Half-relaxation time	[114]
Maximal dynamic strength	[114]
Isokinetic strength	[114]
Isometric strength	[170]
Isometric endurance	[170]
Dynamic endurance	[170]
Passive length-tension curves	[112, 116, 160]
Neurology/Bioelectrical	
Spindle activity	[137-141, 143
Electromyograms	[113, 136]
Sensitivity	[171]
Motor end plates	[135]
Neuromuscular transmission	[135]

MUSCLE SPINDLES

One extremely important aspect of muscle pathophysiology in regard to the VSC is the effect of immobilization on the structural integrity and the response characteristics of the muscle spindles. It has been shown that the spindles exhibit significant morphological changes following neurogenic atrophy. Tower [137] noted different changes in the spindles upon the ventral rhizotomy compared to dorsal root ganglionectomy. Although changes in the spindles following myogenic atrophy are less marked [138], some alterations do occur, particularly a shortening and thickening of the spindle. When a joint is immobilized, the spindles of the associated muscles show histological signs of degeneration within one week [139]; degeneration of the primary spindle endings, swollen capsules and loss of cross striations.

Following immobilization there is also a change in the physiological response pattern of the spindle afferents showing an increased sensitivity to stretch and an elevation in the resting rate of discharge when the muscle is under no tension[140]. This is in contrast to studies showing a decrease in resting spindle activity in tendotomized muscle preparations [141]. When the severed and control muscles were compared under similar tensions, i.e. severance of the control tendon before recording, the activity of the spindles in the tendotomized muscle was also greater than in the control.

One consequence of such an increase in spindle activity in immobilized muscles would be to feed excessive stimuli into the central reflex pathways resulting in altered efferent (output) response. This could lead to the overstimulation of muscle groups which respond to the stretch reflex, leading in the end state to muscle spasm and tender trigger points. This would constitute a positive feed-back loop (i.e. a vicious cycle) which, if unchecked or uncontrolled, could lead to degeneration.

IMMOBILIZATION DEGENERATION

In other studies in joint immobilization, it was postulated that muscle tension might lead to excessive degeneration of cartilage causing compression of the joint surfaces together [118], thereby contributing to the development of osteoarthritis. On the other hand, it has been noted [142] that thickening of the joint capsule is a regular feature of osteoarthritis. A vicious cycle has been described [143] in which muscle spasticity leads to joint contracture, which in turn leads to more spasticity and muscular contracture; the specified treatment for this condition being to return the joints to their full range of motion and maintain that range through the healing stages. Such a degenerative cycle has been described in spinal cord injuries which are accompanied by a cycle of spasticity, joint contracture and muscle contracture [143]. Alternatively, such abnormal input could lead to reflex inhibition of synergistic or antagonistic muscles of failure of joint musculature upon challenge of the joint [144].

It is known that when a joint is immobilized, the effect on muscles depends upon

their length in the immobilized state [145–146] or the angle at which a joint is fixed [105]. Muscles immobilized in the shortened position show a reduction in tension producing capacity, while those which are chronically stretched retain their ability to generate force in direct proportion to changes in cross-sectional area. Changes in muscle dependent upon the length of the muscle during immobilization have been reported for gross morphologic appearance [147] as well as biochemical [148–150] and ultrastructural [151] characteristics. Thus, as with connective tissue discussed below, changes reflect not only the duration and extent of immobilization, but the position of the joint when immobilized.

In immobilization studies on cats [111] it was shown that there is a continually decreasing electrical output from the anterior tibial muscles during immobilization period. The effect was ascribed to both a decrease in voltage of single motor unit potentials and a decrease in the number of motor units responding. In this study it was shown that there were no fibrillation potentials at any time in the course of the study, and evoked potentials had a normal wave form. These observations suggest that the decrease in muscle potential was not due to alterations in the motor nerve or end plate. These authors concluded that the decrease in response potential of the muscle was due to loss of muscle mass with a concomitant reduction of muscle fiber membrane are a and associated ions.

In other studies, it has been shown that there is a reflex stimulation of myoelectric activity of the hamstring muscles when L4-L5 and L5-S1 facet joints were injected with hypertonic saline [143]. This effect was abolished by injection of the facets with xylocaine. In symptomatic patients, depressed deep tendon reflexes could be restored to normal following injection into the spinal articular capsule of local anesthetic. These responses are characteristic of the facet syndrome [143] and are believed to be due to reflex inhibition of the anterior horn cells by noxious stimuli arising from the facet joints. Similar reflex activity of the intrinsic spinal muscles is believed to occur in patients with nerve root involvement, leading to splinting of the involved painful joints in an attempt to reduce their motion. Elsewhere [117], it has been shown that reflex muscle atrophy is a sequel to induced trauma and chronic pain.

In conjunction with the immobilization/degeneration model of vertebral subluxation [109], it has been shown [151] that alteration of the distractive forces applied to the achilles tendon induces extensive cellular and extracellular changes in the musclotendinous junction. Other studies on the effect of mechanical stress on connective tissue morphology have used tendons and support previous observations [152]; the distribution of cell types and architecture of the extracellular matrix depend to a large degree on the type of force applied to the tissue (compressive, distractive, torsional). [153–157] It was noted that adhesions formed in immobilized limbs between the tendon and its sheath, and similar observations have been made in tendotomized animals as a result of surgical procedures [141]. It has also been shown [158] that early mobilization of previously immobilized limbs increased the rate of healing in lacerated flexor tendons. Not only are tendons affected by immobilization, but the connective tissue scaffolding (stroma) of the muscle substance undergoes changes following

immobilization as well [108, 133, 159]. These changes have been associated with a decrease in muscle extensibility [108]. On the other hand, decreased extensibility has also been correlated with a reduction in the number of sarcomeres [160]. In neither case, however, was a causal relationship established.

In contrast to the effects of immobilization on muscle structure and function, denervation leads to significantly greater degeneration of both intra- and extrafusal fibers [161]. This effect is strongly dependent upon the muscle fiber type, with Type IIB being more strongly affected than Type IIA fibers. Passive activity appears to retard the atrophy of the Type II fibers but has little affect on Type I [162]. It thus appears that trophic influence of the nerves exerts a substantial control over the response characteristics of Type IIB muscle fibers, but not Type I fibers. Since the trophic influence of nerves is known to affect muscle morphology and function [75], this aspect of spinal integration must be incorporated into the VSC model.

The spinal musculature has been partially characterized with regard to fiber type [163, 119–123], and have been shown to contain about 75% Type I fibers on the right side and about 67% Type I on the left side [119] of the spine. This is consistent with these muscles serving a postural role, but with movement as an aspect of these muscle's function as well[163]. It has been shown that there is a decrease in Type I fibers on the concave side of the scoliotic curve, consistent with the idea that this side experiences less mobility [164].

It is clear, from the above discussion, that muscle degeneration and alterations of muscle function are integrally related to joint degeneration following immobilization. In the immobilization degeneration model of subluxations, it will be important to further characterize and understand the role of spinal musculature in posture and movement, and the intricate interrelationships between the spinal musculature and the articular system of the spine.

REFERENCES:

1. Palmer DD. The science, art and philosophy of chiropractic. Portland: Portland printing House, 1910.
2. Janse J. Principles and practice of chiropractic. Hildebrandt RW, ed. Lombard IL: National College of Chiropractic, 1976.
3. Korr IM. The collected papers of IM Korr. Colorado Springs, CO: Am Acad Osteopathy, 1979.
4. Sato A, Swenson R. Sympathetic nervous system response to mechanical stress of the spinal column in rats. J Manipulative Physiol Ther 1984; 7(3): 141-147.
5. Vernon HT, Dhami MS, Howley TP, Amnett R. Spinal manipulation and beta-endorphin: A controlled study of the effect of spinal manipulation on plasma beta-endorphin levels in normal males. J Manipulative Physiol Ther 1986; 9(2):115-123.
6. Briggs L., Boone W. Effects of a chiropractic adjustment on changes in pupillary diameter: A model for evaluating somatovisceral response. J Manip Phys Ther 1988; 11(3):181-189.
7. Yates G, Lamping D, Abram N, Wright C. Effects of chiropractic treatment on blood pressure and anxiety: A randomized, controlled trial. J Manip Physiol Ther 1988; 11(106):484-488.
8. Phillips R, Butler R. Survey of chiropractic in Dade County, Florida. J Manip Phys Ther 1982; 5(2):83-89.
9. Mazion, J.M. Illustrated manual of neurological reflexes/signs/tests: Orthopedic signs/tests/maneuvers for office procedure. Arizona City, AZ: J.M. Mazion, Pub., 1980.
10. Gillete R. A speculative argument for the coactivation of diversive somatic receptor populations by forceful chiropractic adjustments. Manual Med 1987;3:1-14.
11. Dishman R. Review of the literature supporting a scientific basis for the chiropractic subluxation complex. J Manipul Physiol Therap 1985; 8:163-174.
12. Slosberg M. Effects of altered afferent articular input on sensation, proprioception, muscle tone and symapthetic reflex responses. J Manip Phys Ther 1988; 11(5):400-408.
13. Gunn C., Milbrandt W. Early and subtle signs in low-back sprain. Spine 1978; 3:267-281.
14. Tay E., Chacha P. Midline prolapse of a lumbar intervertebral disc with compression of the cauda equina. J

Bone Joint Surg 1979; 61B:43-46.
15. Lindblom K, Rexed B. Spinal nerve injury in dorso-lateral protrusions of lumbar discs. J Neurosurg 1948; 5:413-432.
16. Lyon E. Uncovertebral osteophytes and osteochondrosis of the cervical spine. J Bone Joiny Surg 1945; XXVII(2):248-253.
17. Bronfort G. Chiropractic treatment of low back pain: A Prospective Survey. J Manip Phys Ther 1986; 9(2):99-113.
18. Mierau D, Cassidy J, McGregor M, Kirkaldy-Willis W. A comparison of the effectiveness of spinal manipulative therapy for low back pain patients with and without spondylolisthesis. J Manip Phys Ther 1987; 10(2):49-55.
19. Ingis B, Raser B, Penfold B. Chiropractic in New Zealand Report of the commision of inquiry. Wellington, New Zealand: Government Printer, 1979.
20. Johnson MR, Schultz MK, Ferguson AC. A comparison of chiropractic, medical and osteopathic care for work-related sprains and strains. J Manipulative Physiol Ther 1989;12:335-344.
21. Mooney V, Robertson J. The facet syndrome. Clin Ortho 1976; 115:149-156.
22. Shealy C. Facet denervation in the management of back and sciatic pain. Clin Ortho 1976;115:157-164.
23. DeVilliers P, Booysen E. Fibrous spinal stenosis. Clin Ortho 1976; 115:140-144.
24. Cox J. Low back pain: Mechanism, diagnosis and treatment, 4th ed. Baltimore, MD: Williams & Wilkins, 1985.
25. Hourigan CL, Bassett JM. Facet syndrome: Clinical signs, symptoms, diagnosis and treatment. J Manipulative Physiol Ther 1989; 12:293-297.
26. Lenhart JL. Post-traumatic cervical syndrome. J Manipulative Physiol Ther 1988; 11:409-414.
27. Foreman SM, Croft AC. Whiplash injuries: The cervical acceleration/deceleration syndrome. Baltimore:Williams & Wilkins, 1980.
28. Fitz-Ritson D. The chiropractic management and rehabilitations of cervical trauma. J Manipulative Physiol Ther 1990; 12: 17-25.
29. Jarmel ME. Possible role of spinal dysfunction in the genesis of sudden cardiac death. J Manipulative Physiol Ther 1989; 12:469-477.
30. Klougart N, Nilsson N, Jacobsen J. Infantile colic treated chiropractors: A prospective study of 316 cases. J Manipulative Physiol Ther 1989; 12:281-291.
31. Giesen JM, Center DB, Leach RA. An evaluation of chiropractic manipulation as a treatment of hyperactivity in chil- dren. J Manipulative Physiol Ther 1989; 12:353-363.
32. Mennell J. MCM. The validation of the diagnosis "joint dysfunction" in the synovial joints of the cervical spine. J Manip Physiol Therap 1990; 13:7-12.
33. Vernon HT. Spinal manipulation and headaches of cervical origin. J Manipulative Physiol Ther 1989; 12:455-468.
34. Lantz C. The role of dorsal root ganglia in the development of chiropractic subluxations. A chiropractic theory. Proceedings 3rd Annual Current Topics in Chiropractic. 1986; C2 (1)-C2(12).
35. Svaetichin G. Electrophysiological investigations on single ganglion cells. Acta Phys Scand 1951; 24(1085):5-57.
36. Lieberman A. Sensory ganglia. In: The peripheral nerve. Landon D, ed. New York:John Daily and Sons Inc., 1976:188- 278.
37. Epstein JA, Epstein BS, Rosenthal AD, Carras R, Lavine LS. Sciata caused by nerve root entrapment in the lateral recess: The superior facet syndrome. J Neurosurg 1972; 36: 584-589.
38. Epstein J, Epstein B.S., & Lavine L. Nerve root compression associated with narrowing of the lumbar spinal canal. J Neurol Neurosurg Psychiat 1962; 25:165-176.
39. Bergman L., Alexander L. Vascular supply of the spinal ganglia. Arch Neur Psyc 1941; 46:761-782.
40. O'Connel JAE. Protrusions of the lumbar intervertebral discs. A clinical review based on five hundred cases treated by excision of the protrusion. J Bone Joint Surg 1951; 33B: 8-30.
41. Beatty RA, Lugr O, Fix TA. Protrusion of the posterior longitudinal ligament simulating herniated lumbar intervertebral disc. J Neurol Neurosurg Psychiat 1968;31:61-66.
42. Frykholm R. Cervical nerve root compression resulting from disc degeneration and root-sleeve fibrosis. Acta Chiru Scand 1951; suppl 160:1-149.
43. Rexed BA, Wennstrom KG. Arachnoidal proliferation and cystic formation in the spinal nerve-root pouches of man. J Neurosurg 1959; 16:73-84.
44. Chrisman OD, Gervais EF. Otological manifestations of the cervical syndrome. Clin Orthop 1962; 24:34-39.
45. Morris WT. Spinal nerve compression: A cause of claudication. New Zeal Med J 1978; 88:101-103.
46. Heilbrun MP, Davis DO. Spastic paraplegia secondary to cord constriction by the dura. J Neurosurg 1973; 39:645-647.
47. Davis D. Respiratory manifestations of the dorsal spine radiculitis simulating cardiac asthma. Ann Int Med 1950; 32: 954-959.
48. Smith DR, & Raney FL, Jr. Radiculitis distress as a mimic of renal pain. J Urol 1976; 116:269-276.
49. Davis D. Spinal nerve root pain (radiculitis) simulating coronary occlusion: A common syndrome. Am Heart J 1948; 35: 70-80.
50. LaBan MM, Burk RD, Johnson EW. Sexual impotence in men having low-back syndrome. Arch Phys Med Rehab 1966;:715-723.
51. Badalamente M, Ghillani R, Chien P, Daniels K. Mechanical stimulation of dorsal root ganglia induces increased production of substance P: A mechanism for pain following nerve root compromise? Spine 1987; 12(6):552-555.

52. Spencer DL, Irwin GS, Miller JA. Anatomy and significance of fixation of the lumbosacral nerve roots in sciatica. Spine 1983;8:672-679.
53. Brierley JB. The sensory ganglia: Recent anatomical, physiological and pathological contributions. Acta Psych Neur Scand 1955; 30:553-576.
54. Clements GB, Subak-Sharpe JH. Recovery of Herpes Simplex Virus 1 TS mutants from the dorsal root ganglia of mice. Brain Research 1983; 59:203-207.
55. Sato A, Schiable HG, Schmidt RF. Types of afferents from the knee joint evoking sympathetic reflexes in cat interior cardiac nerves. Neurosci Let 1983; 39:71-75.
56. Wakesman BH. Experimental study of diptheric polyneuritis in the rabbit and guinea-pig. III. The blood nerve barrier in the rabbit. J Neuropain Exp Neurol 1961; 20:35-77.
57. Chang LW, Yip RK. Corn oil-induced changes in dorsal root ganglia of rats. Envir Res 1983; 30:50-58.
58.Porter EL, Wharton PS. Irritability of mammalian nerve following ischemia. J Neurophys 1948; 12:109-116.
59. Tarlov IM. Cysts (perineurial) of the sacral roots. J Amer Med Assoc 1948; 138:740-744.
60. Smith D. Cyst formations associated with human spinal nerve roots. J Neurosurg 1961; 18:6545-660.
61. Rexed B. Arachnoidal proliferations with cystic formation in human spinal roots at their entry into the intervertebral foramen. J Neurosurg 1947; 4:414-421.
62. Howe JF, Loeser JD, Calvin WH. Mechanosensitivity of dorsal root ganglia and chronically injuried axons:A phsyiological basis for the radicular pain of nerve root compression. Pain 1977; 3:25-41.
63. Sharpless S. Compression on spinal roots. In: Goldstein M. 10ed. The research status of spinal manipulative therapy. Bethesda, MD: NINCDS #15, 1975.
64. Marshall LL, Trethewie ER, Curtain CC. Chemical radiculitis. A clinical, physiological and immunological study. Clin Ortho Rel Res 1977; 129:61-67.
65. Kirk EJ. Impulses in dorsal spine nerve rootlets in cats and rabbits arising from dorsal root ganglia isolation from the periphery. J Comp Neur 1975; 115:165-175.
66. Goodman LS, Gilman A. The pharmacological basis of therapeutics. 4th Ed. London: The MacMilan Co., Pub., 1970.
67. Salmons S, Sreter FA. Significance of impulse activity in the transformation of skeletal muscle type. Nature 1976; 263:30-34.
68. Drachman DB, ed. Trophic functions of the neuron Ann NY Acad Sci 1974; 228.
69. Davis HL. Trophic action of nerve extract on denervated skeletal muscle IN VIVO: Dose dependency, species specificity, and timing of treatment. Exp Neurol 1983; 80:383-394.
70 Drachman DB. Is acetylcholine the trophic neuromuscular transmitter? Arch Neurol 1967; 17:206-218.
71. Guth L. "Trophic" influences of nerve on muscle. Physiol Rev 1968; 48:645-687.
72. Davis HL, Heinicke EA. Prevention of denervation atrophy in muscle: Mammalian neurotrophic factor is not transferrin. Brain Research 1984; 309:293-298.
73. Davis HL, Kiernan JA. Neurotrophic effects of sciatic nerve extract on denervated extensor digitorum longus muscle in the rat. Exp Neurol 1980; 69:124-134.
74. Close R. Physiology. The effects of cross-union on motor nerves to fast and slow skeletal muscles. J Physiol 1964; 173:831-832.
75. Close R. Dynamic properties pf fast and slow skeletal muscles of the rat after nerve cross-union. J Physiol 1969; 204: 331-346.
76. Leach RA. The chiropractic theories. A synopsis of scientific research. 2nd ed. Baltimore, MD: Williams & Wilkins, 1980.
77. Fernandez H. Inestrosa N. Role of axoplasmic transport in neurotrophic regulation of muscle end plate acetylcholinesterase. Nature 1976; 262:55-56.
78. Nicholas A, DeBias D, Ehrenfeuchter W, et al. Somatic component to myocardial infarction. J AOA 1987; 87(2):123-129.
79. Sato A, Schiable HG, Schmidt RF. Types of afferents from the knee joint evoking sympathetic reflexes in cat inferior cardiac nerves. Neurosci Let 1983; 39:671-75.(80)
80 Coujard R, Heitz F. Cancerologic: Production de tumeurs malignes consecutives a des lesions des fibres sympathiques du nerf sciatique chez le Cobaye. C R Acad Sci 1957; 244: 409-411.
81. Besedovsky H, DelRey A, Sorkin E, DaPrada M, Keller H. Immunoregulation mediated by the sympathetic nervous system. Cellular Immun 1979; 48:346-355.
82. Stein-Werblowsky R. The sympathetic nervous system and cancer. Exper Neuro 1974; 42:97-100.
83. Delrey A, Besedovsky H, Sorkin E, DaPrada M, Arrenbrecht S. Immunoregulation mediated by the sympathetic nervous system, II. Mol Immunol 1981; 63:329-334.
84. Deal MC, Morlock JW. Somatic dysfunction associated with pulmonary disease. J Am Osteo Assoc 1984; 84:179-183.
85. Wiles M, Diakow P. Chiropractic and visceral disease: A brief survey. J CCA 1982; 26(2):65-68.
86. Bienenstock J, Tomioka M., Matsuda H, et al. The role of mastcells in inflammatory processes: Evidence for nerve/mast cell interactions. Int Archs Allergy appl Immun 1987; 82: 238-243.
87.Jankovic B, Markovic B, Spector N. Neuroimmune interactions. Proceedings of the Second International Workshop on Neuroimmunomodulations. Annals NY Acad Sci 1987; 496:1-3.
88. Ader R. Psychneuroimmunology. Academic Press(1981) New York.
89. Vora GS, Bates HA. The effects of spinal manipulation on the immune system (a preliminary report). ACA J Chiro. 1980; 14:S103-S105.(90)

90. Mooney V. Where is the pain coming from? Spine 1987; 12: 754-759.
91. Wyke B. The neurology of low back pain. In: The lumbar spine and back pain. 2nd ed. Jayson M, ed. Pitman Med. Publ. Co. Ltd. 1976, 1980:265-339.
92. Howe J. Phantom limb pain: A reafferentation syndrome. Pain 1983; 15:101-107.
93. Melzak R. The puzzle of pain. New York: Basic Books, Inc., 1973.
94. Melzak R, Wall PD. Pain mechanisms: A new theory. Science 1965; 150:971.
95. Zusman MA. Theoritical basis for the short-term relief of some types of spinal pain with manipulative therapy. Manual Medicene 1987; 3:54-56.
96. Kempson GE, Muir H, Swanson SAV, Freeman MAR. Correlations between stiffness and the chemical constituents of cartilage on the human femoral head. Biochem Biophys Acta 1970; 215: 70-77.
97. Irving R. Pain and the protective reflex generators:Relevance to the chiropractic concept of spinal subluxation. J Manip Phys Ther 1981; 4(2):69-71.
98. Wyke B. The neurology of joints:A review of general principles. Clin Rheum Dis 1981; 7(1):223-239.
99. Lippitt A. The facet joint and its role in spine pain:Management with facet joint injection. Spine 1984; 9(7):746-750.
100. deJong PTVM, deJong JMB, Cohen B, Jogkees LBW. Ataxia and nystagmus induced by injection of local anesthetics in the neck. Ann Neurol 1977; 1:240-246.
101. Schiable H, Schmidt R. Responses of fine medial articular nerve afferents to passive movements of knee joint. J Neurophys 1983; 49(5):1118-1126.
102. DeAndrade J, Grant C, Dixon A. Joint distension and reflex muscle inhibition in the knee. J Bone Joint Surg 1965; 47 (A/2):313-322.
103. Coggeshall R, Hong K, Langford L, Schaible H, Schmidt R. Discharge characteristics of fine medial articular afferents at rest and during passive movements of inflamed knee joints. Brain Research 1983; 272:185-188.
104. Moritani T, DeVries H. Neural factors versus hypertrophy in the time course of muscle strength gain. Am J Phys Med 1979; 58(3):115-130.
105. Tomanek RJ, Lund DD. Degeneration of different types of skeletal muscle fibers II. Immobilization. J Anat 1974;118: 531-541.
106. Tomanek RJ, Lund DD. Degeneration of different types of skeletal muscle fibers I. Denervation. J Anat 1973; 3:395- 407.
107. McLachlan E. Atrophic effects of proximal tendon transection with and without denervation on mouse soleus muscles. Exper Neuro 1983; 81:651-668.
108. Tardieu C, Tabary JC, Tabar C, Tardieu G. Adaptation of connective tissue length to immobilization in the lengthened and shortened positions in cat soleus muscle. J Physiol Paris 1982; 78:214-220.
109. Lantz CA. Immobilization degeneration and the fixation hypothesis of chiropractic subluxation. Chiro Res J 1988; 1:21- 46.
110. Fuglsang-Frederiksen A, Scheel U. Transient decrease in number of motor units after immobilization in man. J Neuro 1978; 41:924-929.
111. Fudema J, Fizzell J, Nelson E. Electromyography of experimentally immobilized skeletal muscles in cats. Am J Physiol 1961; 200:963-967.
112. Witzmann FA, Kim DH, Fitts RH. Hindlimb immobilization: Length-tension and contractile properties of skeletal muscle. J Appl Physiol: Respirat Environ Exercise Physiol 1982; 53(2):335-345.
113. Fournier M, Roy RR, Perham H, Simard CP, Edgerton VR. Is limb immobilization a model of muscle disuse? Experimental Neurology, 1983; 80:147-156.
114. Witzmann FA, Kim DH, Fitts RH. Recovery time course in contractile function of fast and slow skeletal muscle after hindlimb immobilization. J Appl Physiol:Respirat Environ Exercise Physiol 1982; 52(3):677-682.
115. St. Pierre D, Gardiner PF. The effect of immobilization and exercise on muscle function: A review. Physiotherapy Canada 1987; 39:24-36.
116. Tabray JC, Tabray C, Tardieu C, Tardieu G, Goldspink G. Physiological and structural changes in cat soleus muscle due to immobilization at different lengths by plaster casts. J Physiol, 1972; 224:231-244.
117. Hnik P. Holas M, Payne R. Reflex muscle atrophy induced by chronic peripheral nociceptive stimulation. J Physiol Paris 1977; 73:241-250.
118. Thaxter TH, Mann RA, Anderson CE. Degeneration of immobilized knee joints in rats. J Bone Joint Surg 1965; 47A:568.
119. Bylund P, Jansson E, Dahlberg E, Eriksson E. Muscle fiber types in thoracic erector spinae muscle; fiber types in idiopathic and other forms of scoliosis. Clin Ortho Rel Res 1987; 214:222-228.
120. Yarom R, Robin G. Studies on spinal and peripheral muscles from patients with scoliosis. Spine 1979; 4(1):12-21.
121. Zetterberg C, Aniansson A, Grimby G. Morphology of the paravertebral muscles in adolescent idiopathic scoliosis. Spine 1983; 8(5):457-462.
122. Ford DM, Bagnall KM, McFadden KD, Greenhill BJ, Raso VJ. Paraspinal muscle imbalance in adolescent idiopathic scoliosis. Spine 1984; 9(4):373-376.
123. Hosla K, Tredwell SJ, Day B, Shinn SL, Ovalle WK. An ultrastructural study of multifidus muscle in progressive idio- pathic scoliosis. J Neuro Sci 1980; 46:13-31.
124. Cassidy JD, Brandell BR, Nykolation JW, Wedge J. The role of paraspinal muscles in the pathogenesis of idiopathic scoliosis: A preliminary EMG study. J Canad Chiro Assoc 1987; 31:179-184.
125. Axelgaard J, Anders N, Brown JC. Correction of spinal curvatures by transcutaneous electrical muscle

stimulation. Spine 1983; 8(5):463-481.
126. Herman R, Mixon J, Fisher A, Maulucci T, Stuyk J. Idiopathic scoliosis and central nervous system: A motor control problem. Spine 1985; 10:1-14.
127. Shalstrand T, Ortengren R, Nachemson A. Postural equilibrium in adolescent idiopathic scoliosis. Acta Orthop Scand 1978; 49:354.
128. Evans DB, Eggers GWN, Butler JK, Blumel J. Experimental immobilization and remobilization of rat knee joints. J Bone Joint Surg 1960; 42-A:737-758.
129. Enneking WF, Horowitz M. The inra-articular effects of immobilization on the human knee. J Bone Joint Surg 1972; 54-A: 973-985.
130. Peacock EE. Some biochemical and biophysical aspects of joint stiffness: Role of collagen synthesis as opposed to altered molecular bonding. Ann Surg 1966; 164:1-12.
131. Harris RI, MacNab I. Structural changes in lumbar intervertebral discs. Their relationship to low back pain and sciatica. J Bone Jt Surg 1954; 36B(2):304-322.
132. Booth FW, Seider MJ. Recovery of skeletal muscle after 3 mo of hindlimb immobilization in rats. J Appl Physiol: Respirat Environ Exercise Physiol 1979: 47(2):435-439.
133. Kovanen V, Suominen H, Heikkinen E. Mechanical properties of fast and slow skeletal muscle with special reference to collagen and endurance training. J Biomechanics 1984; 17: 725-735.
34. Spector SA, Simard CP, Fournier M, Sternlight E, Edgerton, VR. Archintectural alterations of rat hindlimb skeletal muscles immobilized at different lengths. Experimental Neurology 1982; 76:94-110.
135. Duchen LW, Tonge DA. The effects of tetanus toxin on neuro muscular transmission and on the morphology of motor endplates in slow and fast skeletal muscles of the mouse. J Physiol 1973; 228:157-172.
136. Edgerton VR, Barnard RJ, Peter JB, Maier A, Simpson DR. Properties of immobilized hind-limb muscles of the GALAGO SENEGALENSIS. Experimental Neurology 1975; 46:115-131.
137. Tower SS. Atrophy and degeneration in the muscle spindle. Brain 1932; 55:79-80.
138. Yellin H, Eldred E. Spindle activity of the tendotomized gastrocnemius muscle. Exp Neurol 1970; 29:513-533.
139. Esaki K. Morphological study of muscle spindle in atrophic muscle induced by immobilization. Nagoya Med J 1966; 12: 185-201.
140. Maier A, Eldred E, Edgerton V. The effects of spindles on muscle atrophy and hypertrophy. Exper Neuro 1972; 37: 100-123.
141. Yellin H, Eldred E. Spindle activity of tendotomized gastrocnemius muscle in the cat. Exper Neuro 1970; 29:513-533.
142. Videman T, Michelsson JE, Rauhamaki R, Langenskiold A. Changes in 35 S sulphate uptake in different tissues in the knee and hip regions of rabbits during immobilization, mobilization and the development of osteoarthritis. Acta Orthop Scand 1976; 47:290-298.
143. Stauffer ES. Rehabilitation of the spinal cord-injuried patient. In: Rothman, Simeone, eds. The spine, Philadelphia: W.B. Saunders Co., 1982.
144. Ferrell W, Nade S, Newbold P. The interrelation of neural discharge, intra-articular pressure, and joint angle in the knee of the dog. J Physiol 1986; 373:353-365.
145. Simard C, Spector S, Edgerton V. Contractile properties of rat hind limb muscles immobilized at different lengths. Exper Neuro 1982; 77:467-482.
146. Fournier M, Roy R, Perham H, Simard C, Edgerton V. Is limb immobilization a model of muscle disuse? Exper Neuro 1983; 80:147-156.
147. Ralston HJ, Feinstein B, Inman VT. Rate of atrophy in muscles immobilized at different lengths. Fed Proc 1952; 11:127.
148. Kurakami K. Studies on changes of rabbit skeletal muscle components induced by immobilization with plaster cast. Nagoya Med J 1966; 12:165-184.
149. Maier A, Crockett J, Simpson D, Saubert C, Edgerton V. Properties of immobilized guinea pig hind limb muscles. Am J Phys 1976; 231(5):1520-1526.
150. Rifenberick DH, Gamble JG, Max SR. Response of mitochondiral enzymes to decrease in muscular activity. Am J Physiol 1973; 225:1295-1299.
151. Flint M. Interrelationships of mucopolysaccharide amd collagen in connective tissue remodeling. J Embryol Exp Morph 1972; 27(2):481-495.
152. Merrilees MJ, Flint MH. Ultrastructural study of tension and pressure zones in a rabbit flexor tendon. Amer J Anat 1980; 157:87-106.
153. Boyle AC. Color atlas of rheumatology. Year Book Medical Pub., Chicago 1980.
154. Flint MH, Gillard GC, Merilees MJ. The effects of local physical environmental factors on connective tissue organization and glycosaminoglycan synthesis. In:Fibrous proteins: Scientific, industrial and medical aspects. Parry DAD, Crea- mer LK, eds. London: Academic Press, 1979.
155. Reimann I. Experimental osteoarthritis of the knee in rabbits induced by alterations of the load-bearing. Acta Orthop Scand 1973; 44:496-504.
156. Higuchi M, Abe K, Kaneda K. Changes in the nucleus pulposus of the intervertebral disc in bipedal mice. Clin Orthop Related Res 1983; 175:251-257.
157. Castor CW. Regulation of connective tissue metabolism. In McCarty, D.J. Arthritis and allied conditions, a textbook of rheumatology. Philadelphia: Lea & Febiger, 1985:242-256.
158. Gelberman R, Manske P, Akeson W, Woo S, Lundborg G, Amiel D. Flexor tendon repair. J Ortho Res 1986;

4:119-128. .pa
159. Borg TK, Caulfield JB. Morphology of connective tissue in skeletal muscle. Tissue & Cell 1980; 12(1):197-207.
160. Huet De La Tour E. Tardieu C, Tabary JC, Tabary C. Decrease of muscle extensibility and reduction of sarcomere number in soleus muscle following a local injection of tetanus toxin. J Neuro Sci 1979; 40:123-131.
161. Davis H. Kiernan J. Effect of nerve extract on atrophy of denervated or immobilized muscles. Exper Neuro 1981;72:582- 591.
162. Pachter B, Eberstein A. Effects of passive exercise on neurogenic atrophy in rat skeletal muscle. Exper Neuro 1985; 90:467-470.
163. Johnson MA, Polgar J, Weightman D, Appleton D. Data on the distribution of fibre types in thirty-six human muscles; an autopsy study. J Neuro Sci 1973; 18:111-129.
164. Halkjaer-Kristensen J. Ingemann-Hansen T. Wasting of the human quadriceps muscle after knee ligament injuries. Scan J Rehab Med Suppl 1985; 13:12-20.
165. Musacchia XJ, Deavers DR, Meininger GA, et al. A model for hypokinesia: Effects on muscle atrophy in the rat. J Appl Physiol: Respirat Environ Exercise Physiol 1980; 48(3):479- 486.
166. Booth FW. Time course of muscular atrophy during immobilization of hindlimbs in rats. J Appl Physiol: Respirat Environ Exercise Physiol 1977; 43:656-661.
167. Sargeant AJ, Davies CTM, Edwards RHT, et al. Functional and structural changes after disuse of human muscle. Clin Sci Mol Med 1977; 52:337-342.
168. Cardenas DD, Stolov WC, Hardy R. Muscle fiber number in immobilization atrophy. Arch Phys Med Rehabil 1977; 58:423- 426.
169. Max SR, Mayer RF, Vogelsang L. Lysosmes and disuse atrophy of skeletal muscle. Arch Biochem. Biophysics 1971; 146:227- 232.
170. Halkjaer-Kristensen J, Ingemann-Hansen T. Wasting of the human quadriceps muscle after knee ligament injuries. Scand J Rehab Med Suppl 1985; 13:29-37.
171. Johns TR, Thesleff S. Effects of motor inactivation on the chemical sensitivity of skeletal muscle. Acta Physiol Scand 1961; 51:136-141.

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179)
The Scientific Basis for Maintenance Care in Chiropractic
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The well-debated topic of maintenance or preventative care in chiropractic is generally understood to be the chiropractic management of a patient who presents without a chief complaint for the purpose of optimizing the function of the body through the adjustment of vertebral subluxations.

Understanding the rationale for maintenance care mandates an understanding of two major well documented concepts:
1) immobilization degeneration (ID); and
2) the neurology of pain processing.

If we can agree that a primary component of the chiropractic vertebral subluxation is **hypo**mobility in a spinal joint complex, there is an immense body of research to support the ensuing degenerative process and the logical conclusion of restoring movement. Immobilization degeneration is supported by over 40 years of research. The literature notes a joint that has lost a degree of its normal movement will begin degenerating at a rate measurable within one week of onset. Notable is that this degenerative process is histologically distinct from osteoarthritis and will continue, often painlessly, until significant degeneration has occurred or sudden a significant biomechanical st ress creates an acute injury.

ID alone is substantial enough to argue for the chiropractic care of a patient without back pain, but it is also important to understand why a vertebral subluxation may be present and the patient may remain asymptomatic. Nociceptors are peripheral receptors that depolarize with noxious stimuli. The impulse is carried into the spinal cord and ascends through the lateral spinothalamic tract to the thalamus. Once the signal reaches the thalamus the impulse is sent to three major cortical areas involved in the perception of pain: the postcentral gyrus, the anterior cingulated, and the insula. It is well understood that pain is perceived in the cortex. Three factors influence the perception of pain:

1) the intensity of the stimulus;
2) the duration of the stimulus; and
3) descending inhibition. It is also understood that most nociception never reaches the cortex allowing tissue damage to occur without symptoms.

The spinothalamic tract sends impulses into the hypothalamus and reticular formation(spinoreticular tract) in the brain stem which accounts for more systemic autonomic changes secondary to nociceptor activity which, again, may occur without the perception of pain. This is the same neural mechanism that allows serious disease processes to progress subclinically.

Additionally, nociceptors synapse on excitatory interneurons in the dorsal horn, which fire directly into the intermediolateral cell column resulting in increased firing in postganglionic sympathetic efferents. This is the connection between the musculoskeletal and non-musculoskeletal systems.

REFERENCES:

- Lantz, C. Immobilization degeneration and the fixation hypothesis of chiropractic subluxation. ChiroResearch J, 1988. 1(1): 21-45.
- Krassioukov AV, Weaver LC. Anatomy of the Autonomic Nervous System. Phys Med Rehab-State ofthe Art Reviews; 1996; 10(1):1-14.
- Ghelarducci B, Sebastiani L. Contribution of the cerebellar vermis to cardiovascular control. JAutonomic Nervous System; 1996; 56:149-156.
- Sato A. The reflex effects of spinal somatic nerve stimulation on visceral function. J Musc PhysiolTher; Jan 1992; v15 no1.
- DeBoer, et al. Acute effects of spinal manipulation on gastrointestinal myoelectric activity in conscious rabbits. Manual Med; 1988; v3; pp85-94.
- Nansel D, Szlazak M. Somatic dysfunction and the phenomenon of visceral disease simulation: aprobable explanation for the apparent effectiveness of somatic therapy in patients presumed to be suffering from true visceral disease. J Manip Physiol Ther; 1995; 18(6):379-397.
- Coote JH. Somatic sources of afferent input as factors in aberrant autonomic, sensory and motor function. In: Korr IM, ed. The Neurobiologic Mechanisms in Manipulative Therapy. New York,Plenum Press, 1978:91-127.
- Bienenstock, et al. The role of mast cells in inflammatory processes. Int Arch Allergy and Applied Immunol 1987;82:238-243.
- Grieve G. Common Vertebral Joint Problems, 2d ed. 1988, New York, Churchill Livingstone; pp151-152.
- Price D. Physchological and Neural Mechanisms of Pain 1988; New York, Raven Press; p100.
- Price D. Psychological and Neural Mechanisms of Pain 1988.New York, Raven Press; p86.
- Slosberg M. Effects of altered afferent articular input on sensation, proprioception, muscle tone and sympathetic reflex response. J Musc Physiol Ther 1988; 11:400-408.
- Cabell J. Sympathetically maintained pain, p 141-149 In: Willis W, ed.
- Hyperalgesia and Allodynia. New York, Raven Press; 1992.
- Light A. The Initial Processing of Pain and Its Descending Control: Spinal and Trigeminal Systems. New York, Karger; 1992; p28.

- Dubner R. Neuronal plasticity in the spinal and medullary dorsal horns: A possible role in central pain mechanisms, In: Pain and Central Nervous System Disease: The Central Pain Syndromes; New York, Raven Press; 1991;pp143-155.
- Bennett G. Neuropathic Pain, p201-224, In: Wall and Melzack, Textbook of Pain, 3rd ed., New York, Churchill Livingstone; 1994.
- Wolf C. Physiological, inflammatory and neuropathic pain, Adv Tech Sta nd Neurosurg; 1987;15:39-62.
- Bonica J. Clinical Importance, pp17-43 In: Willis, W. Hyperalgesia and Allodynia. New York, Raven Press; 1992.
- Budgell B, et al. Spinovisceral reflexes evoked by noxious and innocuous stimulation of the lumbar spine. J Neuromusculoskel Syst 1995; 3:122-131.
- Patterson M. The spinal cord: participant in disorder. J Spinal Manip 1993;9(3):2-11.
- Sato A, Sato Y, Schmidt RF. The Impact of Somatosensory Input on Autonomic Functions. Reviews of Physiology, Biochemistry and Pharmacology 1997; vol 130; Springer-Verlag, Berlin and New York, as reviewed in Chapman-Smith D. The Chiropractic Report. May 1997; v11 no3.

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180)

Spine (Phila Pa 1976). 2011 Jan 17. [Epub ahead of print]

Does maintained Spinal manipulation therapy for chronic non-specific low back pain result in better long term outcome?

Senna MK, Machaly SA.

Source

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Abstract

Study Design. A prospective single blinded placebo controlled study was conducted.Objective. to assess the effectiveness of spinal manipulation therapy (SMT) for the management of chronic non-specific low back pain (LBP) and to determine the effectiveness of maintenance SMT in long-term reduction of pain and disability levels associated with chronic low-back conditions after an initial phase of treatments.

Summary of background. SMT is a common treatment option for low back pain. Numerous clinical trials have attempted to evaluate its effectiveness for different subgroups of acute and chronic LBP but the efficacy of maintenance SMT in chronic non-specific LBP has not been studied.

Subjects and Methods. 60 patients with chronic, nonspecific LBP lasting at least 6 months were randomized to receive either (1) 12 treatments of sham SMT over a one-month period, (2) 12 treatments, consisting of SMT over a one-month period, but no treatments for the subsequent nine months, or (3) 12 treatments over a one-month period, along with "maintenance spinal manipulation" every two weeks for the following nine months. To determine any difference among therapies, we measured pain and disability scores, generic health status, and back-specific patient satisfaction at baseline and at 1-month, 4-month, 7-month and 10-month intervals.

Results: Patients in second and third groups experienced significantly lower pain and disability scores than first group at the end of 1-month period (P = 0.0027 and 0.0029 respectively). However, only the third group that was given spinal manipulations during the follow-up period showed more improvement in pain and disability scores at the 10-month evaluation. In the no maintained SMT group,

however, the mean pain and disability scores returned back near to their pretreatment level.
Conclusion. SMT is effective for the treatment of chronic non specific LBP. To obtain long-term benefit, this study suggests maintenance spinal manipulations after the initial intensive manipulative therapy.

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b) Stroke and Chiropractic

181)
Is chiropractic safe?

A number of literature reviews of serious occurrences from chiropractic adjustments have been documented. The most exhaustive study discussed 113 cases of vertebro-basilar accidents following spinal manipulative therapy, from 1934 to 1987, a period of 53 years. Of the cases documented 66 were chiropractic, 18 medical, 9 osteopathic, 2 physical therapist and the remaining 13 were divided between "wife," "self," and "unknown".

Putting these numbers in perspective, there were 66 chiropractic cases in 53 years; a little more than one per year. There are currently about 52,000 chiropractors in practice treating, on average, about 100 patients per week. That works out to 5.2 million adjustments per week or 286 million adjustments per year. This works out to 1 to 2 cases of stroke, paralysis or death per 286 million adjustments. Maigne has stated, "there is probably less than one death of this nature out of several tens-of-millions of manipulations." No matter how one interprets the results, more people die from complications of drugs and surgery in one single afternoon than in decades of cervical adjustments. As a comparison to the risk of manipulation, the risk of paralysis from neurosurgery of the cervical spine is 15,000 cases per million.

Chiropractic: Safer Than Common Pain Medications, Studies Show

Recent news reports on the risks of chiropractic cervical manipulation, or neck adjustments, have needlessly alarmed patients about one of the most safe and effective treatments in health care today, according to the American Chiropractic Association (ACA).

The ACA believes that patients have the right to know about the health risks associated with any type of treatment, including chiropractic. However, health care consumers should be aware that the risks associated with chiropractic treatment are "infinitesimally low," according to Dr. William J. Lauretti, an ACA member and chiropractic researcher from Bethesda, Maryland. "If you drive about a mile to get to your chiropractor's office, you have a statistically greater chance of being seriously injured in a car accident than of being seriously injured during your chiropractic treatment," explains Dr. Lauretti. "The risks of chiropractic have been grossly exaggerated, and health care consumers need to put these sensationalistic news reports into perspective."

Despite statistics from dozens of studies demonstrating the safety of chiropractic treatments, recent news reports have alleged that chiropractic neck adjustments can frequently damage arteries in the neck that carry blood to the brain, possibly leading to a stroke. However, according to a study by the Rand Corporation, a serious adverse reaction from cervical manipulation occurs less than once in 1

million treatments. The study also showed that on the rare occasion of an adverse reaction, it is often the result of the procedure being performed by a health professional (M.D., P.T.) who is inexperienced or inadequately trained in spinal

manipulation, rather than by a licensed doctor of chiropractic. Other scientific textbooks and reports have estimated the risk to be even more minute -- as low as one in 10 million treatments.

During their five-year post-graduate education, doctors of chiropractic are alerted to possible risk factors and taught when to modify their technique or refer a patient for other specialty care. Risk management is also a frequent topic in the continuing education seminars that most states require practicing chiropractors to attend annually.

"Chiropractic researchers have published dozens of studies in recent years that will help chiropractors identify the rare patients who have risk factors," notes Dr. Lauretti. "Studies recently published in the chiropractic literature have found that the risks associated with chiropractic treatments are less than or similar to the risks associated with other conservative treatments often used for similar conditions, such as common prescription and non-prescription medications. Other recently

published and ongoing studies are testing the validity of pre-treatment screening tests, and devising strategies for even further minimizing the risks of chiropractic neck treatments."

When compared to the number of illnesses and deaths that will occur this year from the use of prescription and over-the-counter drugs, the number of serious complications from chiropractic treatment is extremely low. A study published in the April 15, 1998 issue of the Journal of the American Medical Association found that more than 2 million Americans become seriously ill every year from reactions to drugs that were correctly prescribed and taken; 106,000 Americans die annually from those side effects.

Complications from non-steroidal anti-inflammatory drugs (NSAIDs) -- a group that includes prescription and non-prescription pain medications such as aspirin and ibuprofen -- are responsible for 16,500 deaths each year, according to the New England Journal of Medicine. To put this in perspective, approximately 16,500 people died of AIDS in the United States in 1998, according to the Centers for Disease Control and Prevention.

In addition, a more recent study conducted by the Institute of Medicine revealed that nearly 100,000 people die each year from medical mistakes made by physicians, pharmacists and other medical professionals.

"The time has come for the medical community and the media to focus their efforts on warning patients about common procedures with very real risks associated with them -- such as the inappropriate use of drugs and surgery," said Dr. Lauretti.

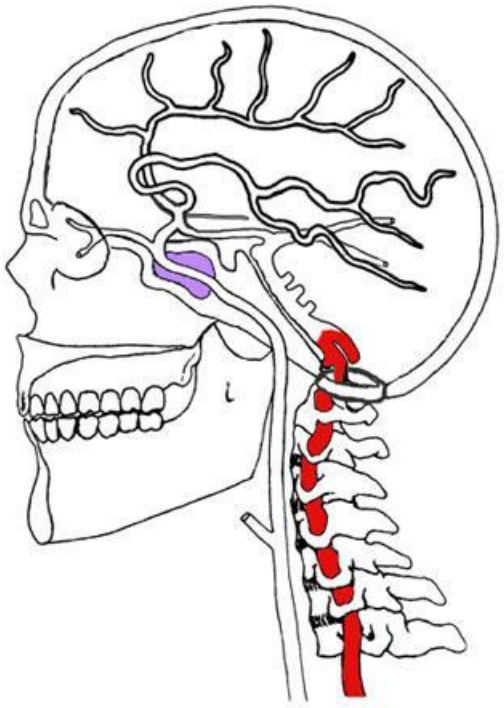
"Chiropractic has been proven to be a safe and effective non-drug, non-surgical treatment for a variety of conditions, and tens of millions of satisfied chiropractic patients will attest to this fact."

a) STROKE & CHROPRACTIC

Stroke is one of the **leading causes of death**. The CDC reports that 700,000 people experience a stroke each year, and that 160,000 of themare fatal. **The risk of death from stroke also increases with age.** Statistics, reviewed between the years 1979 to 1991, found that the yearly incidence rates of death by stroke for those in the 25–44 years age bracket was only 3,418 deaths, whereas at the age of 65 or above, incidence rates increased to **140,938** deaths yearly. [1]

Stroke is characterized by the sudden loss of circulation to an area of the brain, resulting in a corresponding loss of neurologic function. Also called a "*Cerebrovascular Accident*" (CVA), stroke is a nonspecific term, which describes a cross–section of pathophysiologic causes, which include thrombosis, embolism, and hemorrhage. [1]

Chiropractors are particularly interested in strokes caused by "***Vertebral Artery Dissection***" (VAD). Dissections of the Carotid Artery (CAD) or the Vertebral Artery (VAD) are relatively rare. The combined incidence of both VAD and CAD is estimated to be 2.6 per 100,000. However, cervical dissections are the underlying etiology in as many as 20% of the ischemic strokes presenting in younger patients aged 30–45 years. Among all extracranial cervical artery dissections, CAD is 3–5 times more common than VAD. The female–to–male incidence ratio is 3:1 [2]



The path of the Vertebral Artery is well described elsewhere. [2] The portion referred to as ***Segment III*** follows a "tortuous" route from the transverse foramen of C2, running posterolaterally to loop around the posterior arch of C1". This is the most common site for VAD associated with cervical manipulation. The rest of this page is devoted to examining the causes of Vertebral Artery Dissection. **VAD has occurred following actions as trivial as coughing, rotating the head to back a car out of a driveway, and other "normal" activities like archery and visits to the hairdresser.** (**See the collected abstracts below**).

Most reported cases of VAD have similar characteristics: The underlying and **pre-existing disease of the intima of the artery**, and an "**initiating event**" which involves rotation and/or extension of the cervical spine. Chiropractic manipulation (which is typically the *diversified technique*) has been labeled the "proximal event" in reported cases of stroke-after-manipulation because of it's reliance on a rotational component. **Even thought more than 90% of the profession uses that technique, the reported incidence of VAD is still only about 1 out of 3 million manipulations.** [4]

A well-balanced report in the **Canadian Medical Association Journal** [3], states that "neck manipulation as a therapeutic strategy for head and neck pain is common and may be effective" and concludes that until methods of identification of "high risk" populations improves, chiropractors should inform all patients of possible serious complications before neck manipulation (informed-consent).

The Stroke Page is devoted to demonstrating the astounding safety of the chiropractic adjustment. When compared to many medical procedures

used for the same complaint, the chiropractic adjustment is hundreds to thousands of times safer! Refer to the "Comparison of Death Rates Attributed to Various Causes" Chart below.

Dr. Scott Haldeman et al. wrote a follow–up article to the Canadian Stroke Consortium piece cited above. **They reviewed 10 years worth of malpractice**

claims files in Canada for it's 4500 chiropractors. They found that: "**The likelihood that a chiropractor will be made aware of an arterial dissection following cervical manipulation is approximately 1:8.06 million office visits, 1:5.85 million cervical manipulations, 1:1430 chiropractic practice years and 1:48 chiropractic practice careers. This is significantly less than the estimates of 1:500,000–1 million cervical manipulations calculated from surveys of neurologists**". [4].

An recent in-depth retrospective review [5] of patient files from reported cases of VAD attempted to evaluate the characteristics of the treatment rendered, and the presenting complaints of those patients. They found:

- 25 % cases presented with sudden onset of **new and unusual headache and neck pain** often associated with other neurological symptoms that may represent a dissection in progress; A second, earlier study [6] also notes **vertigo or unilateral facial paresthesia** is an important warning sign that may precede onset of stroke by several days.
- There was no apparent dose-response relationship to these complications;
- They occurred following any form of standard cervical manipulation technique, including rotation, extension, lateral flexion and non-force and neutral position manipulations, and
- **Based upon this review, stroke, particularly vertebrobasilar dissection, should be considered a random and unpredictable complication of any neck movement, including cervical manipulation**.

The most recent in-depth review, published in the Feb 15, 2008 Spine Journal [9] was completed by members of the Spine Decade Task Force. It reviewed 10 years worth of hospital records, involving 100 million person-years. Those records revealed no increase in vertebral artery dissection risk with chiropractic, compared with medical management, and further stated that "**increased risks of VBA stroke associated with chiropractic and PCP visits is likely due to patients with headache and neck pain from VBA dissection seeking care before their stroke.**"

It is now becoming apparent that chiropractors may have prematurely accepted the notion that cervical adjusting/manipulation could be a "causative" event for VAD. That was a reasonable and professional response to case-studies and reports in the peer-reviewed medical literature, which was **often based on a pattern of medical mis-reporting later documented by Terrett.** [7]

The recently published **"Current Concepts: Spinal Manipulation and Cervical Arterial Incidents 2005" (NCMIC)** [8] concludes in it's Executive Summary: "Unfortunately, opinion rather than fact has tended to dominate discussions

regarding CVAs and chiropractic, even though there has been no definitive evidence that chiropractic adjustments (actually) cause strokes. The good news is that **this monograph notes that a causative relationship between chiropractic manipulation and stroke is unlikely**. There is an associative relationship

between the two because **people may go to chiropractors for relief of stroke-related symptoms**".

It also recommends that chiropractors pay close attention when patients present with **sudden onset of headache/neck/face pain that's different than the patient has had before**.

If so, evaluate for a history of:

- **Drugs/medication** (smoking, oral contraceptives);
- **Physical trauma** (which may have damaged arterial structures);
- **Connective tissue diseases** (autosomal dominant polycystic kidney disease, Ehlers-Danlos type IV, Marfan Syndrome, Fibromuscular Dystrophy);
- **Genitourinary system** (frequent urinary tract infection, hematuria);
- **Nervous system** (dysarthria, dysphagia, visual changes, dizziness, confusion, giddiness and vertigo);
- **Cardiovascular system** (stroke, TIAs, mitral prolapse, aortic dilation, hypertension).

Differentiating "normal" head and neck pain from a CVA:

- **Transient Ischemic Attacks (TIAs)—** often have similar symptoms to a CVA. If the patient suffers from carotid TIAs, get a quick medical referral. The patient may suffer a complete stroke after only a few episodes.
- **Dizziness, unsteadiness, vertigo, giddiness—**Question the patient about:
- Aggravating factors, such as neck position or head movement
    - If any of the other **5 Ds and 3 Ns** exist (see below)
    - Whether new symptoms have occurred or existing symptoms aggravated by previous cSMT

- **Migraine headaches—** When a patient presents with a migraine, stroke is uncommon and is usually in the posterior cerebral artery.
- **Cervicogenic headaches—** primary features:
- Mechanical precipitation or aggravation of head pain
- facet joint tenderness
- neck muscle tenderness
- palpatory pressures reproducing head symptoms

If so, then evaluate for the "signs" of a stroke. Can they: smile, raise both

arms, stand steady on both feet with their eyes closed. speak a simple sentence with several vowels that run together, such as "Simple Simon Says", or stick out their tongue?

These are also known as the 5 D's and the 3 N's:

- **Diplopia** → Doubl vision or other vision problems
- **Dizziness** → Vertigo, light-headedness
- **Drop Attacks** → Sudden numbness/weakness of face/arm/leg

- **Disarthria** → Difficulty speaking
- **Dysphagia** → Difficulty swallowing
- **Ataxia of Gait** → Diff culty walking
- **Nausea** → Vomiting or queasiness
- **Numbness** → Loss of sensation on one side
- **Nystagmus** → Involuntary rapid eye movements

If you suspect that your patient may have had (or is having) a stroke, do NOT adjust their neck. Get them to a hospital for an evaluation MRI/MRA.

It's also advisable to not offer the patient anything to eat or drink, and that you do NOT allow patients who improve spontaneously to drive home. Remember that transient ischemic attacks (TIA) are **warning signs** for stroke. The symptoms are similar to CVAs although they can resolve spontaneously. Protect your patient by advising an immediate medical referral.

REFERENCES:

[1] Ischemic Stroke
eMedicine Journal 2001 (Aug 17); 2 (8)
[2] Sudden Vertebral Artery Dissection
eMedicine Journal 2002 (May 30); 3 (5)
[3] Sudden Neck Movement and Cervical Artery Dissection
CMAJ 2000; 163 (1): 38–40
[4] Sudden Neck Movement and Cervical Artery Dissection:
The Chiropractic Experience
CMAJ 2001; 165 (7): 905–906
[5] Stroke, Cerebral Artery Dissection, and Cervical Spine Manipulation Therapy
J Neurol 2002 (Aug); 249 (8): 1098–1104
[6] Vertebral Artery Dissection: Warning Symptoms, Clinical Features
and Prognosis in 26 Patients
Can J Neurol Sci 2000 (Nov); 27 (4): 292-296
[7] Misuse of the Literature by Medical Authors in Discussing Spinal Manipulative Therapy Injury
J Manipulative Physiol Ther 1995 (May); 18 (4): 203-210
[8] Current Concepts:
Spinal Manipulation and Cervical Arterial Incidents 2005
From NCMIC ~ The Executive Summary (8 pages)
[9] Risk of Vertebrobasilar Stroke and Chiropractic Care:
Results of a Population-based Case-control and Case-crossover Study
Spine 2008 (Feb 15); 33 (4 Suppl): S176–183

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182)
Beauty Parlor Stroke Syndrome
http://www.chiro.org/LINKS/ABSTRACTS/Beauty_Parlor_Stroke.shtml
If you think chiropractic adjustments can cause stroke, please review this series of abstracts. **Extension and rotational stressors, on an already–diseased**

Vertebral Artery, is the real culprit. There has been less reporting of "Beauty Parlor Stroke" than there has been for chiropractic–related strokes, but it is likely it occurs much more frequently.

183)
Bow Hunter's Stroke
Another instance of extension and rotational stresses leading to stroke.
http://www.chiro.org/LINKS/ABSTRACTS/Bow_Hunter_Stroke.shtml

184)
Iatrogenic Vertebral Artery Injury
http://www.chiro.org/LINKS/ABSTRACTS/Iatrogenic_Vertebral_Artery_Injury.shtml
Vertebral Arteries are also injured during a wide variety of medical procedures and surgeries.

185)
Stroke & Essential Fatty Acids
http://www.chiro.org/nutrition/ABSTRACTS/Stroke_and_EFA.shtml
Stroke is the third leading cause of death in the US. Fortunately, diagnostic imaging for stroke risk and stroke-prevention strategies have advanced greatly in recent years. **It is now possible to reduce the artery-clogging plaque that leads to stroke**, offering hope that this debilitating condition can be prevented.

186)
The Safety of Cervical Manipulation: Putting Stroke Risk in Perspective
http://www.chiro.org/LINKS/ABSTRACTS/The_Safety_of_Cervical_Manipulation.shtml
Dynamic Chiropractic 2011 (May 20); 29 (11): 29, 43, 45
Several studies have attempted to link chiropractic manipulation to adverse events, the most serious and widely studied being strokes following dissections of the vertebral artery. [**1-6**] To begin to shed light on this problem, several retrospective studies against large population bases have been conducted. As shown in Table 1, [**7-15**] a large sampling of such studies indicates that the number of serious complications or cerebrovascular accidents (CVAs), as established by researchers from both the chiropractic and medical professions, ranges from one case per 400,000 manipulations to zero in 5 million.

187)
Examining Vertebrobasilar Artery Stroke in Two Canadian Provinces. Supplementary Research Studies
Spine. 33(4S) Neck Pain Task Force Supplement:S170-S175, February 15, 2008.
*Boyle, Eleanor PhD *+; Cote, Pierre DC, PhD *+++[S][P]; Grier, Alexander R. DC, MBA [//]; Cassidy, J David DC, PhD, DrMedSc *+++[S]*
Abstract:
Study Design. Ecological study.
Objectives. To determine the annual incidence of hospitalized vertebrobasilar artery (VBA) stroke and chiropractic utilization in Saskatchewan and Ontario between 1993 and 2004. To determine whether at an ecological level, the incidence of VBA stroke parallels the incidence of chiropractic utilization.
Summary of Background Data. Little is known about the incidence and time trends of VBA stroke diagnoses in the population. Chiropractic manipulation to the neck is believed to be a risk factor for VBA stroke. No study has yet found an

association between chiropractic utilization and VBA diagnoses at the population level.
Methods. All hospitalizations with discharge diagnoses of VBA stroke were extracted from administrative databases for Saskatchewan and Ontario. We included incident cases that were diagnosed between January 1993 and December 2004 for Saskatchewan and from April 1993 to March 2002 for Ontario. VBA cases that had previously been hospitalized for any stroke or transient ischemic attack (TIA) were excluded. Chiropractic utilization was measured using billing data from Saskatchewan Health and Ontario Health Insurance Plan. Denominators were derived from Statistics Canada's annual population estimates.
Results. The incidence rate of VBA stroke was 0.855 per 100,000 person-years for Saskatchewan and 0.750 per 100,000 person-years for Ontario. The annual incidence rate spiked dramatically with a 360% increase for Saskatchewan in 2000. There was a 38% increase for the 2000 incidence rate in Ontario. The rate of chiropractic utilization did not increase significantly during the study period.
Conclusion. In Saskatchewan, we observed a dramatic increase in the incidence rate in 2000 and there was a corresponding relatively small increase in chiropractic utilization. In Ontario, there was a small increase in the incidence rate; however, chiropractic utilization decreased. At the ecological level, the increase in VBA stroke does not seem to be associated with an increase in the rate of chiropractic utilization.
(C) 2008 Lippincott Williams & Wilkins, Inc.

188)
Conducting an Orchestra Can Cause Vertebral Artery Dissection: "Ostrich Sign" Indicates Bilateral Vertebral Artery Dissection
Journal of Stroke and Cerebrovascular Diseases 2011 (Mar 24) [Epub ahead of print]
http://www.ncbi.nlm.nih.gov/pubmed/21440457
Vertebral artery dissections (VADs) comprise about 2% of ischemic strokes and can be associated with trauma, chiropractic manipulation, motor vehicle collisions, whiplash, amusement park rides, golfing, and other motion-induced injuries to the neck. **We present a case of bilateral extracranial VAD as a complication of conducting an orchestra**. To our knowledge, this has not been documented in the literature. Conceivably, vigorous neck twisting in an inexperienced, amateur conductor may place excessive rotational forces upon mobile portions of the verterbral arteries, tear the intima, deposit subintimal blood that extends longitudinally, and cause neck pain and/or posterior fossa ischemic symptoms.

189)
A Population-Based Case-Series of Ontario Patients Who Develop a Vertebrobasilar Artery Stroke After Seeing a Chiropractor
J Manipulative Physiol Ther 2011 (Jan); 34 (1): 15–22
http://www.ncbi.nlm.nih.gov/pubmed/21237403
Ninety-three VBA stroke cases consulted a chiropractor during the year before their stroke. The mean age was 57.6 years (SD, 16.1), and 50% were female. Most cases had consulted a medical doctor during the year before their stroke, and 75.3% of patients had at least one cerebrovascular comorbidity. The 3 most

common comorbidities were neck pain and headache (prevalence, 66.7%; 95% confidence interval [CI], 57.0%-76.3%), diseases of the circulatory system (prevalence, 63.4%; 95% CI, 54.8%-74.2%), and diseases of the nervous system and sense organs (prevalence, 47.3%; 95% CI, 38.7%-58.1%). Our population-based analysis suggests that VBA stroke patients who consulted a chiropractor the year before their stroke are older than previously documented in clinical case series. We did not find that women were more commonly affected than men. Moreover, we found that most patients had at least one cardio or cerebrovascular comorbidity. Our analysis suggests that relying on case series or surveys of health care professionals may provide a biased view of who develops a VBA stroke.

190)
Current Understanding of the Relationship Between Cervical Manipulation and Stroke: What Does It Mean for the Chiropractic Profession?
Chiropractic & Osteopathy 2010 (Aug 3); 18 (1): 1–9
http://chiromt.com/content/pdf/1746-1340-18-22.pdf
The understanding of the relationship between cervical manipulative therapy (CMT) and vertebral artery dissection and stroke (VADS) has evolved considerably over the years. In the beginning the relationship was seen as simple cause-effect, in which CMT was seen to cause VADS in certain susceptible individuals. This was perceived as extremely rare by chiropractic physicians, but as far more common by neurologists and others. Recent evidence has clarified the relationship considerably, and suggests that the relationship is not causal, but that patients with VADS often have initial symptoms which cause them to seek care from a chiropractic physician and have a stroke some time after, independent of the chiropractic visit. **This new understanding has shifted the focus for the chiropractic physician from one of attempting to "screen" for "risk of complication to manipulation" to one of recognizing the patient who may be having VADS so that early diagnosis and intervention can be pursued**. In addition, this new understanding presents the chiropractic profession with an opportunity to change the conversation about CMT and VADS by taking a proactive, public health approach to this uncommon but potentially devastating disorder.

191)
Preliminary Report: Biomechanics of Vertebral Artery Segments C1-C6 During Cervical Spinal Manipulation
J Manipulative Physiol Ther. 2010 (May); 33 (4): 273–278
http://www.ncbi.nlm.nih.gov/pubmed/20534313
The results of this study suggest complex and nonintuitive strain patterns of the VA within the cervical transverse foramina. Consistent (for 2 chiropractors) and repeatable (for 3 repeat measurements for each chiropractor) elongation and shortening of adjacent VA segments were observed simultaneously and could not be explained with a simple model of neck movement. We hypothesized that they were caused by variations in the location and stiffness of the VA fascial attachments to the vertebral foramina and by coupled movements of the cervical vertebrae. However, in agreement with previous work on VA strains proximal and distal to the cervical transverse foramina, strains for cervical spinal manipulations were consistently lower than those obtained for cervical rotation.

192)
Microstructural Damage in Arterial Tissue Exposed to Repeated Tensile Strains
J Manipulative Physiol Ther 2010 (Jan); 33 (1): 14–19
http://www.chiro.org/LINKS/ABSTRACTS/Microstructural_Damage.shtml
Twenty-four test specimens from cadaveric rabbit ascending aorta were divided into 2 control groups (n = 12) and 2 experimental groups (n = 6 each). **Specimens were exposed to 1000 strain cycles** of 0.06 and 0.30 of their in situ length. A pathologist, blinded to the experimental groups, assessed microstructural changes in the arteries using quantitative histology. Pearson ?2 analysis (a = .05) was used to assess differences in tissue microstructure between groups. **Cadaveric arterial tissues of New Zealand white rabbit with similar size, structure, and mechanical properties of human vertebral artery did not exhibit histologically identifiable microdamage when exposed to repeated mechanical loading equivalent to the strains observed in human vertebral artery during chiropractic cervical spine manipulative therapy**.

193)
Patients With Symptoms and Signs of Stroke Presenting to a Rural Chiropractic Practice
J Manipulative Physiol Ther 2010 (Jan); 33 (1): 62–69
http://www.ncbi.nlm.nih.gov/pubmed/20114102
Patients with symptoms and signs of stroke may infrequently present to chiropractic physicians for evaluation and treatment, regardless of the interval since the last prior chiropractic treatment. Several prehospital stroke recognition instruments were introduced in the mid-1990s, including the Los Angeles Paramedic Stroke Scale, the Cincinnati Prehospital Stroke Scale, and in the United Kingdom the Face Arm Speech Test (FAST), a modification of the Cincinnati scale. [**37**] The FAST seems particularly well suited as a tool for chiropractic physicians, their staff, and for patient education; indeed, this tool is already being used by health educators and nurses to train persons for rapid stroke recognition (Table 4). [**5**]

Table 4. The Face Arm Speech Test, also known as FAST [5]

F	**Face:** Ask person to smile. Does one side of the face droop?
A	**Arm:** Ask person to raise both arms. Does one arm drift downward?
S	**Speech:** Ask the person to say their name or a simple sentence. Is the speech slurred or unusual?
T	**Time:** If any of these signs, call 911 or get to the nearest stroke center or hospital immediately.

194)
Risk of Vertebrobasilar Stroke and Chiropractic Care:
Results of a Population-based Case-control and Case-crossover Study
Spine 2008 (Feb 15); 33 (4 Suppl): S176–183
http://www.ncbi.nlm.nih.gov/sites/entrez?cmd=Retrieve&db=pubmed&dopt=Citation&list_uids=18204390
VBA stroke is a very rare event in the population. There was an association between chiropractic services and subsequent vertebrobasilar artery stroke in persons under 45 years of age, but a similar association was also observed among patients receiving general practitioner services**.** This is likely explained by patients with vertebrobasilar artery dissection-related neck pain or headache seeking care before having their stroke.

195)
Putting Risk into Perspective
ACAnews ~ September 2007
http://www.chiro.org/LINKS/ABSTRACTS/Putting_Risks_into_Perspective.shtml
Over the last three years, doctors of chiropractic in the state of Connecticut have been subject to a rash of anti-chiropractic advertisements conspicuously placed on rolling and static billboards, and in well-read statewide newspapers. Most recently, doctors saw a spate of unprecedented anti-chiropractic legislation aimed to mandate informed consent in chiropractic offices and require open access to chiropractic malpractice records. **To properly assess the risks of chiropractic treatment, it must be compared against the risks of other treatments for similar conditions.** For example, the most common first-line medical treatment for neck pain are non-steroidal anti-inflammatory drugs (NSAIDs). **A 1999 study published in the New England Journal of Medicine (NEJM) estimated that at least 103,000 patients are hospitalized per year in the United States for serious gastrointestinal complications due to NSAID use. More recently a separate study from NEJM estimated that at least 16,500 NSAID-related deaths occur among patients each year.**

196)
The Benefits Outweigh the Risks for Patients Undergoing Chiropractic Care for Neck Pain: A Prospective, Multicenter, Cohort Study
J Manipulative Physiol Ther 2007 (Jul); 30 (6): 408–418
http://www.chiro.org/LINKS/ABSTRACTS/The_Benefits_Outweigh_the_Risks.shtml
In contrast to clinical trials of prescription medication, researchers in the area of conservative care for musculoskeletal complaints have focused their attention on treatment effectiveness and, to a much lesser degree, on adverse events. This study, consisting of patients treated in a wide variety of chiropractic practices and settings, describes both positive and negative, and short- and long-term clinical outcomes for a relatively large study population with neck pain. **Although many of the subjects (in this study) had chronic, recurrent neck pain and had undergone prior care for this complaint, many patients experienced benefit from the treatment (based upon diminished pain and disability, the percentage of patients recovered and percentage satisfied with care). Furthermore, many responded relatively quickly to treatment (48% were**

recovered at the fourth visit).

197)
Inappropriate Use of the title Chiropractor and term Chiropractic Manipulation in the Peer-reviewed Biomedical Literature
Chiropractic & Osteopathy 2006 (Aug 22); 14 (1): 16
http://chiromt.com/content/pdf/1746-1340-14-16.pdf
The results of this year-long prospective review suggests that the words chiropractor and chiropractic manipulation are often used inappropriately by European biomedical researchers when reporting apparent associations between

cervical spine manipulation and symptoms suggestive of traumatic injury. Furthermore, in those cases reported here, the spurious use of terminology seems to have passed through the peer-review process without correction. Additionally, **these findings provide further preliminary evidence, beyond that already provided by Terrett, that the inappropriate use of the title chiropractor and term chiropractic manipulation may be a significant source of over-reporting of the link between the care provided by chiropractors and injury.**

198)
Are German Orthopedic Surgeons Killing People With Chiropractic? Journal of Neurology 2006 (Mar 6)
Editorial Commentary: I present for your review an abstract from the **Journal of Neurology**.
http://www.chiro.org/Professional_Regulation/
This abstract blatantly conceals the facts stated in the body of the paper when it states that "we describe 36 patients with vertebral artery dissections and prior chiropractic neck manipulation". When I read that sentence, I am led to believe that "real-live chiropractors" (meaning licensed Doctors of Chiropractic, who received their training at a CCE/WCCE accredited schools) were the ones to provide the "chiropractic neck manipulation". Unfortunately, that couldn't be further from the truth!

199)
Cerebrovascular Accident Without Chiropractic Manipulation: A Case Report
J Manipulative Physiol Ther 2006 (May); 29 (4): 330–335
http://www.ncbi.nlm.nih.gov/pubmed/16690388?dopt=Abstract
A 49-year-old man with non-traumatic chronic episodic head and neck pain presented for care. Examination and plain film radiographs were unremarkable, suggesting a mechanical origin for the symptoms; **however, information in the case history raised concerns**. The patient was examined and not manipulated by the doctor of chiropractic but referred back to his general practitioner for a second opinion. The following week, the patient was admitted to hospital having had a cerebrovascular accident. **The possible indication of the prodrome to a stroke may lie in the case history rather than the examination findings and provocative testing**.

200)
Cerebrovascular Accidents: The Rest of The Story
Anthony L. Rosner, PhD., Research Director for FCER
http://www.chiro.org/LINKS/CVA/Cerebrovascular_Accidents.shtml
During the past decade, the issues of cerebrovascular accidents [CVAs] and spinal manipulation have become linked in a debate of ever-increasing intensity. A copious number of studies have investigated spinal manipulation as a putative causative factor of CVAs; however, **a common theme among these is the failure to adequately explore the possibility that the majority of CVAs may be spontaneous, cumulative, or caused by factors other than spinal manipulation itself**. The problem is only exacerbated by the sometimes hysterical reactions apparent in the mass media over the past three years in reaction to the flawed investigations. This paper was presented Friday June 20, 2003 at the *International Spinal Trauma Conference* in Chicago, IL.

201)
The Stroke Issue:
Paucity of Valid Data, Plethora of Unsubstantiated Conjecture
J Manipulative Physiol Ther 2004 (June); 27 (5): 368–372
http://www.jmptonline.org/article/S0161-4754%2804%2900054-5/fulltext
Chiropractic can be proud of its exemplary standards in the areas of informed consent and the allocation of funding for research to study issues of safety. As a responsible, ethical, and caring profession, chiropractic must continue to look into the issue regarding the potential risk of chiropractic adjustment. At this time, it cannot be scientifically stated that there is no risk of VBA dissection from chiropractic cervical adjustment. It can, however, be scientifically stated that there is neither valid evidence of a causal relationship between chiropractic cervical adjustment and VBA dissection nor any valid data to estimate a risk of VBA dissection associated with chiropractic cervical adjustment. It can also be stated that the data that are available regarding the total number of adjustments performed each year, the total number of VBA dissections and occlusions that occur in the absence of chiropractic adjustment each year, and the data that indicate a chiropractic cervical adjustment represents less force to the vertebral artery than movement within the normal range of motion make it more logical to assume a temporal rather than causal link between these 2 events.

202)
A Risk Assessment of Cervical Manipulation vs. NSAIDs
for the Treatment of Neck Pain
J Manipulative Physiol Ther 1995 (Oct); 18 (8): 530–536
http://www.ncbi.nlm.nih.gov/pubmed/8583176
As for comparative safety, the best available evidence indicates that NSAID use poses a significantly greater risk of serious complications and death than the use of cervical manipulation for comparable conditions. In conclusion, **the best evidence indicates that cervical manipulation for neck pain is much safer than the use of NSAIDs, by as much as a factor of several hundred times.** There is no evidence that indicates NSAID use is any more effective than cervical manipulation for neck pain.

203)
Efficacy and Risks of Chiropractic Manipulation:
What Does the Evidence Suggest?
Integrative Medicine 1998; 1: 61-66
http://www.chiro.org/LINKS/ABSTRACTS/Efficacy_and_Risks_of_Chiropractic.shtml
This review article drew upon the appropriateness studies conducted at RAND, which indicated efficacy of manipulation for acute or sub-acute low back pain, neck pain, and muscle-tension-type headaches. The article also reported the low risk of serious complications from lumbar and cervical manipulations. **According to the literature review, the estimated risk for serious complications from cervical manipulation is 6.39 per 10 million manipulations. For lumbar manipulation, it is 1 per 100 million manipulations**. These estimates compare favorably to other forms of therapy, such as cervical spine surgery or nonsteroidal anti-inflammatory drugs (NSAIDS). The risk from manipulation is low and compares favorably to other forms of therapy for the same conditions (e.g., 15.6 complications per 1000 cervical spine surgeries, 3.2 per 1000 subjects for nonsteroidal anti-inflammatory drugs)

204)
Is Cervical Spinal Manipulation Dangerous?
J Manipulative Physiol Ther 2002 (Oct); 25 (8): 504-510
http://www.ncbi.nlm.nih.gov/pubmed/12532139
It appears that the risk of cerebrovascular accidents after cervical manipulation is low, considering the enormous number of treatments given each year, and very much lower than the risk of serious complications associated with generally accepted surgery. Provided there is a solid indication for cervical manipulation, we believe that the risk involved is acceptably low and that the fear of serious complications is greatly exaggerated.

205)
Defining the Effect of Cervical Manipulation on Vertebral Artery Integrity: Establishment of an Animal Model
J Manipulative Physiol Ther 2004 (Nov); 27 (9): 539–546
http://www.ncbi.nlm.nih.gov/pubmed/15614240
Over the past 5 to 10 years, the issue of cerebrovascular accidents (CVAs) and spinal manipulation has become a debate of ever-increasing intensity. A copious number of studies have investigated spinal manipulation as a putative causative factor of CVAs [**1-5**]; however, **a common theme among these is the failure to consider that the majority of vertebrobasilar accidents (VBAs) may be spontaneous, cumulative, or caused by factors other than spinal manipulation.** The problem is not served by the sometimes hysterical reactions apparent in the media over the past 2 years in reaction to the flawed investigations.[**6-11**] In light of these recent reports, the entire phenomenon of spontaneous cervical artery dissections should be revisited to put this matter into a better perspective.

206)
Association of Internal Carotid Artery Dissection and Chiropractic Manipulation
Neurologist 2003 (Jan); 9 (1): 35–44
http://w3.palmer.edu/michael.haneline/ICAD_Haneline.pdf
In reviewing the cases of internal carotid dissection potentially related to CMT, there were many confounding factors, such as connective tissue aberrations, underlying arteriopathy, or coexistent infection, that obscured any obvious cause-and-effect relationship. To date there are only 13 reported cases of ICAD temporally related to CMT. Most ICADs seem to occur spontaneously and progress from local symptoms of headache and neck pain to cortical ischemic signs. Approximately one third of the reported cases were manipulated by practitioners other than chiropractic physicians, and because of the differential risk related to major differences in training and practice between practitioners who manipulate the spine, it would be inappropriate to compare adverse outcomes between practitioner groups.

207)
Spontaneous Cervical Artery Dissections and Implications for Homocysteine
J Manipulative Physiol Ther 2004 (Feb); 27 (2): 124–132
http://www.journals.elsevierhealth.com/periodicals/ymmt/article/PIIS0161475403002318/fulltext
As shown in Table 1, the annual incidence of spontaneous VADs in hospital settings has been estimated to occur at the rate of 1 to 1.5 per 100,000 patients. [15] The corresponding VAD incidence rate in community settings has been reported to be twice as high. [16,17] Using an estimated value of 10 from the literature to represent an average number of manipulations per patient per episode, [23] it becomes apparent that the proposed exposure rate for CVAs attributed to spinal manipulation is equivalent to the spontaneous rates for cervical arterial dissections as reported. [15-17] If the threat of stroke or stroke-like symptoms is to be properly assessed, therefore, at least half our attention needs to be directed toward the spontaneous events instead of primarily or solely on spinal manipulation.

208)
Cervical Artery Dissection A Comparison of Highly Dynamic Mechanisms: Manipulation Versus Motor Vehicle Collision
J Manipulative Physiol Ther 2005 (Jan); 28 (1): 57–63
http://www.ncbi.nlm.nih.gov/pubmed/15726036
This recent review of the literature finds: "Additionally, long-lasting abnormalities of blood flow velocity within the vertebral artery have been reported in patients following common whiplash injuries, whereas no significant changes in vertebral artery peak flow velocity were observed following cervical chiropractic manipulative therapy". and concludes that: "The direct evidence suggests that the healthy vertebral artery is not at risk from properly performed chiropractic manipulative procedures".

209)
Motor Vehicle Accidents:
The Most Common Cause of Traumatic Vertebrobasilar Ischemia
Can J Neurol Sci 2003 (Nov); 30 (4): 320–325
http://www.ncbi.nlm.nih.gov/pubmed/14672263
There were 80 patients whose vertebrobasilar ischemia was attributed to neck trauma. Five were diagnosed as due to chiropractic manipulation, but the commonest attributed cause was motor vehicle accidents (MVAs), which accounted for 70 cases; one was a sports injury, and five were industrial accidents. In some cases neck pain from an MVA led to chiropractic manipulation, so the cause may have been compounded. In most vehicular cases the diagnosis had been missed, even denied, by the neurologists and neurosurgeons initially involved. The longest delay between the injury and the onset of delayed symptoms was five years.

210)
Clinical Perceptions of the Risk of Vertebral Artery Dissection After Cervical Manipulation: The Effect of Referral Bias
Spine J 2002 (Sep); 2 (5): 334–342
http://www.ncbi.nlm.nih.gov/pubmed/14589464
For the 10-year period 1988 to 1997, there were 23 cases of vertebral artery dissection after cervical manipulation reported to the CCPA that represents 83% of practicing chiropractors in Canada. Based on the survey, an estimated 134,466,765 cervical manipulations were performed during this 10-year period. This gave a calculated rate of vertebral artery dissection after manipulation of 1:5,846,381 cervical manipulations. Based on the number of practicing chiropractors and neurologists during the period of this study, 1 of every 48 chiropractors and one of every two neurologists would have been made aware of a vascular complication from cervical manipulation that was reported to the CCPA during their practice lifetime

211)
Response to Vertebral Artery Dissection Study: Synopsis Paper by Smith et al. Published in May 13, 2003 Issue of Neurology
FCER ~ May 18, 2003
http://www.chiro.org/LINKS/FULL/Response_to_NEUROLOGY_Vertebral_Artery_Study.shtml
The recent publication by Smith et al. in Neurology addressing vertebral artery dissection represents another episode of regrettable studies which, despite serious flaws which raise substantial questions as to their internal validity, go at great lengths to selectively disparage the advisability of performing cervical manipulations as a means of patient care while obscuring the larger picture.

212)
Perspectives: An Overview of Comparative Considerations of Cerebrovascular Accidents
Chiropractic Journal of Australia 1999; 29 (3): 87—102
http://www.chiro.org/LINKS/CVA/CVA_Perspectives.shtml
This paper seeks to contrast reports concerning major adverse side effects, viz.

cerebrovascular accidents (CVAs) attributed to cervical spine manipulation, within a broad perspective of medical procedures. It also seeks to correlate the incidence rates of other adverse events and medical procedures with the general incidence rate of CVAs. On analysis, an accurate position would indicate that cervical spinal manipulation is one of the more conservative, least invasive and safest of procedures in the provision of human health care services. The paper also alludes to the political connotations on the subject.

213)
Unpredictability of Cerebrovascular Ischemia Associated with Cervical Spine Manipulation Therapy: A Review of Sixty-four Cases After Cervical Spine Manipulation
Spine 2002 (Jan 1); 27 (1): 49–55
http://www.ncbi.nlm.nih.gov/pubmed/11805635
This study was unable to identify factors from the clinical history and physical examination of the patient that would assist a physician attempting to isolate the patient at risk of cerebral ischemia after cervical manipulation. Cerebrovascular accidents after manipulation appear to be unpredictable and should be considered an inherent, idiosyncratic, and rare complication of this treatment approach.

214)
Vertebral Arteries and Cervical Rotation:
Modeling and Magnetic Resonance Angiography Studies
J Manipulative Physiol Ther 2002 (Jul); 25 (6): 370-383
http://www.ncbi.nlm.nih.gov/pubmed/12183695
All 16 vertebral arteries from the 8 patients displayed no changes in their lumen dimensions with full cervical rotation, although curves in each of the arteries did change. The model and cadaveric vertebral arteries demonstrated localized compression or kinking of the vessel wall with atlanto-axial rotation contralaterally but revealed no evidence of major contribution of stretching to stenosis.

215)
Manipulation of the Neck and Stroke:
Time for More Rigorous Evidence
Medical Journal of Australia 2002 (Apr 15); 176 (8): 376-380
http://www.chiro.org/LINKS/FULL/Manipulation_of_the_Neck_and_Stroke.htm
In this issue of the Journal, Ernst (page 376) reviews case reports of serious adverse events associated with cervical spine manipulation. Although Ernst acknowledges the considerable doubt about a causal relationship between the manipulation and the adverse event, he is inconsistent in suggesting that the anecdotal and uncontrolled evidence of the case reports favors the adverse events, often strokes, being an effect of manipulation. Elucidating a causal relationship calls for greater clarity, less ambivalence and generally better science in the present evidence-based climate. Thus, the important question to be answered in the light of

Ernst's article is whether the association between neck manipulation and stroke is actually causal and, if so, in what direction?

216)
VAD Following Cervical Manipulation: D.C. vs M.D. Experiences Affect Perception of Risk
FCER ~ January 13, 2003
http://www.chiro.org/LINKS/FULL/VAD_Following_Cervical_Manipulation.htmExamination of the database of the Canadian Chiropractic Protective Association (CCPA, which provides malpractice insurance for 83% of chiropractors in Canada) for the period 1988 to 1997 found 23 cases of VAD. Retrospective review of these cases and a survey of chiropractors suggests an estimated 134,466,765 cervical manipulations were performed during the 10-year period. Records from these reported VAD cases indicates that in a 30 year practice, only one in 48 chiropractors would be aware of a vascular incident following cervical manipulation. In contrast, examination of the records show that these 23 VAD patients saw a total of 216 physicians, including 69 neurologists.

217)
The Benefits and Risks of Spinal Manipulation
Paul G. Shekelle, MD, PhD; Reed B. Phillips, DC, PhD; Daniel C. Cherkin, PhD; William C. Meeker, DC, MPH
http://www.chiroweb.com/archives/ahcpr/chapter11.htm
This chapter summarizes what has been learned from clinical trials about the benefits of spinal manipulation for specific problems and from case reports about the risks of spinal manipulation. In addition, findings of studies examining the ability of spinal manipulation to increase patient satisfaction, decrease cost, or increase cost-effectiveness of care are summarized. This is the 11th chapter of "***Chiropractic in the United States: Training, Practice, and Research***", a publication (Dec 1997) by the Agency for Health Care Policy and Research (AHCPR).

218)
Chiropractic Manipulation and Stroke
Stroke 2001 (Sep); 32 (9): 2207—2208
http://stroke.ahajournals.org/content/32/9/2207.full
This is the response to the Rothwell et al. article (Stroke 2001;32:1054) by Anthony Rosner, PhD of the FCER.

219)
Consequences of Neck Manipulation Performed by a Non-professional
Spinal Cord 2001 (Feb); 39 (2): 112–113
http://www.ncbi.nlm.nih.gov/pubmed/11402369
A 30-year-old man who fainted after neck manipulation by a barber and developed spinal cord and brainstem dysfunction. His MRI revealed an extramedullary, intradural dumbbell shaped mass on the right side at C1 and C2 level compressing the spinal cord.

220)
Internal Forces Sustained by the Vertebral Artery During Spinal Manipulative Therapy
J Manipulative Physiol Ther 2002 (Oct); 25 (8): 504–510

http://www.ncbi.nlm.nih.gov/pubmed/12381972
SMT resulted in strains to the VA that were almost an order of magnitude lower than the strains required to mechanically disrupt it. We conclude that under normal circumstances, a single typical (high-velocity/low-amplitude) SMT thrust is very unlikely to mechanically disrupt the VA.

221)
Uneventful Upper Cervical Manipulation in the Presence of a Damaged Vertebral Artery
J Manipulative Physiol Ther 2002 (Sept); 25 (7): 472–483
http://www.chiro.org/LINKS/ABSTRACTS/Uneventful_Upper_Cervical_Manipulation.shtml
This case report demonstrates that vigorous manipulation of the upper cervical spine is possible without injuring an already damaged vertebral artery. It is suggested that the line of drive used during the single manipulation, almost pure lateral flexion with slight rotation, was responsible for the apparent innocuous response. Guidelines for the evaluation and management of vertebral artery dissection are reviewed. Because it is currently impossible to identify patients at risk of having a dissected vertebral artery with standard in-office examination procedures, rotational manipulation of the upper cervical spine should be abandoned by all practitioners, and schools should remove such techniques from their curriculums.

222)
Stroke, Cerebral Artery Dissection, and Cervical Spine Manipulation Therapy
Journal of Neurology 2002 (Jul); 249 (8): 1098–1104
http://www.springerlink.com/content/8kmh4hbml7naqkru/
Stroke represents an infrequent adverse reaction associated with cervical spine manipulation therapy. Attempts to identify the patient at risk and the type of manipulation most likely to result in these complications of manipulation have not been successful. A retrospective review of 64 medical legal cases of stroke temporally associated with cervical spine manipulation was performed to evaluate characteristics of the treatment rendered and the presenting complaints in patients reporting these complications. Ninety two percent of cases presented with a history of head and/or neck pain and 16 (25 %) cases presented with sudden onset of new and unusual headache and neck pain often associated with other neurological symptoms that may represent a dissection in progress. The strokes occurred at any point during the course of treatment. Certain patients reporting onset of symptoms immediately after first treatment while in others the dissection occurred after multiple manipulations. There was no apparent dose-response relationship to these complications.

223)
International Expert Debunks Stroke Consortium Chief's Claims About Link Between Stroke and Neck Adjustment
Canada Newswire; Nov 18, 2002
ORONTO, Nov 18, 2002 (Canada NewsWire via COMTEX) --

http://www.chiro.org/LINKS/ABSTRACTS/International_Expert.shtml
A leading world expert on scientific methodology and research, Dr. David Sackett, an officer of the Order of Canada and member of the Canadian Medical Hall of Fame, today described Dr. John Norris, former Chair of the Canadian Stroke Consortium, as "incompetent" in scientific research and "irresponsible" with regard to the Consortium's work attributing strokes to neck adjustment.

224)
Arterial Dissections Following Cervical Manipulation:
The Chiropractic Experience
Canadian Medical Association Journal 2001 (Oct 2); 165 (7): 905–906
http://www.chiro.org/LINKS/DISCONTINUED/Arterial_dissections_following_cervical_manipulation.html
Following approval by the Institutional Review Board of the Canadian Memorial Chiropractic College in Toronto, Ont., a review of malpractice data from the Canadian Chiropractic Protective Association (CCPA) was carried out to evaluate all claims of stroke following chiropractic care for the 10-year period between 1988 and 1997. There are over 4500 licensed chiropractors in Canada. **The likelihood that a chiropractor will be made aware of an arterial dissection following cervical manipulation is approximately 1 in 8.06 million office visits**, 1 in 5.85 million cervical manipulations, 1 in 1430 chiropractic practice years and 1 in 48 chiropractic practice careers.

225)
Sudden Neck Movement and Cervical Artery Dissection Canadian Medical Association Journal 2000 (Jul 11); 163: 38–40
http://www.cmaj.ca/content/163/1/38.full
During the past year the Canadian Stroke Consortium, a national network of stroke physicians, has been prospectively collecting detailed information on cases of dissection of the cervical arteries. Seventy-four patients have been studied so far: their age range was 16-87 years (mean 44 years), 60% were male, and there was a predominance of vertebrobasilar artery dissections compared with carotid artery dissections (72% v. 28%). Most (81%) of the dissections were associated with sudden neck movement, ranging from therapeutic neck manipulation to a vigorous game of volleyball, but some occurred during mild exertion such as lifting a pet dog or during a bout of coughing.

226)
New Study Puts Stroke From Neck Adjustment at Less than 1 in 5 Million Adjustments
Toronto, October 12, 2001— A new Canadian study, reported in the October 2, 2001 issue of the Canadian Medical Association Journal (CMAJ), puts the risk of stroke following neck adjustment at 1 in every 5.85 million adjustments. The study, which is based on patient medical files and malpractice data from the Canadian Chiropractic Protective Association, evaluated all claims of stroke following chiropractic care for a ten year period between 1988 and 1997.

227)
A Review of the Significant Shortcomings in the Reporting of Stroke Associated with Cervical Manipulation
Clinical Practice Guidelines, Chapter 9: Patient Safety
http://www.chiro.org/LINKS/FULL/New_Study_Puts_Stroke_From_Neck.html
In the case of strokes purportedly associated with manipulation, the panel noted significant shortcomings in the literature. A summary of the relevant literature follows. For example: "In a letter to the editor of the Journal of Manipulative and Physiological Therapeutics, Myler(9) wrote, I was curious how the risk of fatal stroke after cervical manipulation, placed at 0.00023%(10) compared with the risk of (fatal) stroke in the general population of the United States. According to data

obtained from the National Center for Health Statistics, the mortality rate from stroke in the general population was calculated to be 0.00057%. **If these data are correct, the risk of a fatal stroke following cervical manipulation is less than half the risk of fatal stroke in the general population.**"

228)
Risk Assessment of Neurological and/or Vertebrobasilar Complications in the Pediatric Chiropractic Patient
Journal of Vertebral Subluxation Research (JVSR) 1998; 2 (2): 73–78
http://www.chiro.org/pediatrics/ABSTRACTS/Risk_Assessment_in_Pediatric_Chiropractic_Patient.shtml
The estimate of risk due to the pediatric chiropractic patient in this category of complication was estimated to be 4.0 x 10 -7 % of all visits. Stated otherwise, there would be a chance of approximately 1 in 250 million pediatric visits that a N/VB complication would result. While some pre-existing conditions may predispose a pediatric patient to a higher incidence of such complications, the estimates derived in the present study are considered applicable to the general pediatric population.

229)
What are the Risks of Chiropractic Neck Treatments?
William J. Lauretti, DC
http://www.chiro.org/LINKS/FULL/What_are_the_Risk_of_Chiropractic.shtml
Every published study which has estimated the incidence of stroke (CVA) from cervical manipulation has agreed that the risk is 1 to 3 incidents per million treatments. Dvorak, [1] in a survey of 203 practitioners of manual medicine in Switzerland, found a rate of one serious complication per 400,000 cervical manipulations, without any reported deaths, among an estimated 1.5 million cervical manipulations. Jaskoviak [2] reported approximately 5 million cervical manipulations from 1965 to 1980 at The National College of Chiropractic Clinic in Chicago, without a single case of vertebral artery stroke or serious injury.

230)
Manipulation and Mobilization of the Cervical Spine.
A Systematic Review of the Literature
Spine 1996 (Aug 1); 21 (15): 1746–1760

http://www.ncbi.nlm.nih.gov/pubmed/8855459
The combination of three of the randomized controlled trials comparing spinal manipulation with other therapies for patients with subacute or chronic neck pain showed an improvement on a 100-mm visual analogue scale of pain at 3 weeks of 12.6 mm (93% confidence interval, -0.15, 25.5) for manipulation compared with muscle relaxants or usual medical care. The highest quality randomized controlled trial demonstrated that spinal manipulation provided short-term relief for patients with tension-type headache. The complication rate for cervical spine manipulation is estimated to be between 5 and 10 per 10 million manipulations.

231)
Response to Vertebral Artery Dissection Study:
Canadian Journal of Neurological Sciences
Anthony L. Rosner, Ph.D. ~ December 22, 2000
http://www.chiro.org/LINKS/FULL/RESPONSE_TO_VERTEBRAL_ARTERY_DISSECTION_STUDY.html
A recent publication addressing vertebral artery dissection in The Canadian Journal of Neurological Sciences [1] is surprisingly anecdotal and sketchy in its depiction of both the possible causes and etiology of the subject it is intended to discuss. As such, it is laden with severe methodological deficiencies which severely undercut its credibility and create misleading impressions of vertebral artery dissection and raise more fundamental questions as to how retrospective studies should be conducted. There are at least five critical issues which need to be brought into consideration in order to more fully understand this particular study in a broader perspective.

232)
Vertebral Artery Dissection: Warning Symptoms, Clinical Features and Prognosis in 26 Patients
Can J Neurol Sci 2000 (Nov); 27 (4): 292–296
http://www.ncbi.nlm.nih.gov/pubmed/11097518
Headache and/or neck pain followed by vertigo or unilateral facial paresthesia is an important warning sign that may precede onset of stroke by several days.

233)
Vertebral Artery Dissection and Migraine Headaches in Children
J Child Neurol 2000 (Oct); 15 (10): 694–696
http://www.ncbi.nlm.nih.gov/pubmed/11063085
Risk factors for vertebral artery dissection are reviewed, with emphasis on association with migraine headaches. A review of imaging studies for the diagnosis of dissection is also presented. **This case demonstrates the importance of considering arterial wall dissection in pediatric patients with a history of atypical migraines associated with new neurologic findings.**

234)
Is There a Role for Premanipulative Testing Before Cervical Manipulation?
J Manipulative Physiol Ther 2000 (Mar); 23 (3): 175–179
http://www.ncbi.nlm.nih.gov/pubmed/10771502
It appears that a positive premanipulative test is not an absolute contraindication to

manipulation of the cervical spine. If the test is able to identify patients at risk for cerebrovascular accidents, we suggest patients with a reproducible positive test should be referred for a duplex examination of the vertebral artery flow. If duplex flow is normal, the patient should be eligible for cervical manipulation despite the positive premanipulative test.

235)
Safety in Chiropractic Practice, Part I: The Occurrence of Cerebrovascular Accidents After Manipulation to the Neck in Denmark from 1978–1988
J Manipulative Physiol Ther 1996 (Jul); 19 (6): 371–377
http://www.ncbi.nlm.nih.gov/pubmed/8864967
Although the incidence of CVA after chiropractic SMT was confirmed to be low, there seems to be sufficient evidence to justify a firm policy statement cautioning against upper cervical rotation as a technique of first choice.

236)
Safety in Chiropractic Practice Part II: Treatment to the Upper Neck and the Rate of Cerebrovascular Incidents
J Manipulative Physiol Ther 1996 (Nov); 19 (9): 563–569
http://www.ncbi.nlm.nih.gov/pubmed/8976474
Retrospective data were collected from questionnaires covering the period 1978-1988 inclusive; in a second survey, chiropractors provided information obtained through inspection of their own case records.

237)
Misuse of the Literature by Medical Authors in Discussing Spinal Manipulative Therapy Injury
J Manipulative Physiol Ther 1995 (May); 18 (4): 203–210
http://www.ncbi.nlm.nih.gov/pubmed/7636409
The words chiropractic and chiropractor have been incorrectly used in numerous publications dealing with SMT injury by medical authors, respected medical journals and medical organizations. In many cases, this is not accidental; the authors had access to original reports that identified the practitioner involved as a non–chiropractor. The true incidence of such reporting cannot be determined. Such reporting adversely affects the reader's opinion of chiropractic and chiropractors.

238)
Vertebral Artery Flow and Cervical Manipulation:
An Experimental Study
J Manipulative Physiol Ther 1999 (Sep); 22 (7): 431–435
http://www.ncbi.nlm.nih.gov/pubmed/10519558
We present an experimental model for investigations of vertebral artery hemodynamics during biomechanical interventions. We found a modest and transient effect of cervical manipulation on vertebral artery volume flow. The model may have further applications in future biomechanical research, for example, to determine whether any of several spinal manipulative techniques imposes less strain on the vertebral artery, thereby reducing possible future cerebrovascular accidents after such treatment.

239)
Vertebral Artery Flow and Spinal Manipulation:
A Randomized, Controlled and Observer Blinded Study
J Manipulative Physiol Ther 1998 (Mar); 21 (3): 141–144
http://www.ncbi.nlm.nih.gov/pubmed/9567231
To the best of our knowledge, this is the first study comparing flow velocity in the vertebral artery before and after spinal manipulative therapy. We found no significant changes in otherwise healthy subjects with a biomechanical dysfunction of the cervical spine.

240)
Vertebral Artery Volume Flow in Human Beings
J Manipulative Physiol Ther 1999 (Jul); 22 (6): 363–367
http://www.ncbi.nlm.nih.gov/pubmed/10478767
This appears to be the first in vivo Doppler study on human vertebral artery volume blood flow. Our results indicate that in symptom-free subjects there is no change in vertebral artery perfusion during rotation in spite of significant changes in flow velocity.

241)
A Review of the Reported Complications from Spinal Manipulation
John J. Triano, D.C., Ph.D.
http://www.chiro.org/LINKS/ABSTRACTS/Reported_Complications.shtml
In general, chiropractic treatment has little associated risk. Table TX5 displays the complications of spinal manipulation that have been reported [Haldeman, Haldeman, LeBoeuf-Yve]. Nearly all reactions to manipulation are mild and self-limiting, lasting less than 24 hours. Rarely, significant injury can result from injudicious or inappropriate use. The incidence of serious complication is less than 1:1,000,000.

242)
Risk Factors and Precipitating Neck Movements Causing Vertebrobasilar Artery Dissection After Cervical Trauma and Spinal Manipulation
Spine 1999 (Apr 15); 24 (8): 785–794
http://www.ncbi.nlm.nih.gov/pubmed/10222530
The literature does not assist in the identification of the offending mechanical trauma, neck movement, or type of manipulation precipitating vertebrobasilar artery dissection or the identification of the patient at risk. Thus, given the current status of the literature, it is impossible to advise patients or physicians about how to avoid vertebrobasilar artery dissection when considering cervical manipulation or about specific sports or exercises that result in neck movement or trauma.

243)
Claims of Risk From Chiropractic Care For Neck Pain Are Exaggerated Say Experts At The Texas Back InstitutePlano, TX - May 10, 2000
http://www.chiro.org/LINKS/ABSTRACTS/Stroke.shtml
Periodic claims posed in the public and professional media that Chiropractic treatment to the neck poses a high risk for stroke are unwarranted say the experts

at the Texas Back Institute.

244)
A risk assessment of cervical manipulation vs. NSAIDs for the treatment of neck pain.
Dabbs V, Lauretti WJ
J Manipulative Physiol Ther 1995 Oct;18(8):530-6
OBJECTIVE: We reviewed the literature to evaluate the risk of serious injury or death resulting from cervical manipulation and to assess the evidence that cervical manipulation is an effective treatment for mechanical neck pain. We also reviewed the literature to assess the risks and effectiveness of nonsteroidal anti-inflammatory drugs (NSAIDs), which are often used as the "conventional" first-line treatment for similar musculoskeletal conditions. DATA SOURCES: A series of Medicine literature searches were performed, and materials were reviewed from 1966-1994. Key words included: Chiropractic or Orthopedic Manipulation; Non-Steroidal Anti-Inflammatory Agents; Neck or Back Pain; Randomized Controlled Trials; Adverse Effects.
STUDY SELECTION: Studies and literature reviews that provided a numerical estimate of the risk of serious adverse effects or death from cervical manipulation or NSAID use were selected. Also, randomized, controlled studies that evaluated the effectiveness of manipulation or NSAID use for neck pain were included.
DATA SYNTHESIS: Although there are a small number of well-performed trials of cervical manipulation for neck pain, we were unable to locate even a single randomized, controlled trial examining NSAID use specifically for neck pain. As for comparative safety, the best available evidence indicates that NSAID use poses a significantly greater risk of serious complications and death than the use of cervical manipulation for comparable conditions.
CONCLUSION: The best evidence indicates that cervical manipulation for neck pain is much safer than the use of NSAIDs, by as much as a factor of several hundred times. There is no evidence tha indicates NSAID use is any more effective than cervical manipulation for neck pain.

245)
Misuse of the literature by medical authors in discussing spinal manipulative therapy injury.
Terrett AG. School of Chiropractic and Osteopathy, Faculty of Biomedical and Health Sciences, RMIT University, Bundoora, Australia.
J Manipulative Physiol Ther 1995 May;18(4):203-10
OBJECTIVE: This study was conducted to determine how the words chiropractic and chiropractor have been used in publications in relation to the reporting of complications from cervical spinal manipulation therapy (SMT). STUDY DESIGN: The study method was to collect recent publications relating to spinal manipulation iatrogenesis which mentioned the words chiropractic and/or chiropractor and then determine the actual professional training of the practitioner involved. METHOD: The training of the practitioner in each report was determined by one of three means: surveying previous publications, surveying subsequent publications and/or by writing to the author(s) of ten recent publications which had used the words chiropractic and/or chiropractor.

RESULTS: This study reveals that the words chiropractic and chiropractor commonly appear in the literature to describe SMT, or practitioner of SMT, in association with iatrogenic complications, regardless of the presence or absence of professional training of the practitioner involved.
CONCLUSION: The words chiropractic and chiropractor have been incorrectly used in numerous publications dealing with SMT injury by medical authors, respected medical journals and medical organizations. In many cases, this is not accidental; the authors had access to original reports that identified the practitioner involved as a nonchiropractor. The true incidence of such reporting cannot be determined. Such reporting adversely affects the reader's opinion of chiropractic and chiropractors.

246)
Inappropriate use of the title chiropractor and term chiropractic manipulation in the peer-reviewed biomedical literature.
Wenban AB. Chiropr Osteopat. 2006 Aug 22;14(1):16 [Epub ahead of print]
ABSTRACT: BACKGROUND: The misuse of the title chiropractor and term chiropractic manipulation, in relation to injury associated with cervical spine manipulation, have previously been reported in the peer-reviewed literature. The objectives of this study were to 1) Prospectively monitor the peer-reviewed literature for papers reporting an association between chiropractic, or chiropractic manipulation, and injury; 2) Contact lead authors of papers that report such an association in order to determine the basis upon which the title chiropractor and/or term chiropractic manipulation was used; 3) Document the outcome of submission of letters to the editors of journals wherein the title chiropractor, and/or term chiropractic manipulation, had been misused and resulted in the over-reporting of chiropractic induced injury.
METHODS: One electronic database (PubMed) was monitored prospectively, via monthly PubMed searches, during a 12 month period (June 2003 to May 2004). Once relevant papers were located, they were reviewed. If the qualifications and/or profession of the care provider/s were not apparent, an attempt was made to confirm them via direct e-mail communication with the principal researcher of each respective paper. A letter was then sent to the editor of each involved journal.
RESULTS: A total of twenty four different cases, spread across six separate

publications, were located via the monthly PubMed searches. All twenty four cases took place in one of two European countries. The six publications consisted of four case reports, each containing one patient, one case series, involving twenty relevant cases, and a secondary report that pertained to one of the four case reports. In each of the six publications the authors suggest the care provider was a chiropractor and that each patient received chiropractic manipulation of the cervical spine prior to developing symptoms suggestive of traumatic injury. Regarding two of the four case reports contact with the principal researcher revealed that the care provider was not a chiropractor, as defined by the World Federation of Chiropractic. The authors of the other two case reports did not respond to my communications. Regarding the case series, which involved twenty relevant cases, the principal researcher conceded that the term chiropractor had been inappropriately used and that his case series did not relate to chiropractors who had undergone appropriate formal training. The author of the secondary report, a British Medical Journal editor,

conceded that he had misused the title chiropractor. Letters to editors were accepted and published by all four journals to which they were sent. To date one of the four journals has published a correction.
CONCLUSIONS: The results of this year-long prospective review suggests that the words chiropractor and chiropractic manipulation are often used inappropriately by European biomedical researchers when reporting apparent associations between cervical spine manipulation and symptoms suggestive of traumatic injury. Furthermore, in those cases reported here, the spurious use of terminology seems to have passed through the peer-review process without correction. Additionally, these findings provide further preliminary evidence, beyond that already provided by Terrett, that the inappropriate use of the title chiropractor and term chiropractic manipulation may be a significant source of over-reporting of the link between the care provided by chiropractors and injury. Finally, editors of peer-reviewed journals were amenable to publishing letters to editors, and to a lesser extent corrections, when authors had inappropriately used the title chiropractor and/or term chiropractic manipulation.

247)
Stroke Prevention Guidelines Issued
http://www.chiro.org/LINKS/ABSTRACTS/Stroke_Prevention_Guidelines.shtml
"Stroke is... killing about 160,000 Americans each year," Dr. Ralph Sacco of the departments of neurology and public health at Columbia University in New York told reporters at a telephone press conference on Thursday. "About 700,000 people will have a new or recurrent stroke each year," he added, "and stroke incidence seems to be on the rise". To reduce risk of stroke, the NSA offers these basic recommendations.

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c) Iatrogenic injury

248)
Iat·ro·gen·ic
Pronunciation: I-a-tro-jen-ik
Function: *adjective*
Meaning: **Induced inadvertently by a physician or surgeon, or by medical treatment or diagnostic procedures <an *iat·ro·gen·ic* rash>**
- **iat·ro·gen·i·cal·ly** /-'jen-i-k(&-)lE/ *adverb*
- **iat·ro·ge·nic·i·ty** /-j&-'nis-&t-E/ *noun*, *plural* **-ties**

> **"Medicine is now a high risk industry, like aviation. But, the chance of dying in an aviation accident is one in 2 million, while the risk of dying from a medical accident is one in 200!"**
>
> **––Dr. Leape of the Harvard Medical School of Public Health**

A) The number of physicians in the U.S. is 700,000
B) Accidental deaths caused by Physicians per year are 120,000
C) Accidental deaths per physician is 0.171 (or 1 per 6 MDs)
Statistics courtesy of U.S. Dept. of Health Human Services (these are "conservative" estimates)

Iatrogenic Abstracts

249)
The Antibiotic Abuse Page
http://www.chiro.org/LINKS/Antibiotic_Abuse.shtml
This new page explores the emergence of antibiotic resistant bacteria because of medical over-reliance on antibiotics as a cure-all, and due to use of antibiotics as a fattening agent in animal feed.

250)
The American Iatrogenic Association
Medical errors are the not only way that consumers are harmed. The Centers for Disease Control and Prevention estimates that **2 million people annually acquire infections while they are hospitalized** (nosocomial infection) and **90,000 people die from those infections**. More than 70 percent of hospital-acquired infections have become resistant to at least one of the drugs commonly used to treat them, largely due to the overprescribing of antibiotics by physicians.

251)
No-fault Compensation for Treatment Injury in New Zealand: Identifying Threats to Patient Safety in Primary Care

British Medical Journal Quality & Safety 2011 (Jan 12) [Epub ahead of print]

http://www.ncbi.nlm.nih.gov/pubmed/21228439
New Zealand's no-fault treatment injury claims database provides information about primary care patient safety events from an unusual 'no-fault' perspective. **This analysis reinforces previous research identifying medication as a high-risk primary care activity and further identifies other primary care activities (dental care, injections, venepuncture, cryotherapy and ear syringing) as carrying important risks for patient harm**.

252)
Widely Used Anti-Inflammatory Drug Risky Even in Small Doses
MedPage Today ~ October 26, 2009
http://www.chiro.org/LINKS/ABSTRACTS/Widely_Used_Anti-Inflammatory_Drug_Risky.shtml
Even at low doses, naproxen (Aleve, Anaprox, Naprosyn, Naprelan) may increase the risk of upper gastrointestinal complications, researchers said here. Patients taking a 500-mg/day dose had a 2.5-fold increased risk of hospitalization from complicated gastric or duodenal ulcer, while those on the 750-mg/day dose had almost a threefold increased risk, Gurkirpal Singh, MD, of Stanford University, and colleagues reported at the American College of Gastroenterology meeting. [**1**]

253)
Money and Spinal Surgery: What Happened to the Patient?
JAMA. 2010 (Apr 7); 303 (13): 1259–1265
http://jama.ama-assn.org/content/303/13/1259.full?home
There is a lack of evidence-based support for the efficacy of complex fusion surgeries over conservative surgical decompression for elderly stenosis patients. There is, however, a significant financial incentive to both hospitals and surgeons to perform the complex fusions. Spinal stenosis is the most frequent cause for spinal surgery in the elderly. There has been a slight decrease in these surgeries between 2002 and 2007. However, there has also been an overall 15 fold increase in the more complex spinal fusions (360 degree spine fusions). Deyo et. al. in yesterday's issue (April 7, 2010) of the Journal of the American Medical Association concludes that "It is unclear why more complex operations are increasing. It seems implausible that the number of patients with the most complex spinal pathology increased 15-fold in just 6 years. The introduction and marketing of new surgical devices and the influence of key opinion leaders may stimulate more invasive surgery, even in the absence of new indications…financial incentives to hospitals and surgeons for more complex procedures may play a role…" There is a significant difference in mean hospital costs for simple decompression versus complex surgical fusion. The cost of decompression is $23,724 compared to an average of $80,888 for complex fusion. Despite the much higher cost, there is no evidence of superior outcomes and there is greater morbidity associated with the complex fusion. The surgeon is typically reimbursed only $600 to $800 for simple decompression and approximately ten times more, $6,000 to $8,000 for the complex fusion.

254)
Development, Testing, and Findings of a Pediatric-Focused Trigger Tool to Identify Medication-Related Harm in US Children's Hospitals
Pediatrics 2008 (Apr); 121 (4): e927–935
http://pediatrics.aappublications.org/content/121/4/e927.full
Adverse drug event rates in hospitalized children are substantially higher

than previously described. Most adverse drug events resulted in temporary harm, and 22% were classified as preventable. Only 3.7% of these injuries were identified by using traditional voluntary reporting methods! Our pediatric-focused trigger tool is effective at identifying adverse drug events in inpatient pediatric populations. **[Editorial Commentary: These findings (that only 3.7% of adverse events find their way into hospital error reports) is very alarming, and suggests that previous reports have only documented the tip of the iceberg.]**

255)
Early Life Infections Improve the Function of the Immune System
American Journal of Clinical Chiropractic 2006 (Apr); 16 (2): 22–25
http://www.chiro.org/Immunity/
This collection of medical citations demonstrates that **early exposure to**

antibiotic use and Pertussis vaccination contribute to the development of atopic disorders such as asthma, and hay fever, and may also be associated with the onset of pediatric lymphoblastic leukemia

256)
Gastrointestinal Toxicity of Nonsteroidal Anti-inflammatory Drugs
New England Journal of Medicine 1999 (Jun 17); 340 (24): 1888–99
http://aramis.stanford.edu/downloads/GI..NSAID.pdf
Starting in the early 1970s, numerous new NSAIDs were developed that were initially believed to be devoid of gastrointestinal toxicity, but few, if any, are entirely harmless. These agents constitute one of the most widely used classes of drugs, with more than 70 million prescriptions and more than 30 billion over-the-counter tablets sold annually in the United States. [9] Although NSAIDs are generally well tolerated, adverse gastrointestinal events occur in a small but important percentage of patients, resulting in substantial morbidity and mortality.

257)
Recent Considerations in Nonsteroidal Anti-inflammatory Drug Gastropathy
American Journal of Medicine 1998 (Jul 27); ; 105 (1B): 31S-38S
http://www.ncbi.nlm.nih.gov/pubmed/9715832
Conservative calculations estimate that approximately **107,000 patients are hospitalized annually for nonsteroidal anti-inflammatory drug (NSAID)-related gastrointestinal (GI) complications and at least 16,500 NSAID-related deaths occur each year among arthritis patients alone. The figures for all NSAID users would be overwhelming, yet the scope of this problem**

is generally under-appreciated. Analysis of these data indicates that: (1) osteoarthritis (OA) and rheumatoid arthritis (RA) patients are **2.5—5.5 times more likely than the general population to be hospitalized for NSAID-related GI events**; (2) the absolute risk for serious NSAID-related GI toxicity remains constant and the **cumulative risk increases over time**; (3) **there are no reliable warning signals- >80% of patients with serious GI complications had no prior GI symptoms**; (4) independent risk factors for serious GI events were age, prednisone use, NSAID dose, disability level, and previous NSAID-induced GI symptoms; and (5) **antacids and H2 antagonists do not prevent NSAID-induced gastric ulcers, and high-risk NSAID users who take gastro-protective drugs are more likely to have serious GI complications than patients not taking such medications**. **Currently,**

limiting NSAID use is the only way to decrease the risk of NSAID-related GI events.

258)
Prescription-related Illness--A Scandalous Pandemic
J Eval Clin Pract 2004 (Nov); 10 (4): 491–497
http://www.ncbi.nlm.nih.gov/pubmed/15482411
Prescribed drugs are now a major cause of morbidity and mortality, particularly in the elderly. The extent of this pandemic is described and its likely causes in primary care are identified: unnecessary prescribing, imprecise diagnosis, inadequate undergraduate and postgraduate education in pharmacology and therapeutics, the uncritical application of evidence-based medicine, the outstanding development of new drugs and their sometimes unjustified promotion. Urgent action is recommended under seven headings, by health administration, epidemiologists, medical educators and prescribing doctors.

259)
Death by Medicine
Life Extension Magazine ~ March 2004
http://www.chiro.org/LINKS/FULL/Death_By_Medicine.html
No one had ever analyzed and combined ALL of the published literature dealing with injuries and deaths caused by government-protected medicine. That has now changed. A group of researchers meticulously reviewed the statistical evidence and their findings are absolutely shocking. This fully referenced report shows the number of people having in-hospital, adverse reactions to prescribed drugs to be 2.2 million per year. The number of unnecessary antibiotics prescribed annually for viral infections is 20 million per year. The number of unnecessary medical and surgical procedures performed annually is 7.5 million per year. The number of people exposed to unnecessary hospitalization annually is 8.9 million per year. **The most stunning statistic, however, is that the total number of deaths caused by conventional medicine is an astounding 783,936 per year!!!**

260)
Adverse Side Effects from Medication Are Common
LE Magazine 2003 (Dec)

http://www.chiro.org/LINKS/ABSTRACTS/Adverse_Side_Effects.shtml
"This study is important because it showed that adverse drug events were found in 23% of ambulatory patients, a rate five times as high as that found in another recent study of the community-living elderly," said Dr. Gandhi. "We probably found such a high rate because we called patients directly, while other studies have relied mainly on chart review."

261)
NSAIDs and Musculoskeletal Treatment:
What Is the Clinical Evidence?
PHYSICIAN AND SPORTSMEDICINE 2003 (Jan); 31 (1)
http://www.chiro.org/LINKS/FULL/NSAIDs_and_Musculoskeletal_Treatment.html
Nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly prescribed for musculoskeletal injuries because the conditions are believed to be inflammatory in nature. However, **because inflammation is a necessary component in the healing process, decreasing inflammation may prove counterproductive**. Also, many tendon injuries called 'tendinitis' are, in fact, degenerative and not inflammatory conditions. **An analysis of the pathophysiology and healing of musculoskeletal injuries questions the use of NSAIDs in many treatment protocols. Because NSAIDs have profound side effects, they should not automatically be the first choice for treating musculoskeletal injuries**.

262)
Severe Complication of a Commonly Prescribed Drug:
Minocycline-Induced Lupus
J Am Board Fam Pract 2002 (May); 15 (3):239–241
http://www.jabfm.org/cgi/reprint/15/3/239
The constellation of symptoms that includes persistent fever, weight loss, general malaise with rash, myalgias, and arthritis brings a number of serious conditions into consideration: malignancies, connective tissue diseases, and systemic infections. Drug-induced complications also fall into this differential diagnosis. Drug-induced lupus is most commonly associated with procainamide (first described in 1962), hydralazine, chlorpromazine, isoniazid, a-methyldopa, and quinidine. **From 46 to 70 drugs can cause drug-induced lupus**.

263)
Understanding NSAIDs: From Aspirin to COX-2
Clin Cornerstone 2001; 3 (5): 50–60
http://www.ncbi.nlm.nih.gov/pubmed/11464731
Nonsteroidal anti-inflammatory drugs (NSAIDs) annually account for 70 million prescriptions and 30 billion over-the-counter (OTC) medications sold in the United States alone. Some formulas are safe enough to be sold OTC for use in infants with fever, **while others are available only as a prescription medication and are a leading cause of iatrogenic reactions, hospitalizations, and death**.

264)
A Comparison of Iatrogenic Injury Studies in Australia and the USA. II: Reviewer Behaviour and Quality of Care

Int J Qual Health Care 2000 (Oct); 12 (5): 379–388
http://www.ncbi.nlm.nih.gov/pubmed/11079217
This article found that approximately **2% of those admitted to a hospital experience major disability and/or death.**

265)
Incidence of Adverse Drug Reactions in Hospitalized Patients
JAMA 1998 (Apr 15); 279 (15): 1200–1205
http://jama.ama-assn.org/content/279/15/1200.full
Although the abstract quotes no numbers in the text, the body of the article states "that **more than 2 million Americans become seriously ill every year from reactions to drugs that were correctly prescribed and taken, and that 106,000 Americans die annually from those side effects**." (emphasis added) **A related JAMA Editorial in the same issue** also states that "**ADRs may be the fourth to sixth leading cause of death, and that drug-related injuries occur in 6.7% of hospitalized patients**."

266)
Therapeutic Misadventures With Acetaminophen:
Hepatoxicity After Multiple Doses in Children
J Pediatr 1998 (Jan); 132 (1): 22—27
http://www.ncbi.nlm.nih.gov/pubmed/9469995
Twenty-four of 43 patients (53%) died, with an additional three surviving after orthotopic liver transplantation. Parents should be advised about the potential hepatotoxicity of acetaminophen when given to ill children in doses exceeding weight-based recommendations.

267)
Prescribing of Nonsteroidal Anti-inflammatory Drugs in General Practice: Determinants and Consequences
Aliment Pharmacol Ther 1997 (Apr);; 11 (2):; 293–298
http://www.ncbi.nlm.nih.gov/pubmed/9146765
The data are compatible with 1 hospital admission per 2823 NSAID prescriptions (95% confidence intervals 2098-8110) and they emphasize the need for strategies to reduce levels of NSAID prescribing.

268)
Emergency Admissions for Upper Gastrointestinal Disease and Their Relation to NSAID Use
Aliment Pharmacol Ther 1997 (Apr); 11 (2): 283–291
http://www.ncbi.nlm.nih.gov/pubmed/9146764
There is a strong association between NSAID use and propensity for upper gastrointestinal emergency admission; NSAID use is associated with significant morbidity and mortality each year in UK.

269)
A Risk Assessment of Cervical Manipulation vs. NSAIDs for the Treatment of Neck Pain

J Manipulative Physiol Ther 1995 (Oct); 18 (8): 530–536
http://www.ncbi.nlm.nih.gov/pubmed/8583176
As for comparative safety, the best available evidence indicates that NSAID use poses a significantly greater risk of serious complications and death than the use of cervical manipulation for comparable conditions. In conclusion, **the best evidence indicates that cervical manipulation for neck pain is much safer than the use of NSAIDs, by as much as a factor of several hundred times.** There is no evidence that indicates NSAID use is any more effective than cervical manipulation for neck pain.

270)
Effect of Non–steroidal Anti–inflammatory Drugs on the Course of Osteoarthritis
Lancet 1989 (Sep 2); 2 (8662): 519–522
http://www.ncbi.nlm.nih.gov/pubmed/2570233?dopt=Abstract
To test the hypothesis that non–steroidal anti–inflammatory drugs (NSAIDs) accelerate the progression of osteoarthritis by reducing synthesis of vasodilator prostaglandins, thereby diminishing joint perfusion, 105 osteoarthritis patients awaiting hip arthroplasty were treated prospectively with a strong or weak prostaglandin synthesis inhibitor, indomethacin or azapropazone, respectively. **In the indomethacin group the affected hips lost joint space more rapidly than did the contralateral hips, a difference not seen in the azapropazone group.**

271)
Even Small Amounts of Tylenol May Be Dangerous for Infants and Small Children
http://www.chiro.org/pediatrics/ABSTRACTS/Small_Amounts_of_Tylenol.shtml
In a paper published in Contemporary Pediatrics, Dr. James E. Heubi states that in infants and small children, studies have indicated that the toxic dose is less than twice the recommended dose. Studies have also shown that it is very easy to mistakenly give children too much acetaminophen and, as a result, endanger their lives and health.

272)
Child Acetaminophen Deaths Reported
http://www.chiro.org/pediatrics/ABSTRACTS/Acetaminophen.shtml
At least 24 children in the United States have died and three have required liver transplants after receiving accidental overdoses of acetaminophen –– the most widely used medication for relief of pain and fever in children and infants, according to a report in the Journal of Pediatrics.

273)
Public Citizen Petitions FDA to Take Celebrex and Bextra Off the Market
Public Citizen ~ January 24, 2005
http://www.chiro.org/LINKS/ABSTRACTS/Public_Citizen.shtml
Public Citizen today petitioned the U.S. Food and Drug Administration (FDA) to immediately remove two widely prescribed pain relievers, Celebrex and Bextra,

from the market because they increase the risk of heart attacks in patients. The group also urged the FDA to cancel plans to approve two other drugs in the same class.

Unnecessary Surgical Procedures

In 1974, the Congressional Committee on Interstate and Foreign Commerce held hearings on unnecessary surgery. Their findings from the first surgical second opinion program found that 17.6% of recommendations for surgery were not confirmed. The House Subcommittee on Oversight and Investigations extrapolated these figures to estimate that, on a nationwide basis, **there were 2.4 million unnecessary surgeries performed annually resulting in 11,900 deaths at an annual cost of $3.9 billion.** [1]

With the total number of lower back surgeries having been estimated in 1995 to exceed 250,000 in the U.S. at a hospital cost of $11,000 per patient. [2] This would mean that the total number of unnecessary back surgeries each year in the U.S. could approach 44,000, costing as much as $484 million.

From: **Testimony to the Department of Veterans Affairs' Chiropractic Advisory Committee**
George B. McClelland, D.C., Foundation for Chiropractic Education and Research
March 25, 2003

[1] US Congressional House Subcommittee Oversight Investigation. *Cost and Quality of Health Care: Unnecessary Surgery*. Washington, DC: Government Printing Office, 1976

[2] Herman R. *Back Surgery*. Washington Post [Health Section], April 18, 1995

274)
Medicare Patients Dying at Rate of 195,000 a Year Due to Medical Errors HealthGrades Quality Study. Patient Safety in American Hospitals ~ July 2004
http://www.seniorjournal.com/NEWS/Health/4-08-07Errors.htm
An average of 195,000 Medicare patients in the U.S. died due to potentially preventable, in-hospital medical errors in each of the years 2000, 2001 and 2002, according to a new study of 37 million patient records that was released in July by HealthGrades, the healthcare quality company. **That's 534 people killed every day!**

275)
Free Drugs For Grandma!
Todays Chiropractic ~ March 2004
http://www.chiro.org/LINKS/FULL/Free_Drugs_For_Grandma.shtml

Uncle Sam now proposes giving senior Americans free prescription drugs. While this ploy may help many cash-strapped seniors financially, it will definitely be a windfall for the drug companies—as if they needed more profits. The drug industry last year was the most profitable industry on Wall Street, with earnings of over 40 percent. Considering the fact that Americans are the most over-medicated society in the history of the world, or the fact that the American Medical Asociation estimates 2.2 million adverse drug reactions occur every year resulting in over 100,000 deaths, people are nonetheless sold on "wonder" drugs as their quick-fix salvation to serious health problems. I recall one article that mentioned the average senior already takes 28 prescriptions.

276)
The True Cost of Drugs
Rush Limbaugh Online and Anne Boone
http://www.chiro.org/LINKS/ABSTRACTS/The_Real_Cost_Of_Drugs.shtml
Did you ever wonder how much it costs a drug company for the active ingredient in prescription medications? Some people think it must cost a lot, since many drugs sell for more than $2.00 per tablet. In reality, the markup on many popularly used drugs ranges from 2000% to 224,973%.

277)
Use Caution With Pain Relievers
FDA Consumer Magazine ~ January-February 2003
http://www.chiro.org/LINKS/FULL/Use_Caution_With_Pain_Relievers.shtml
The committee also recommended that labeling for aspirin and other non-steroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen and naproxen include **warnings about the potential for gastrointestinal bleeding** that may be associated with use of these products. Aspirin is sold under brand names such as Bayer and St. Joseph's. Ibuprofen is sold under names such as Advil and Motrin. Naproxen is sold under the name Aleve. There are generic versions available for all of these products, as well.

278)
Nearly One in Five Seniors Takes Medication for Chronic Pain
http://www.chiro.org/LINKS/FULL/Nearly_One_in_Five_Seniors.shtml
Nearly one in five Americans over age 60 regularly takes medication for chronic pain, according to a 1997 survey. The majority of the 7.5 million seniors who take medication for chronic pain say their medications are effective, but **one in four suffers from side effects caused by the drugs**. Nearly 40 percent say doctors don't discuss possible side effects of pain medication they prescribe, and half say doctors don't warn them about potential drug interactions.

279)
Medication Errors Observed in 36 Health Care Facilities
Arch Intern Med 2002 (Sept 9); 162 (16): 1897–1903
http://www.ncbi.nlm.nih.gov/pubmed/12196090?dopt=Abstract
Answering 20% of the questions wrong on tests taken in school is generally considered better than average, earning a student a B or C letter grade. But when

it comes to hospitals providing medication to patients, **would you consider dosage mistakes made 20% of the time acceptable?** In this study, one in five doses were incorrect; 7% of all dosages (or nearly 40% of errors) were deemed potentially harmful to the patient. In order of likelihood, the most frequent errors were: drugs given at the wrong time; omission of the correct medication; incorrect dosages; or unauthorized drugs given.

280)
Drug-induced Iatrogenic Intraparenchymal Hemorrhage
Neurosurg Clin N Am 2002 (Jul); 13 (3): 299–312
http://www.ncbi.nlm.nih.gov/pubmed/12486920?dopt=Abstract
Intracerebral hemorrhage is bleeding into the brain parenchyma with possible extension into the ventricles and subarachnoid space. Each year, approximately 37,000 to 52,400 people suffer from intraparenchymal hemorrhage (IPH) in the United States. This rate is expected to rise dramatically in the next few decades as a result of the increasing age of the population and a change in racial demographics. IPH accounts for 8% to 13% of all stroke cases and is associated with the highest mortality rate.

281)
Perioperative Deaths: A Further Comparative Review of Coroner's Autopsies with Particular Reference to the Occurrence of Fatal Iatrogenic Injury
Ann Acad Med Singapore 2000 (Jul); 29 (4): 486–497
http://www.chiro.org/LINKS/ABSTRACTS/Perioperative_Deaths.shtml
Another article finds that approximately 2% of those admitted to a hospital experience death, as revealed at autopsy. It goes on to say that "it is not clear why initial, supposedly elective, interventions should be associated with an apparently greater risk of iatrogenic injury than those classified as emergency procedures."

Iatrogenic Articles

282)
The Antibiotic Warnings Page
http://www.chiro.org/LINKS/Antibiotic_Abuse.shtml
This new page explores the emergence of antibiotic resistant bacteria because of medical over-reliance on antibiotics as a cure-all, and due to use of antibiotics as a fattening agent in animal feed.

283)
36 Percent of Acute Liver Failures Are Linked to Acetaminophen
U.S. News & World Report July 2, 2001
http://www.chiro.org/LINKS/ABSTRACTS/Liver_Failures_Are_Linked_to_Acetaminophen.shtml
Mixing the pain reliever acetaminophen with alcohol can be hard on the liver; but

so can taking it while fasting. Yet, surprisingly, many doctors don't tell you that.

284)
U.S. Drug Safety Monitoring Must Be Expanded
JAMA 1998; 279: 1571-1573
http://www.chiro.org/LINKS/DISCONTINUED/US_Drug_Safety_Monitoring.html#jco71133
Thomas J. Moore of the Center for Health Policy Research at George Washington University Medical Center in Washington, D.C., and colleagues, note that an estimated **1.5 million people require hospitalization and 100,000 die each year because of injuries linked to prescription drugs.**

285)
The Challenge of Antibiotic Resistance
Scientific American March 1998
http://www.chiro.org/LINKS/FULL/Challenge_of_Antibiotic_Resistance.shtml
Last year an event doctors had been fearing finally occurred. In three geographically separate patients, an often deadly bacterium, Staphylococcus aureus, responded poorly to a once reliable antidote--the antibiotic vancomycin. Fortunately, in those patients, the staph microbe remained susceptible to other drugs and was eradicated. But the appearance of S. aureus not readily cleared by vancomycin foreshadows trouble.

286)
CDC Reports:
Hospital Infections and Drug-resistance Rise in U.S.
http://www.chiro.org/ChiroZine/ABSTRACTS/cdc.shtml
The rate at which patients pick up an infection while being treated in a U.S. hospital has increased 36 percent in the past 20 years, U.S. health researchers said Wednesday.

287)
Abstaining From Medicine May Cure Drug Rebound Headache
March 23, 1998 --
http://www.pslgroup.com/dg/634de.htm
Many people who suffer from chronic daily headaches would find relief simply by not taking daily headache medicine, according to a report in this month's issue of the Western Journal of Medicine.

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d) Chiropractic in the Military

288)
In November 2000, President Bill Clinton signed the National Defense Authorization Act for Fiscal Year 2001. The legislation included a historic provision requiring access to chiropractic services for active-duty personnel and full implementation of chiropractic benefits over a five-year period in all service branches of the military; and mandated that the Department of Defense develop an implementation plan to ensure adequate provision of those benefits.

Since the introduction of chiropractic services to the Veterans Health Administration (VA) in 2004, there have been a number of developments at the national and local levels. One development of much success and pride is the academic affiliations for training chiropractic students.

Part of the VA's mission is to promote excellence in the education of future health care professionals. This educational effort is led by the Office of Academic Affiliations, which oversees the training of health care professionals who will serve the needs of the VA and the nation. In 2008, more than 30,000 medical residents, over 20,000 medical students, and in excess of 50,000 other health professionals received some or all of their clinical training at VA facilities. This is accomplished through partnerships with more than 1,300 academic institutions including schools of medicine, dentistry, optometry, podiatry and nursing, among many others.

As many readers may know, chiropractic colleges are now among this group as well. As of April 2009, 17 VA facilities have established academic affiliations with 11 chiropractic colleges (**see table**) and several others are in development. These affiliations are not required by the law that established chiropractic services in the VA; rather, they arose from the successful work of individual VA doctors of chiropractic, the willingness and support of the given VA facilities, and the cooperation of the affiliated chiropractic colleges.

The first such affiliation was realized in 2004, with several others initiated each year thereafter. To date, more than 500 chiropractic students have participated in VA training rotations. Under the direction of the supervising DC, chiropractic students function much like they do in a chiropractic college clinic setting, taking patient histories, performing examinations and providing treatment.

These training opportunities - called clerkships in medical education - mark a significant step in the evolution of chiropractic education. Our students are exposed to a broad patient population, hospital policies and procedures, and integrated case management strategies. A number of chiropractic colleges had developed such opportunities with other medical facilities prior to the VA program. However, at present the VA is the largest integrated health care system in which chiropractic trainees can acquire clinical skills along-side other medical professionals.

More recently (Oct. 17, 2006), President George W. Bush signed H.R.5122, the

National Defense Authorization Act for FY 2007. Section 712 calls for the Secretary of Defense to evaluate the cost and feasibility of making chiropractic services available to all active-duty military personnel, reservists, retirees and eligible dependents; and to submit a report to the House and Senate Armed Services

Committee by March 31, 2008.

VA Medical Facility	Affiliated Chiropractic Educational Institution
Buffalo, N.Y.	New York Chiropractic College
Canandaigua & Rochester, N.Y.	New York Chiropractic College
Bath, N.Y.	New York Chiropractic College
West Haven & Newington, Conn.	University of Bridgeport College of Chiropractic
St. Louis	Logan College of Chiropractic
Kansas City, Mo.	Cleveland Chiropractic College Kansas City
Miami	New York Chiropractic College
West Los Angeles	Southern California University of Health Sciences
Dallas	Parker College of Chiropractic Palmer College of Chiropractic
Temple, Texas	Texas Chiropractic College
Martinsburg, W.V.	Life University Chiropractic College
Sioux Falls, S.D.	Northwestern Health Sciences University
Danville, Ill.	National University of Health Sciences
Ft. Harrison, Mont.	Northwestern Health Sciences University
Jackson, Miss.	Palmer College of Chiropractic

286)
H.R.5202 Mandates Chiropractic at Every VA Medical Center by 2010
Providing chiropractic benefits to the nation's veterans has been a goal of the chiropractic profession for decades, the profession finally reached its goal in January 2002, when President George W. Bush signed into law the Department of Veterans Affairs Health Care Programs Enhancement Act, which established a permanent chiropractic benefit within the Veterans Affairs health care system.

Among other things, the Health Care Programs Enhancement Act authorized the hiring of doctors of chiropractic in the VA health system, and mandated that chiropractic care be available in at least one VA medical center of each geographic service area of the Veterans Health Administration. It also called for the creation of an advisory committee, designed to assist the Secretary of Veterans Affairs in the

development and implementation of the chiropractic health program.

In November 2003, the chiropractic advisory committee submitted a list of 38 recommendations to Sec. Anthony J. Principi that covered numerous aspects of chiropractic's involvement in the VA system. Included in the list were recommendations that doctors of chiropractic be "integrated into the VHA health care system as a partner in a health care team," and that chiropractic care be provided "at each of the major VHA facilities in each of the Veterans Integrated Service Networks, consistent with the VHA distance and time standards for specialty access."

In March 2004, based in part on the advisory committee's recommendations, Sec. Principi issued an order that the VA begin the inclusion of chiropractic care into the veterans health system. At the time he issued the order, Principi stated that one of his goals was "to ensure that chiropractic care is ultimately available and accessible to veterans who need it throughout the DVA system."

287)



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Management of Operation Iraqi Freedom and Operation Enduring Freedom veterans in a Veterans Health Administration chiropractic clinic: A case series

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http://www.rehab.research.va.gov/jour/10/471/pdf/lisi.pdf

Abstract — Operation Iraqi Freedom/Operation Enduring Freedom (OIF/OEF) veterans commonly seek care for musculo-skeletal complaints in Veterans Health Administration (VHA) facilities. Chiropractic services for musculoskeletal conditions have recently been introduced to VHA. No reports have been published on chiropractic care for OIF/OEF veterans. This study was designed to describe elements of the processes and outcomes of care for OIF/OEF veterans in a VHA chiropractic clinic. A retrospective review of consecutive cases consulted to one VHA chiropractic clinic was conducted.

Thirty-one cases were identified. Consultations originated in primary care and specialty clinics that commonly manage musculoskeletal conditions. Military traumatic injury and posttraumatic stress disorder were common. Adverse effects of treatment were mild and transitory. In 19 cases (61%), a pain decrease above the threshold for minimally important change was reported. This article is the first description of health services delivered to OIF/OEF veterans in a VHA chiropractic clinic. Chiropractic management was safe in these cases, and results support the hypothesis that such management may be effective in certain OIF/OIF veterans. A better understanding of the characteristics of these particular patients and the processes of care received in VHA chiropractic clinics is needed to improve the clinical care of these veterans.

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e) Chiropractic and Pediatrics

288)
ADD/ADHD:

Cervical kyphosis is a possible link to attention-deficit/hyperactivity disorder
Journal: J Manipulative Physiol Ther. 2004;27(8):e14
Authors: Bastecki AV, Harrison DE, Haas JW

Abstract:
Objective: To discuss the case of a patient who was diagnosed with attention-deficit/hyperactivity disorder (ADHD) by a general practitioner and was treated with chiropractic care.
Clinical features: A 5-year-old patient was diagnosed with ADHD and treated by a pediatrician unsuccessfully with methylphenidate (Ritalin), Adderall, and Haldol for 3 years. The patient received 35 chiropractic treatments during the course of 8 weeks. A change from a 12 degrees C2-7 kyphosis to a 32 degrees C2-7 lordosis was observed after treatment. During chiropractic care, the child's facial tics resolved and his behavior vastly improved. After 27 chiropractic visits, the child's pediatrician stated that the child no longer exhibited symptoms of ADHD. The changes in structure and function may be related to the correction of cervical kyphosis.
Conclusion: The patient experienced significant reduction in symptoms. Additionally, the medical doctor concluded that the reduction in symptoms was significant enough to discontinue the medication. There may be a possible connection that correction of cervical kyphosis in patients with ADHD may produce a desirable clinical outcome.

289)
An evaluation of chiropractic manipulation as a treatment of hyperactivity in children
Journal: J Manipulative Physiol Ther. 1989 12(5):353-63
Authors: Giesen JM, Center DB, Leach RA
Abstract:
The principle aim of this study was to determine the effectiveness of chiropractic manipulative therapy in the treatment of children with hyperactivity. Using blinds between investigators and a single subject research design, the investigators evaluated the effectiveness of the treatment for reducing activity levels of hyperactive children. Data collection included independent evaluations of behavior using a unique wrist-watch type device to mechanically measure activity while the children completed tasks simulating school-work. Further evaluations included electrodermal tests to measure autonomic nervous system activity. Chiropractic clinical evaluations to measure improvement in spinal biomechanics were also completed. Placebo care was given prior to chiropractic intervention. Data were analyzed visually and using nonparametric statistical methods. Five of seven children showed improvement in mean behavioral scores from placebo care to

treatment. Four of seven showed improvement in arousal levels, and the improvement in the group as a whole was highly significant (p = 0.009). Agreement between tests was also high in this study. For all seven children, three of the four principal tests used to detect improvement were in agreement either positively or negatively (parent ratings of activity, motion recorder scores, electrodermal measures, and X-rays of spinal distortions). While the behavioral improvement taken alone can only be considered suggestive, the strong interest agreement can be taken as more impressive evidence that the majority of the children in this study did, in fact, improve under specific chiropractic care. The results of this study, then, are not conclusive, however, they do suggest that chiropractic manipulation has the potential to become an important nondrug intervention for children with hyperactivity. Further investigation in this area is certainly warranted.

Breastfeeding Dysfunction:

290)
Chiropractic care for infants with dysfunctional nursing: a case series
Journal: Jour Clin Chiro Pediatrics. 1999;4(1):241-244
Authors: Hewitt E

Abstract:
Objective: To present the cases of two infants with dysfunctional nursing who were able to breastfeed normally after receiving chiropractic care. Physiological mechanisms are presented explaining how chiropractic care may restore normal suckling.
Clinical Features: The first case involves an 8-week-old girl unable to maintain suction while breastfeeding since birth. She was diagnosed by a chiropractor with cranial subluxations. The second infant a 4-week-old boy, had been unable to suckle effectively since birth. He was diagnosed with spinal and cranial subluxations.
Intervention and Outcome: Each infant received diversified spinal adjusting and/or craniosacral therapy based on the clinical findings. The first was able to nurse normally after receiving 2 chiropractic adjustments over 14 days. The second infant suckled immediately following his first adjustment and received a total of 4 adjustments in 21 days.
Conclusions: This paper reports two cases in which chiropractic care was followed by immediate resolution of dysfunctional nursing. Further research is needed to determine the role of the chiropractic adjustment in normalizing neonatal suckling.

291)
Exploring the effectiveness of chiropractic treatments for young infants with ongoing breastfeeding difficulties
In: Proceedings of the 134th Annual Meeting of the American Public Health Association. Washington, D.C.: American Public Health Association. Washington, D.C., Nov 4-7, 2007:
http://apha.confex.com/apha/135am/techprogram/paper_151981.htm
Authors: Spegman A, Haas M, Hewitt EG

Abstract:
National and international public health goals promote breastfeeding throughout the 1st year of life. The majority of mothers exclusively breastfeed after birth, yet 37% terminated breastfeeding by 2-weeks and 70% by 2-months. Mothers who discontinued breastfeeding after 1-month reported problems with their infant latching or sucking. It is noteworthy that the bulk of intervention for breastfeeding difficulty is mother-directed. Fewer interventions are available to the motivated mother whose breastfeeding commitment is thwarted by problems originating with the infant.
Given the increasing use of CAM therapies, it is not surprising that mothers are seeking chiropractic consultation for ongoing breastfeeding difficulties. Neonatal assessments often reveal an abnormal head posture, tongue motion, or suck reflex. It is possible that positions in-utero or trauma during birth may disturb the neuromuscular coordination and stamina required for successful breastfeeding. It is hypothesized that chiropractic care may reduce such dysfunction through gentle adjustments of the head and neck.

A preliminary study was conducted to assess the feasibility of research on the efficacy of chiropractic treatment for breastfeeding difficulties. Participants included 12 self-referred mothers and their infants, aged 12-days to 9-weeks (M=5.2wks). Prior to care, 9 mothers consulted lactation specialists (M=3 times) and reported dissatisfaction with breastfeeding (M=2.1 on 10-point scale; 10=satisfied). Infants received 3-9 chiropractic treatments (M=6) over several weeks. This presentation describes characteristics, birth experiences, and breastfeeding difficulties prior to care, and maternal satisfaction with breastfeeding and infant weight gain at 4-weeks post treatment and 6-months of age. Challenges surrounding neonatal chiropractic research will be discussed.

292)
Chiropractic evaluation and treatment of musculoskeletal dysfunction in infants demonstrating difficulty breastfeeding
Journal: J Clin Chiro Pediatrics. 2004;6(1):349-368.
Authors: Vallone S
Abstract:
Objective: Breastfeeding during the first year of an infant's life is currently supported and promoted by lactation consultant, midwives, naturopaths, chiropractors and allopathic physician. In 1997, the American Academy of Pediatric and in 1998, the World Health Organization published their position papers that advocated breastfeeding as the optimal form of nutrition for infants. This study was to investigate problems interfering with a successful breastfeeding experience and to see if proper lactation management, with the chiropractor acting as a member of a multidisciplinary support team, can help to assure a healthy bonding experience between mother and infant.
Methods: 25 infants demonstrating difficulties breastfeeding were evaluated for biomechanical dysfunction potentially resulting in an inability to suckle successfully. The biomechanics of 10 breastfeeding infants without complaint were also evaluated for comparison.
Results: An overview of the infants with breastfeeding difficulty revealed

imbalanced musculoskeletal action as compared to the infants without difficulty breastfeeding. Utilization of soft tissue therapies and chiropractic adjustments of the cranium and spine resulted in improved nursing in over 80% of the patients. **Conclusions**: The results of this study suggest that biomechanical dysfunction based on articular or muscular integrity may influence the ability of an infant to suckle successfully and that intervention via soft tissue work, cranial therapy and spinal adjustments may have a direct result in improving the infant's ability to suckle efficiently.

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293)
Contribution of Chiropractic Therapy to Resolving Suboptimal Breastfeeding: A Case Series of 114 Infants
Journal: J Manipulative Physiol Ther 2009;32(8):670-674
Authors: Miller JE, Miller L, et al
Summary: Miller et al also performed a clinical case series of chiropractic care for 114 infants with hospital- or lactation consultant-diagnosed nursing dysfunction. The average age at first visit was 3 weeks. All infants in the study showed some improvement, with 78% able to exclusively breastfeed after 2-5 treatments within a 2-week period.

Chiropractic Pediatrics (general):

294)
Chiropractic care of children
Journal: Arch Pediatr Adolesc Med. 2000;154:401-407
Authors: Lee AC, Li DH, Kemper KJ
Abstract:
Objective: To describe the practice characteristics and pediatric care of chiropractors.
Study Design: Cross-sectional, descriptive survey.
Setting: Chiropractic practices in the Boston, Mass, metropolitan area.
Participants: One hundred fifty licensed chiropractors.
Main Outcome Measures: Demographics, practice characteristics, and fee structure. Practitioners were also asked about their approach to childhood immunizations and a clinical scenario. Data were analyzed using simple descriptive statistics.
Results: Ninety (60%) chiropractors responded. All were white and 65% were men. Respondents had on average 122 patient visits weekly, of which 13 (11%) were from children and adolescents. Typical visit frequency ranged from 1 to 3 times weekly. Average visit fees were $82 and $38 (initial and follow-up) and 49% of the fees were covered by insurance. Seventy percent of the respondents recommended herbs and dietary supplements. For pediatric care, 30% reported actively recommending childhood immunizations; presented with a hypothetical 2-week-old neonate with a fever, 17% would treat the patient themselves rather than immediately refer the patient to a doctor of medicine, doctor of osteopathy, or an emergency facility.
Conclusions: Children and adolescents constitute a substantial number of patients in chiropractics. An estimated 420,000 pediatric chiropractic visits were made in the

Boston metropolitan area in 1998, costing approximately $14 million. Pediatric chiropractic care is often inconsistent with recommended medical guidelines. National studies are needed to assess the safety, efficacy, and cost of chiropractic care for children.

Colic:

295)
Chiropractic management of infantile colic
Journal: Clinical Chiropractic 2004;7(4):180-186
Author: Hipperson, A
Abstract:
Objective: To present two case studies in which the complete resolution of infantile colic and associated symptoms was achieved with chiropractic treatment. This case series supports the aetiological mechanism of an imbalanced autonomic nervous system, via somatovisceral reflexes secondary to regional cranial and spinal dysfunction. In addition, they provide support towards the birth process being a causative factor in the development of colic.
Design:A case series.
Setting: Private chiropractic practice.
Subjects: The first case involved a 7-week-old male infant presenting with medically diagnosed colic, with associated reflux and disturbed sleep, all of which were persistent since birth. The second infant, aged 10 weeks, had suffered maternally diagnosed colic for approximately 1 month. Associated symptoms included some vomiting and asymmetry with breast-feeding. Both infants demonstrated many typical colic characteristics and had experienced birth trauma. Upper cervical, mid thoracic, sacroiliac and cranial dysfunction was recorded in both cases.
Methods: Each infant received diversified paediatric chiropractic manipulation to the areas diagnosed as dysfunctional. Treatment was provided over a 3-week period, though the intensity differed for the two infants.
Results: Complete resolution of all presenting symptoms was achieved in both instances.
Conclusions: These cases suggest a possible association between birth trauma; the development of cranial and spinal segmental dysfunction and consequential manifestation of symptoms of infantile colic. Secondly, they demonstrate chiropractic treatment successfully restoring correct spinal and cranial motion, with an associated resolution of symptoms.

296)
Infantile colic treated by chiropractors: a prospective study of 316 cases
Journal: J Manipulative Physiol Ther. 1989;12(4):281-88
Authors: Klougart N, Nillson N, Jacobsen J
Abstract:
A prospective, uncontrolled study of 316 infants suffering from infantile colic and selected according to well-defined criteria shows a satisfactory result of spinal manipulative therapy in 94% of the cases. The median age of the infants was 5.7 wk at the beginning of the treatment. The results were evaluated by analysis of a

diary continuously kept by the mother and an assessment file comprised by interview. The study was carried out as a multicenter study lasting 3 months and involving 73 chiropractors in 50 clinics. The results occurred within 2 weeks and after an average of three treatments.

297)
The short-term effect of spinal manipulation in the treatment of infantile colic: A randomized controlled clinical trial with a blinded observer
Journal: J Manipulative Physiol Ther. 1999;22(8):517–22
Authors: Wiberg JMM, Nordsteen J, Nilsson N.
Abstract:
Objective: To determine whether there is a short-term effect of spinal manipulation in the treatment of infantile colic.
Design: A randomized controlled trial.
Setting: A private chiropractic practice and the National Health Service's health visitor nurses in the suburb Ballerup (Copenhagen, Denmark).
Subjects: Infants seen by the health visitor nurses, who fulfilled the diagnostic

criteria for infantile colic.
Intervention: One group received spinal manipulation for 2 weeks, the other was treated with the drug dimethicone for 2 weeks.
Outcome Measure: Changes in daily hours of crying as registered in a colic diary.
Results: By trial days 4 to 7, hours of crying were reduced by 1 hour in the dimethicone group compared with 2.4 hours in the manipulation group (P = .04). On days 8 through 11, crying was reduced by 1 hour for the dimethicone group, whereas crying in the manipulation group was reduced by 2.7 hours (P = .004). From trial day 5 onward the manipulation group did significantly better that the dimethicone group.
Conclusion: Spinal manipulation is effective in relieving infantile colic.

298)
Comparison of the short-term effects of chiropractic spinal manipulation and occipito-sacral decompression in the treatment of infant colic: A single-blinded, randomised, comparison trial
Journal: Clinical Chiropractic 2008;11(3): 122-129
Authors: Browning M, Miller JE
Summary*:* Browning et al performed a single-blinded randomized comparison trial of the effects of spinal manipulative therapy (SMT) and occipito-sacral decompression therapy (OSD) on infants with colic[iii]. 43 infants younger than 8 weeks of age received two weeks of chiropractic care. Two weeks and four weeks after beginning treatment, the infants in both treatment groups cried significantly less and slept significantly more than prior to receiving chiropractic care.

299)
Long-term effects of infant colic: a survey comparison of chiropractic treatment and non-treatment groups
Journal: J Manipulative Physiol Ther 2009;32(8):635-638
Authors: Miller JE, Phillips HL

Summary: Research has shown that children who were colicky as infants suffer from poor behavior and disturbed sleep as toddlers. Miller et al performed a survey of parents of 117 such toddlers who had received chiropractic care as infants vs. 111 who had not received chiropractic care[iv]. They found the treated toddlers were twice as likely not to experience long-term sequelae of infantile colic, such as temper tantrums and frequent nocturnal waking. In other words, colicky infants who had received chiropractic care were twice as likely to sleep well and experience less temper tantrums in their toddler years

Gastrointestinal Reflux and GERD:

300)
Chiropractic care of a pediatric patient with symptoms associated with gastroesophageal reflux disease
Journal: J Chiropr Educ 2005;19(1):43
Authors: Alcantara J, Anderson R
***Abstract**:*
Objective: The purpose of this article is to describe the chiropractic care of a pediatric patient with complaints associated with Gastroesophageal reflux disease (GERD).
Clinical features: A 3-month-old girl was provided with chiropractic and cranial sacral care at the request and consent of her mother for symptoms associated with

medically diagnosed GERD. The patient exhibited frequent vomiting, difficulty with breastfeeding, interrupted sleep, generalized muscle rigidity, ,and frequent high-pitched crying. The patient previously received chiropractic care elsewhere as well as medically prescribed Prilosec. The infant's condition was unaffected by these previous treatments to the point that the infant's condition was adversely affecting the family dynamics in a variety of ways.
Intervention and outcome: The patient was treated with site-specific, low-amplitude, high-velocity chiropractic adjustments to sites of vertebral subluxations, particularly at the atlas and the fourth thoracic vertebra. The patient was also cared for with low-force cranial sacral therapy to the mandible, temporal, and parietal cranial plates. The patient responded favourably to care with reduction in frequency of vomiting, improved feeding, decreased generalized muscle rigidity, and decreased high-pitched crying. The above notable changes were observed within four patient visits and with total resolution of symptoms within approximately 3 months of care.
Conclusion: This case study demonstrates that pediatric patients suffering from gastrointestinal disorders such as GERD may benefit from a clinical and theoretical framework of adjustments to sites of vertebral subluxations.

301)
Gastroesophageal Reflux Disease, Spinal Manipulative Therapy and Ischemic Compression: A Preliminary Study
Journal: Journal of the American Chiropractic Association 2007; Jan-Feb;44(1):7-19
Authors: Hains G, Hains F, Descarreaux M
Abstract:

Objective: The first objective was to determine if chiropractic spinal manipulative therapy and ischemic compression in the upper 2 quadrants of the abdomen resulted in clinically important changes in gastroesophageal reflux disease (GERD) symptoms in adults. The second objective was to determine if spinal manipulative therapy (SMT) alone, as well as ischemic compression alone, resulted in clinically important changes in GERD symptoms in adults.
Methods: A total of 62 adult patients with mild to severe GERD symptoms were divided into 2 groups. One group of patients received 20 treatments consisting of SMT and myofascial therapy using the ischemic compression technique. A second group of patients was randomly subdivided into 2 treatment groups. The first group received only SMT while the second group received only ischemic compression therapy. After 20 treatments, the SMT group received an additional 20 treatments consisting of ischemic compression. Changes in GERD symptoms were reported by patients in 2 questionnaires. One questionnaire recorded the patient's symptoms using numeric grading scales. The other gathered data pertaining to the patient's perceived impact of symptoms on social activities.
Results: Based on the data gathered from both questionnaires, the patients (n=22) in the group receiving SMT and ischemic compression reported an improvement of 39% after 10 treatments, 66% after 20 treatments, 73% at 1-month follow-up, and 57% at 6-month follow-up. Among the subjects receiving only ischemic compression therapy (n=27), improvements in GERD symptoms were reported to be 44% after 10 treatments, 65% after 20 treatments, 63% at 1-month (30 days) follow-up, and 67% at 6-month follow-up. Among patients receiving only SMT (n=13), improvements in the GERD symptoms were reported to be 39% after 10 treatments, 40% after 20 treatments, and 38% at 1-month follow-up. Eight of these patients agreed to then receive an additional 20 treatments consisting of only ischemic compression therapy. Data gathered at the end of the 20 treatments indicated that these patients reported an average of 71% improvement in their GERD symptoms in relation to the baseline.
Conclusions: Considering these findings, we suggest that both SMT and ischemic compression were found to be effective treatments for patients experiencing GERD symptoms, even at 6-month follow-up. Ischemic compression alone was more effective than SMT alone.

Low Back Pain:

302)
Evaluation of chiropractic management of pediatric patients with low back pain: a prospective cohort study
Journal: J Manipulative Physiol Ther. 2003 Jan;26(1):1-8
Authors: Hayden JA, Mior SA, Verhoef MJ
***Abstract**:*
BACKGROUND: Recent epidemiologic studies have estimated that the lifetime prevalence of low back pain (LBP) in children is approximately 50%, with almost 15% of children experiencing frequent or continual pain. A literature search revealed no published studies addressing conservative treatment of childhood LBP.
OBJECTIVE: To describe chiropractic management of LBP in patients between the ages of 4 and 18 years, as well as outcomes and factors associated with the

outcomes.
METHODS: Prospective cohort study of consecutive pediatric patients with LBP seeing randomly selected chiropractors within the cities of Calgary, Alberta, and Toronto, Ontario, Canada. Follow-up data collection included the type and extent of treatment rendered and its outcome, which was measured with a 5-point subjective rating scale and a self-report pediatric visual analogue scale.
RESULTS: Fifteen chiropractors provided data on 54 consecutive pediatric patients with **LBP**. The average age of the patients was 13.1 years, 57% were male, 61% were acute, with 47% attributing onset to a traumatic event (most commonly sports-related); 24% reported an episode duration of greater than 3 months. Almost 90% of cases presented with uncomplicated mechanical LBP, most frequently diagnosed as lumbar facet dysfunction or subluxation. Patients were managed with manipulation, with a minority (7.7%) receiving some form of active management. "Important" improvement was seen in 62% and 87% on the visual analogue and subjective scales, respectively, within a 6-week course of management (Kaplan-Meier survival analysis). Patients with chronic LBP were less likely to respond within themedian number of treatments (relative risk = 2.1).
CONCLUSIONS: Patients responded favorably to chiropractic management, and there were no reported complications. Future investigations should establish the natural history and compare chiropractic management with other forms of treatment to gain knowledge about the effectiveness of chiropractic in managing pediatric LBP.

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Otitis Media:

303)
The role of the chiropractic adjustment in the care and treatment of 332 children with otitis media
Journal: Journal of Clinical Chiropractic Pediatrics 1997;2(2):167-183
Author: Fallon, JM
Abstract:
Objective: To conduct a pilot study of chiropractic adjustive care on children with

otitis media using tympanography as an objectifying measure, and to propose possible mechanisms whereby subluxation is implicated in the pathophysiology of otitis media.
Design: Case series.
Setting: Subjects presented in a private clinical practice in New Rochelle, New York. The subjects were referred by various sources including pediatricians, other MDs, chiropractors and parents.
Participants: 332 children who presented consecutively with previously diagnosed otitis media, ages 27 days to 5 years.
Main outcome measures: A survey of the parent/guardian was used to determine historical data with respect to previous otitis media bouts, age of onset of initial otitis media, feeding history, history of antimicrobial therapy, referral patterns, and birth history. Otoscopic and tympanographic data was collected as well as data concerning the number of adjustments administered to produce resolution of the otitis media. Data with respect to recurrence rates over six months was also

collected.
Results: The average number of adjustments administered by types of otitis media were as follows: acute otitis media (n=127) 4.0±103, chronic/serous otitis media (n=104)±1.53, for the mixed type of bilateral otitis media (n=10) 5.3±1.35 and where no otitis was initially detected on otoscopic and tympanographic exam (but with history of multiple bouts) (n=74) 5.88±1.87. The number of days it took to normalize the otoscopic examination was for acute 6.67±1.9, chronic/serous 8.57±1.96, and mixed 8.3±1.00. The number of days to took to normalize the tympanographic examination: acute 8.35±2.88, chronic/serous 10.18±3.39, and mixed 10.9±2.02. The overall recurrence rate over a six month period from initial presentation in the office was for acute 11.02%, chronic/serous 16.34%, for mixed 30% and for none present 17.56%.
Conclusion: To our knowledge this is the first time that tympanography has been used as an objectifying tool with respect to the efficacy of the chiropractic adjustment in the treatment of children with otitis media. As tympanography has been used extensively in the medical assessment of children with otitis media, it also serves as a bridge from which the chiropractic field and the medical field can begin to communicate with respect to otitis media. The results indicate that there is a strong correlation between the chiropractic adjustment and the resolution of otitis media for the children in this study. This pilot study can now serve as a starting point from which the chiropractic profession can begin to examine its role in the treatment of children with otitis media. Large scale clinical trials need to be undertaken in the field using tympanography as an objectifying measure. In addition, the role of the occipital adjustment needs to be examined. This study begins the process of examining the role of the vertebral cranial subluxation complex in the pathogenesis of otitis media, and the efficacy of the chiropractic adjustment in its resolution.

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304)
Ear infection: a retrospective study examining improvements from chiropractic care and analyzing for influencing factors
Journal: J Manipulative Physiol Ther 1996;19:169-77
Author: Froehle RM
Abstract:
Objective: The aims of this study were to determine (a) if the patients improved while under chiropractic care; (b) how many treatments were needed to reach improvement; and (c) which factors were associated with early improvement.

Design: Cohort, nonrandomized retrospective study. Setting: Private chiropractic practice in a Minneapolis suburb. Participants: Forty-six children aged 5 yr and under. Intervention: All treatments were done by a single chiropractor, who adjusted the subluxations found and paid particular attention to the cervical vertebrae and occiput. Sacral Occipital Technique-style pelvic blocking and the doctor's own modified applied kinesiology were also used. Typical treatment regimen was three treatments per week for 1 wk, then two treatments per week for 1 wk, then one treatment per week. However, treatment regimen was terminated when there was improvement.
Outcome measure: Improvement was based on parental decision (they stated

that the child had no fever, no signs of ear pain, and was totally asymptomatic), and/or the child seemed to be asymptomatic to the treating DC and/or the parent stated that the child's MD judged the child to be improved. A data abstraction form was used to determine number of treatments used and presence of factors possibly associated with early improvement.
Results: 93% of all episodes improved, 75% in 10 days or fewer and 43% with only one or two treatments. Young age, no history on antibiotic use, initial episode (vs. recurrent) and designation of an episode as discomfort rather than ear infection were factors associated with improvement with the fewest treatments.
Conclusion: Although there were several limitations to this study (mostly because of its retrospection but also, significantly, because very little data was found regarding the natural course of ear infections), this study's data indicate that limitation of medical intervention and the addition of chiropractic care may decrease the symptoms of ear infection in young children.

305)
The use of osteopathic manipulative therapy as adjuvant therapy in children with recurrent acute otitis media
Journal: Arch Ped Adolesc Med 2003;157(9):861-66
Authors: Mills MV, Henley CE, Barnes LLB et al
Abstract:
Objective: To study effects of osteopathic manipulative treatment as an adjuvant therapy to routine pediatric care in children with recurrent acute otitis media (AOM).
Study design: Patients 6 months to 6 years old with 3 episodes of AOM in the previous 6 months, or 4 in the previous year, who were not already surgical candidates were placed randomly into 2 groups: one receiving routine pediatric care, the other receiving routine care plus osteopathic manipulative treatment. Both groups received an equal number of study encounters to monitor behavior and obtain tympanograms. Clinical status was monitored with review of pediatric records. The pediatrician was blinded to patient group and study outcomes, and the osteopathic physician was blinded to patient clinical course.
Main outcome measures: We monitored frequency of episodes of AOM, antibiotic use, surgical interventions, various behaviors, and tympanometric and audiometric performance.
Results: A total of 57 patients, 25 intervention patients and 32 control patients, met criteria and completed the study. Adjusting for the baseline frequency before study entry, intervention patients had fewer episodes of AOM (mean group difference per month, -0.14 [95% confidence interval, -0.27 to 0.00]; P = .04), fewer surgical procedures (intervention patients, 1; control patients, 8; P = .03), and more mean surgery-free months (intervention patients, 6.00; control patients, 5.25; P = .01). Baseline and final tympanograms obtained by the audiologist showed an increased frequency of more normal tympanogram types in the intervention group, with an adjusted mean group difference of 0.55 (95% confidence interval, 0.08 to 1.02; P = .02). No adverse reactions were reported.
Conclusions: The results of this study suggest a potential benefit of osteopathic manipulative treatment as adjuvant therapy in children with recurrent AOM; it may prevent or decrease surgical intervention or antibiotic overuse.

Safety:

306
Chiropractic care of children
Journal: Arch Pediatr Adolesc Med. 2000;154:401-407
Authors: Lee AC, Li DH, Kemper KJ
Abstract:
Objective: To describe the practice characteristics and pediatric care of chiropractors.
Study Design: Cross-sectional, descriptive survey.
Setting: Chiropractic practices in the Boston, Mass, metropolitan area.
Participants: One hundred fifty licensed chiropractors.
Main Outcome Measures: Demographics, practice characteristics, and fee structure. Practitioners were also asked about their approach to childhood immunizations and a clinical scenario. Data were analyzed using simple descriptive statistics.
Results: Ninety (60%) chiropractors responded. All were white and 65% were men. Respondents had on average 122 patient visits weekly, of which 13 (11%) were from children and adolescents. Typical visit frequency ranged from 1 to 3 times weekly. Average visit fees were $82 and $38 (initial and follow-up) and 49% of the fees were covered by insurance. Seventy percent of the respondents recommended herbs and dietary supplements. For pediatric care, 30% reported actively recommending childhood immunizations; presented with a hypothetical 2-week-old neonate with a fever, 17% would treat the patient themselves rather than immediately refer the patient to a doctor of medicine, doctor of osteopathy, or an emergency facility.
Conclusions: Children and adolescents constitute a substantial number of patients in chiropractics. An estimated 420,000 pediatric chiropractic visits were made in the Boston metropolitan area in 1998, costing approximately $14 million. Pediatric chiropractic care is often inconsistent with recommended medical guidelines. National studies are needed to assess the safety, efficacy, and cost of chiropractic care for children.

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308)
Adverse effects of spinal manipulation therapy in children younger than 3 years: a retrospective study in a chiropractic teaching clinic.
Journal: J Manipulative Physiol Ther 2008;31(6):419-422
Authors: Miller JE, Benfield K
Summary: Miller et al examined 781 pediatric patients under 3 years of age (73.5% of whom were under 13 weeks) who received a total of 5242 chiropractic treatments at a chiropractic teaching clinic in England from 2002-2004[i]. There were no serious adverse effects (reaction lasting >24 hours or needing hospital care) over the three-year study period. There were 7 reported minor adverse effects, such as transient crying or interrupted sleep. Though the study was not examining effectiveness, it is interesting to note that 85% of the parents reported improvement in their children's symptoms.

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SUMMARY:

a) COST EFFECTIVENESS OF CHIROPRACTIC

THE MANGA REPORT
THE EFFECTIVENESS AND COST-EFFECTIVENESS
OF CHIROPRACTIC MANAGEMENT OF LOW BACK-PAIN
Pran Manga, Ph.D.;Douglas E. Angus, M.A.;Costa Papadopoulos, M.H.A.
*William R. Swan, B.Comm.;*Funded by the Ontario Ministry of Health
August, 1993

- As the largest existing analysis of scientific literature on low back pain, the 1993 Ontario Ministry of Health commissioned study drew international attention when it recommended the management of low back pain be moved from medical doctors to chiropractic doctors. This comprehensive study reviewed all the published literature on low back pain and made some astounding suggestions. In a nutshell, it concluded that: chiropractic should be the treatment of choice for low back pain – excluding traditional medical care altogether!
- There is an overwhelming body of evidence indicating that chiropractic management of low-back pain is more cost-effective than medical management
- Many medical therapies are of questionable validity or are clearly inadequate
- There is no clinical or case-control study that demonstrates or even implies that chiropractic spinal manipulation is unsafe in the treatment of low-back pain. Some medical treatments are equally safe, but others are unsafe and generate iatrogenic complications for LBP patients.
- Chiropractic is more cost-effective. There would be highly significant cost savings if more management of LBP was transferred from medical physicians to chiropractors.
- There is good empirical evidence that patients are very satisfied with chiropractic management of LBP and considerably less satisfied with physician management
- Chiropractic services should be fully insured under the Ontario Health Insurance Plan
- Chiropractic services should be fully integrated into the health care system. Because of the high incidence and cost of LBP, hospitals, managed health care groups, community health centers, comprehensive health organizations, and health service organizations and long-term care facilities should employ chiropractors on a full-time and/or part-time basis
- A good case could be made for placing chiropractic as the gatekeepers for all musculoskeletal complaints that presented to hospitals.

References:
A Comparison of Health Care Costs for Chiropractic and Medical Patients
J Manipulative Physiol Ther 1993 (Jun); 16 (5):291–299;Stano M; School of Business Administration, Oakland University, Rochester, MI 48039
http://www.ncbi.nlm.nih.gov/pubmed/8345311?dopt=Abstract
Health Maintenance Care in Work-Related Low Back Pain and Its Association With Disability Recurrence
Journal of Occupational and Environmental Medicine 2011 (Apr); 53 (4): 396–404;
http://www.ncbi.nlm.nih.gov/pubmed/21407100
A Hospital-Based Standardized Spine Care Pathway: Report of a Multidisciplinary, Evidence-Based Process
J Manipulative Physiol Ther 2011 (Feb); 34 (2): 98–106
http://www.ncbi.nlm.nih.gov/pubmed/21334541
Cost-effectiveness of Guideline-endorsed Treatments for Low Back Pain:A Systematic Review
Eur Spine J. 2011 (Jan 13) [Epub ahead of print]
http://www.ncbi.nlm.nih.gov/pubmed/21229367
Cost of Care for Common Back Pain Conditions Initiated With Chiropractic Doctor vs Medical Doctor/Doctor of Osteopathy as First Physician: Experience of One Tennessee-Based General Health InsurerJ Manipulative Physiol Ther 2010 (Nov); 33 (9): 640–643
http://www.jmptonline.org/article/S0161-4754%2810%2900216-2/abstract
Clinical Utilization and Cost Outcomes from an Integrative Medicine Independent Physician Association: An Additional 3-year Update
J Manipulative Physiol Ther 2007 (May); 30 (4): 263–269
http://www.ncbi.nlm.nih.gov/pubmed/17509435
Effects of a Managed Chiropractic Benefit on the Use of Specific Diagnostic and Therapeutic Procedures in the Treatment of Low Back and Neck Pain

J Manipulative Physiol Ther 2005 (Oct); 28 (8): 564–569
http://www.ncbi.nlm.nih.gov/pubmed/16226623
Cost-effectiveness of Medical and Chiropractic Care for Acute and Chronic Low Back Pain
J Manipulative Physiol Ther 2005 (Oct); 28 (8): 555–563
http://www.ncbi.nlm.nih.gov/pubmed/16226622
Cost Effectiveness of Physical Treatments for Back Pain in Primary Care
British Medical Journal 2004 (Dec 11); 329 (7479): 1381
http://www.bmj.com/content/329/7479/1381.full
Comparative Analysis of Individuals With and Without Chiropractic Coverage: Patient Characteristics, Utilization, and Costs
Archives of Internal Medicine 2004 (Oct 11); 164 (18): 1985–1892
http://archinte.ama-assn.org/cgi/content/full/164/18/1985
An Evaluation of Medical and Chiropractic Provider Utilization and Costs: Treating Injured Workers in North Carolina
J Manipulative Physiol Ther 2004 (Sep); 27 (7): 442–448
http://www.ncbi.nlm.nih.gov/pubmed/15389175
Chiropractic Care: Is It Substitution Care or Add-on Care in Corporate Medical Plans?
J Occup Environ Med 2004 (Aug); 46 (8): 847-855
http://www.ncbi.nlm.nih.gov/pubmed/15300137
Clinical and Cost Outcomes of an Integrative Medicine IPA
J Manipulative Physiol Ther 2004 (Jun) ; 27 (5): 336–347
http://www.ncbi.nlm.nih.gov/pubmed/15195041
A Practice-Based Study of Patients With Acute and Chronic Low Back Pain Attending Primary Care and Chiropractic Physicians: Two-Week to 48-Month Follow-up
J Manipulative Physiol Ther 2004 (Mar); 27 (3): 160–169
http://www.ncbi.nlm.nih.gov/pubmed/15129198
Cost Effectiveness of Physiotherapy, Manual Therapy, and General Practitioner Care for Neck Pain: Economic Evaluation Alongside a Randomised Controlled Trial
British Medical Journal 2003 (Apr 26); 326 (7395): 911
http://www.bmj.com/content/326/7395/911.full
Chiropractic Treatment of Workers' Compensation Claimants in the State of Texas
MGT of America, Austin, Texas ~ February 2003
http://www.dynamicchiropractic.com/mpacms/dc/article.php?id=9212
Manual Therapy, Physical Therapy, or Continued Care by a General Practitioner for Patients with Neck Pain. A Randomized, Controlled Trial
Ann Intern Med 2002 (May 21); 136 (10): 713-722
http://www.ncbi.nlm.nih.gov/pubmed/12020139
Patient Satisfaction With the Chiropractic Clinical Encounter
Abstract #19986
Patient satisfaction with the chiropractic clinical encounter
Karen T. Boulanger, BA, Cheryl Hawk, DC, PhD, and Cynthia R. Long, PhD. Palmer Center for Chiropractic Research, 741 Brady Street, Davenport, IA 52803, 319-884-5160, Boulanger_k@palmer.edu
http://apha.confex.com/apha/129am/techprogram/paper_19986.htm
Testimony to the Department of Veterans Affairs' Chiropractic Advisory Committee
George B. McClelland, D.C., Foundation for Chiropractic Education and Research ~ March 25, 2003
http://www.chiro.org/LINKS/ABSTRACTS/Testimony_to_the_Department_of_Veterans_Affairs.shtml

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SUMMARY:

b) SAFETY OF CHIROPRACTIC

- **Cervical Spine Adjusting**
  No one pays closer attention to injury statistics than Malpractice Insurance carriers. Scott Haldeman, DC, PhD, MD, reviewed malpractice claims records for a 10-year period between 1988 and 1997. In reviewing the outcomes following the application of 134.5 million cervical manipulations (commonly referred to as the chiropractic adjustment), the records indicated that there were 23 reported cases of stroke or vertebral artery dissection (VAD).
- The actual incidence of stroke or VAD following cervical manipulation was found to be one per 5.85 million cervical adjustments. That means that the average chiropractor could work for 1430 years (or practice 48 full chiropractic careers!) before they might be involved with this type of litigation.

- **Low Back Adjusting**
  Lower back injury alleged to have occurred following spinal manipulative therapy has been reported in patients with pre-existing disc herniation or prolapse.
- Of the 30 cauda equina complications associated with manipulation reported in the French, German and English literature over an 80 year period, only 8 were allegedly related to chiropractic treatment.

References

Unconventional Medicine in the United States: Prevalence, Costs, and Patterns of Use
New England Journal of Medicine 1993 (Jan 28); 328 (4): 246–252
http://www.chiro.org/alt_med_abstracts/ABSTRACTS/Unconventional_Medicine.shtml
Incidence of Adverse Events and Negligence in Hospitalized Patients
Results of the Harvard Medical Practice Study I
New England Journal of Medicine 1991 (Feb 7); 324 (6): 370–376
Iatrogenic Injury
http://www.chiro.org/LINKS/Iatrogenic_Page.shtml
Death by Medicine
Life Extension Foundation
http://www.chiro.org/LINKS/FULL/Death_By_Medicine.html
A Study to Examine the Effectiveness and Cost-Effectiveness of Chiropractic Management of Low-Back Pain
Ministry of Health, Government of Ontario Canada 1993
http://www.chiro.org/LINKS/GUIDELINES/Manga_93.shtml
The Adequacy of Medical School Education in Musculoskeletal Medicine
Journal of Bone and Joint Surgery 1998 (Oct); 80-A (10): 1421–1427
http://www.chiro.org/ChiroZine/ABSTRACTS/Adequacy.shtml
Educational Deficiencies in Musculoskeletal Medicine
Journal of Bone and Joint Surgery 2002 (Apr); 84–A (4): 604–608
http://www.chiro.org/ChiroZine/ABSTRACTS/Educational_Deficiencies.shtml
A Comparison of Chiropractic Student Knowledge Versus Medical Residents
Proceedings of the World Federation of Chiropractic Congress 2001 Pgs. 255
http://www.chiro.org/ChiroZine/ABSTRACTS/A_Comparison_of_Chiropractic_Student_Knowledge.shtml
Arterial Dissections Following Cervical Manipulation: The Chiropractic Experience
Canadian Medical Association Journal 2001 (Oct 2); 165 (7): 905–906
http://www.cmaj.ca/cgi/content/full/165/7/905
Misuse of the Literature by Medical Authors in Discussing Spinal Manipulative Therapy Injury
J Manipulative Physiol Ther 1995 (May); 18 (4): 203–210
http://www.chiro.org/LINKS/ABSTRACTS/Misuse_of_literature.shtml
Inappropriate Use of the Title Chiropractor and Term Chiropractic Manipulation in the Peer-reviewed Biomedical Literature
J Manipulative Physiol Ther 1995 (May); 18 (4): 203-210
http://www.chiro.org/ChiroZine/ABSTRACTS/Inappropriate_Use_of_the_title.shtml
Are German Orthopedic Surgeons Killing People With Chiropractic?
ChiroZine ~ 3-26-2005 ~ Editorial Commentary
http://www.chiro.org/Professional_Regulation/
Guidelines on Basic Training and Safety in Chiropractic
World Health Orgainization ~ November 2005
http://www.chiro.org/LINKS/FULL/Basic_Training_and_Safety_in_Chiropractic.pdf

Guidelines for Chiropractic Quality Assurance and Practice Parameters Preceedings of the Mercy Center Consensus Conference; Page 171
Aspen Publications 1993
Recent Considerations in Nonsteroidal Anti-inflammatory Drug Gastropathy
American Journal of Medicine 1998 (Jul 27); 105 (1B): 31S–38S
http://www.chiro.org/LINKS/ABSTRACTS/Recent_Considerations.shtml
36 Percent of Acute Liver Failures Are Linked to Acetaminophen
U.S. News & World Report July 2, 2001
http://www.chiro.org/LINKS/ABSTRACTS/Liver_Failures_Are_Linked_to_Acetaminophen.shtml
Testimony to the Department of Veterans Affairs' Chiropractic Advisory Committee
George B. McClelland, D.C., Foundation for Chiropractic Education and Research March 25, 2003
http://www.chiro.org/LINKS/ABSTRACTS/Testimony_to_the_Department_of_Veterans_Affairs.shtml
Incidence of Adverse Drug Reactions in Hospitalized Patients
JAMA 1998 (Apr 15); 279 (15): 1200-1205
http://jama.ama-assn.org/content/279/15/1200.full
Failed Back Surgery Syndrome: Diagnostic Evaluation Journal of the American Academy of Orthopaedic Surgeons 2006 (Sep); 14 (9): 534-543
http://tinyurl.com/24nn6m
The Spine as Profit Center
New York Times December 30, 2006
http://tinyurl.com/y9qohn
A Risk Assessment of Cervical Manipulation vs. NSAIDs for the Treatment of Neck Pain
J Manipulative Physiol Ther 1995 (Oct); 18 (8): 530–536
http://www.chiro.org/LINKS/ABSTRACTS/Risk_Assessment_of_Cervical_Manipulation.shtml

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SUMMARY:

c) Patient Satisfaction with Chiropractic

- There have been several surveys conducted in recent years assessing patient satisfaction with chiropractic care, which was found to be extremely high.
- These surveys invariably found that the level of satisfaction was significantly higher for care received from chiropractors in comparison to the medical profession.
- Surveys have also indicated that chiropractic patients are willing to return for chiropractic treatment for a similar condition and would recommend chiropractic treatment to friends, family and colleagues.
- The Consumer Reports Health Ratings Center recently surveyed more than 14,000 subscribers who had lower-back pain in the past year but had never had back surgery.
- The percent of people highly (completely or very) satisfied with their back-pain treatments and advice varied by practitioner visited.

Professional	**Highly satisfied**
Chiropractor	59%
Physical therapist	55
Acupuncturist	53
Physician, specialist	44
Physician, primary care	34

Differences in Ratings for physical therapists and acupuncturists were not statistically significant.

Patient Satisfaction With Chiropractic Care in Los Angeles

This RAND Corporation Study found **For overall care, 92% of the patients choose the care of chiropractic as either excellent or the best**. Although the ratings on all the items are high the highest ratings were given to the more personal qualities of the practitioner: courtesy, politeness, and respect shown to the patient (92%); interest shown in the patient as a person (91%); willingness to listen (89%); ability to put the patient at ease (89%). These results support those of previous studies on chiropractic that suggest that the high satisfaction with chiropractic care is a result more of the personal health encounter than the therapeutic outcome. They also suggest that other providers could learn much from the interpersonal art of chiropractors. http://gateway.nlm.nih.gov/MeetingAbstracts/ma?f=102211961.html

References:

Studies on Chiropractic: Patient Satisfaction

Cherkin, D.C., MacCornack, F.A. (1989) "Patient Evaluation of Low Back Pain Care from Family Physicians and Chiropractors", Western Journal of Medicine, Vol.150(3), pp. 351-355..,
Garrett, J., Jackman, A., Mclaughlin, C., Fryer, J., Smucker, D.R. (1995) "The Outcomes and Costs of Care for Acute Low Back Pain Among Patients Seen By Primary Care Practitioners, Chiropractors, and Orthopedic Surgeons", New England Journal of Medicine, Vol. 333, pp. 913-917.
Shekelle, P.G., Markovich, M., Louie, R. (1995) "Factors Associated with Choosing a Chiropractor for Episodes of Back Pain Care", Medical Care, Vol. 33, pp. 842-850.
http://www.ncbi.nlm.nih.gov/pubmed/8423419
http://www.ncbi.nlm.nih.gov/pubmed/9168407
http://www.chiro.org/ChiroZine/ABSTRACTS/Patient_Satisfaction_With_Chiropractic.shtml
http://www.ncbi.nlm.nih.gov/pubmed/11753328
http://www.ncbi.nlm.nih.gov/pubmed/7666878
http://www.ncbi.nlm.nih.gov/pubmed/8184314

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SUMMARY:

d) Effectiveness of Chiropractic

- Spinal manipulation/mobilization is effective in adults for: acute, subacute, and chronic low back pain; migraine and cervicogenic headache; cervicogenic dizziness; manipulation/mobilization is effective for several extremity joint conditions; and thoracic manipulation/mobilization is effective for acute/subacute neck pain
- Spinal manipulation is used to reduce pain and improve function in patients with both chronic low-back pain and acute and sub-acute low-back pain.
- Patients undergoing spinal manipulative treatment for low-back pain often experience improvement in function, in addition to a reduction in their pain levels.
- When used in conjunction with spinal manipulation, exercise is likely to improve the patients' symptoms, increase the speed of recovery, and reduce the recurrence of pain.

- **Chiropractic Treatment of Workers' Compensation Claimants in the State of Texas**
  MGT of America, Austin, Texas
  http://www.dynamicchiropractic.com/mpacms/dc/article.php?id=9212

- Of the nearly 900,000 workers' compensation claims received from 1996 to 2001, only 14.6 percent of claimants were treated by doctors of chiropractic, and only 8.5 percent of those workers received more than half of their treatment from chiropractors.
- Chiropractic care accounted for only 12.5 percent of medical fees and 6.9 percent of the total workers' compensation costs. However, the firm noted that these figures did not include the costs of pharmaceuticals, because insurers are not required to provide such information to the Texas Workers' Compensation Commission (TWCC). If those costs were included, the percentage of costs related to chiropractic care would have been even lower.
- Lower back and neck injuries accounted for 38 percent of all claims costs. Chiropractors treated about 30 percent of workers with lower back injuries, but were responsible for only 17.5 percent of the medical costs and 9.1 percent of the total costs.
- The average claim for a worker with a low-back injury was $15,884. However, if a worker received at least 75 percent of his or her care from a chiropractor, the total cost per claimant decreased by nearly one-fourth to $12,202. If the chiropractor provided at least 90 percent of the care, the average cost declined by more than 50 percent, to $7,632.

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SUMMARY:

e) Education - Chiropractic v. Physical therapy

All information for these comparisons was derived form the institution's catalogs and student interviews at Oregon Health Sciences University.

Comparative class courses correspond horizontally.

The Doctor of Chiropractic is considered a "first professional degree." Unlike the Doctor of Philosophy (Ph.D.) degree, first professional degrees do not presuppose that a student has earned a Bachelor's and a Master's degree. In addition to chiropractic, first professional degrees are characteristic of other health professions [such as dentistry (D.D.S), medicine (M.D.), optometry (O.D.), etc.] and also law (J.D.) and theology. (See 1991 Western States Chiropractic College Catalog.)

There have been nearly thirty clinical studies conducted comparing **manipulative therapy** to other types of treatment for low back pain. Spinal manipulation has been to be constantly **as effective or more effective** than an array of other comparison treatments for low back pain. (Nyiendo, J. Chiropractic effectiveness, Portland, Oregon; Oregon Chiropractic Physicians Association, April, 1991).

COONTINUING EDUCATION REQUIREMENTS

Chiropractics Physicians – The Oregon Board of Chiropractic Examiners' administrative rules require **45 hours of continuing education** for relicensure.

Medical Physicians/ Osteopathic Physicians- The Oregon board of Medical examiners' administrative rules **do not require continuing education** for relicensure.

Physical Therapists- the Oregon Physical Therapists' Licensing Board **does not require continuing education** for relicensure.

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PHYSICIAN / NON-PHYSICIAN COMPARISON

CHIROPRACTIC PHYSCIAN WESTERN STATES CHIROPRACTIC COLLEGE 1990-1992		PHYSICAL THERAPIST PACIFIC UNIVERSITY 1990-1991	
Course Title	**Class Hours**	**Course Title**	**Class Hours**
Gross Anatomy I-III	288	Gross Human Anatomy	171
Spinal Anatomy I-III	24		
Histology I, II	144		
Biochemistry I, II	120		
Physiology I, II	132	Applied Human Physiology	87
Neurophysiology	72		
Neuroanatomy	96	Functional Neuroanatomy	132
Embryology	24		
Nutrition	48		
Clinical Nutrition	24		
Physical Diagnosis I, II	144		
Clinical Psychology	36	Psychological Aspects Illness/ Disability	45
General Pathology I, II	120	Fundamentals of Pathology	15
Clinical Pathology	36		
Genetics	48		
CPR/Emergency Care	24		
Microbiology & Public Health	72		
Clinical Microbiology & Public Health	84		
Toxicology & Pharmacology	48		
Dermatology & Infectious Disease	24		
Clinical Lab	60		
Correlative & Differential Diagnosis	48	Physical Therapy Evaluation Seminar	30
Neuromusculoskeletal-		MS. Disabilities & Therapeutic Pro.	75
Diagnosis/ Treatment I-IV	252	Neurological Disab. & Therapeutic Pro	75
Physiotherapy I, II	120	Physical Agents I, II	105
		Fundamentals of Therapeutic Exercise	30
		Motor Contort & Therapeutic Proceed.	60
Soft Tissue Therapies I, II	48		
Gastroenterology Diagnosis/ Treatment	60	Medical Disability & Therapeutic Proceed.	45
Cardio respiratory Diagnosis/ Therapy	60		
Genitourinary Survey	60		
		Special Topics	30
Obstetrics	36		
Jurisprudence & Ethics	24	Professional Issues	45
Radiographic Anatomy I-III	84		
Bone Pathology I-IV	120		
Radiographic Report Writing	12		
Roentgenometrics I, II	24		
Radiographic Technique I-III	120		
Patient/ Practice Management I-III	84	Organization & Administration	45
		Professional Communication	45
Clinical Pediatrics	24		
Clinical Geriatrics	24	Health Care & the Geriatric Patient	30
Biomechanics & Palpation I-IV	204	Human Motion & Biomechanics I, III	120
Adjustive Technique I-IX	408		
Eye/ Ear/ Nose/Throat	24		
Narrative Report Writing	24		
Radiology Report Writing	12		
Clinical Research Methodology I, II	60	Research and Thesis	171
Principles of Chiropractic I-V	96		
Minor Surgery/ Proctology	36		
TOTAL CALSS HOURS	**3,732**	**TOTAL CLASS HOURS**	**1,356**
Clinical Observation I-III	60	Clinical Experience I-III	280
Clinic Phase I,II,III-A,B,C,D	816	Clinical Internship I-III	800
TOTAL CLINIC HOURS	**876**	**TOTAL CLINIC HOURS**	**1,080**
TOTAL D.C. REQURIEMENTS	**4,608**	**TOTAL P.T. REQUIREMENTS**	**2,436**

Oregon law requires the prescription of a physician for treatment by a physical therapist. Physical therapists are not trained to diagnose and are unable to request

SUMMARY:

f) Education - Chiropractic v. Medicine v. Osteopathy

PHYSICIAN COMPARISON

CHIROPRACTIC PHYSICIAN
WESTERN STSTES CHIROPRACTIC COLLEGE 1988-1990

Course Title	Class Hours
Gross Anatomy I-III	288
Histology I, II	144
Biochemistry I, II	120
Physiology I, II	132
Embryology	24
Neuroanatomy	96
Nutrition	48
Clinical Nutrition	36
Physical Diagnosis I, II	144
Clinical Psychology	36
General Pathology I, II	120
Genetics	48
CPR/ Emergency Care	24
Microbiology & Public Health	84
Clinical Microbiology & Public Health	84
Toxicology & Pharmacology	48
Dermatology & Infectious Disease	24
Clinical Lab	60
Neurophysiology	72
Gastroenterology Diagnosis/ Treatment	48
Cardiorespiratory Diagnosis/ Treatment	24
Clinical Pathology	36
Genitourinary Survey	60
Jurisprudence & Ethics	24
Radiological Interpretation I-V	120
Radiographic Anatomy I-III	84
Roentgenometrics I, II	24
Soft Tissue Radiographic Interp. I, II	48
Radiographic Technique I, II	120
Minor Surgery/ Proctology	24
Obstetrics	36
Patient/ Practice Management I- IV	108
Adjustive Technique I- IX	**396**
Clinical Pediatrics	24
Clinical Geriatrics	24
Spinal Anatomy	24
Biomechanics & Palpation I- IV 264	**264**
Neuromusculoskeletal DX/TX I-IV	**276**
Correlative & Differential Diagnosis	48
Physiotherapy I, II	120
Narrative Report Writing	24
Clinical Research Methodology I, II	60
Principles of Chiropractic Philosophy I-IV	120
TOTAL CLASS HOURS	**3,768**
Clinic Observation I-III	72
Clinic Phase I,II,III A,B,C,D	822
TOTAL CLINIC HOURS	894
TOTAL D.C. REQUIREMENTS	**4,662**

Optional hours not included in totals

MEDICAL PHYSICIAN
OREGON HEALTH SCIENCES UNIVERSITY 1988-1990

Course Title	Class Hours
Gross Anatomy	190
Histology	84
Medical Biochemistry	145
Human Physiology	149
Developmental Physiology	40
Neuroanatomy	84
Nutrition	20
Ophthalmology	36
Otolaryngology	72
Medical Psychology	49
Introduction to Psychiatry	43
General Pathology	68
Medical Genetics	32
Cardiopulmonary Resuscitation	
Introduction to Medical Microbiology	90
Introduction to Public Health	26
Public Health and Epidemiology	40
Immunology	35
Pharmacology	72
Pathophysiology of Skin. Bone C.T.	69
Blood/ Reticuloendothelial Pathophys.	117
Pathophysiology of the CNS/ Muscle and Special Sensory Organs	158
Neurology and Neurosurgery	216
Gastrointestinal Pathophysiology	123
Respiratory Pathophysiology	79
Cardiovascular Pathophysiology	117
Endocrine Pathophysiology	43
Reproductive Pathophysiology	55
Renal Pathophysiology	117
Law and Medicine	24
Radiographic Diagnosis	24
Child Health (CON 620, lecture)	48
TOTAL CLASS HOURS	**2,465**
Patient Evaluation	192
Third- Year Medicine	432
Child Health	384
Psychiatry Clinical Clerkship	216
Obstetrics and Gynecology	216
Surgery	432
Special Programmed Instruction	
TOTAL HOSPITAL HOURS	2,412
TOTAL M.D. REQUIREMENTS	**4,877**

Optional hours not included in totals.

OSTEOPATHIC PHYSICIAN
CHICAGO COLLEGE OF OSTEOPATHIC MEDICINE 1989-1990

Course Title	Class Hours
Gross Anatomy (401,2)	264
Histology	77
Biochemistry (410,2)	143
Physiology (401,2)	176
Embryology (401)	11
Neuroanatomy (401,2)	66
Introduction to Clinical Med. (401,2,3)	33
Psychology (403)	22
Psychiatry (401,2) (504,5)	53
Pathology (401, 502,3)	181
Pharmacology (501,2)	125
Prep. For Clinical Practice (501)	300
Osteopathic Manipulation Med. I-V	**162**
Introduction to Clinical Med. IV, V	63
History of Medicine (401)	11
Electives (500.01, .02,. 03)	70
TOTAL CLASS HOURS	**1,93**
Family Medicine (601, 2)	800
Internal Medicine (601)	800
Pediatrics (601)	240
Psychiatry (601)	160
Obstetrics/ Gynecology (601)	240
Emergency Medicine (601)	160
Pathology (601)	80
Surgery (601)	640
Electives (701, 801)	640
TOTALHOSPITAL HOURS	3,840
TOTAL D.O. REQUIREMENTS	**5,77**

Optional hours included in totals.

SUMMARY:

g) Physical Therapists inadequately trained to safely administer spinal manipulation

Chiropractic in New Zealand, Report of the Commission of Inquiry into Chiropractic
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Scott Haldeman, DC, PhD, MD, FRCP (C), FAAN, FCCS (C), is a foremost international authority on the management of spinal pain, and has qualified as both a chiropractic physician and medical physician. He serves as Clinical Professor, Department of Neurology at University of California, Irvine, Adjunct Professor in the Research Division at SCUHS and Adjunct Professor of Department of Epidemiology at School of Public Health, University of California, Los Angeles. He is on the editorial board of 6 scientific journals including journal Spine and The Spine Journal. He has published over 180 articles or book chapters, over 70 scientific abstracts, and has authored or edited 7 textbooks. Dr. Haldeman is certified by the American Board of Neurology and Psychiatry, is a Fellow of the Royal College of Physicians of Canada and the American Academy of Neurology, and a Diplomate of the American Board of Electrodiagnostic Medicine, the American Board of Electroencephalography and Neurophysiology and the American Board of Clinical Physiology.

Dr. Haldeman was a witness at the New Zealand Commission of Inquiry, the most comprehensive and detailed independent examination of chiropractic ever undertaken at the time. The report withstood judicial hearings and extensive investigations by the Commission in New Zealand, the United States, Canada, England and Australia. Dr. Haldeman stated for the record that for a medical physician to become proficient in spinal manipulative techniques an additional year of full-time education and training, beyond the medical degree, would be required, and even more time for the graduate physical therapist.

Lewit K. *Manipulation - Reflex Therapy and/or Restitution of Impaired Locomotor Function.* Man Med 1986;2:99-100.

To quote the Czech manual medicine specialist Karel Lewit,M.D., who has worked with the U.S. osteopathic leader Phillip Greenman, DO, Michigan State University in recent years to promote adequate medical education for the practice of spinal manipulation in Europe and North America:

> "The great majority of . . . doctors who learn manipulation are taught far too little about how, where and when to use it . . . they are clinically blindfolded. The practice of spinal manipulation, understanding all the many forms of disturbed function of the motor system requires great skill demanding long training."

Grayson MF. *Manipulation in Back Disorders*. Br Med J 1986;293:1481-2.

Cavalier medical attitudes are exemplified by this advice to medical doctors in the *British Medical Journal.*

> "Courses including manipulation (lasting about a week) are run for doctors and physiotherapists by the Cyriax Foundation and by the Society of Orthopaedic Medicine, and intensive weekend courses for doctors are held by the British Association of Manipulative Medicine. These courses provide clinicians with the knowledge and the necessary manual skills to start treating patients safely. Doctors will then need at least six to nine months of regular practice *to begin to feel that they are treating the right patients and doing so appropriately—and years to become fully experienced and confident.*"
>
> However, in some countries such as Australia, physical therapists wishing to practise manual therapy now take a three year full-time postgraduate master's degree in orthopaedic manipulative therapy. In others such as Denmark, the Netherlands and Canada, physical therapists complete a three year part-time postgraduate certification course in manual therapy fulfilling demanding standards of study, practice and examination. In Minnasota, Chapter 146 of its 1998 Statutes, requires 870 hours in relevant basic and clinical sciences including radiographic interpretation and 1,155 hours of supervised clinical practice, as pre-requisites for certification and practice. **(David Chapman-Smith,LLB (Hons), Secretary-General, World Federation of Chiropractic)**

SUMMARY:

h) Medical education - deficiencies in musculoskeletal medicine

- 82% of the eighty-five medical school graduates failed this BASIC competency exam.
- Four years later they redesigned the exam and again gave it to all the residents. Even though the passing grade was LOWERED from 74% to 70%, 78% of them again failed the exam, with a mean test score average of 59.9 percent.
- The exact same test was given to a group of 51 chiropractic students during their last semester of schooling. The results? 70% of the students passed the test. This is in contrast to an 80% failure rate for the MDs.
- The chiropractic group were still JUST STUDENTS in their last undergrad year
- The medical group had already graduated medical school, been awarded their MD degrees, completed all their hospital rotations, and finally been accepted into highly competitive orthopedic residencies.
- A survey of family practice physicians found 51 percent of respondents felt that they had insufficient training in orthopaedics. Furthermore, 56 percent of those surveyed claimed that medical school was their only source for formal musculoskeletal training (MSK).
- In another study, pediatric residents said they had the least adequate training in orthopaedics. Graduating family practice residents felt significantly more confident in performing physical exams, evaluating radiographs, and diagnosing and treating non-MSK disorders than they did for MSK conditions.
- Seventy (82 per cent) of eighty-five medical school graduates from thirty-seven different schools failed to demonstrate such competency on a validated examination of fundamental concepts.

References:

- The Adequacy of Medical School Education in Musculoskeletal Medicine
  Journal of Bone and Joint Surgery 1998 (Oct); 80-A (10): 1421–1427
  http://www.chiro.org/ChiroZine/ABSTRACTS/Adequacy.shtml
- Educating Medical Students About Musculoskeletal Problems: Are Community Needs Reflected in the Curricula of Canadian Medical Schools?
  Journal of Bone and Joint Surgery 2001 (Sept); 83-A (9): 1317–1320
  http://www.jbjs.org/article.aspx?Volume=83&page=1317
- A Comparison of Chiropractic Student Knowledge Versus Medical Residents
  Proceedings of the World Federation of Chiropractic Congress 2001 Pgs. 255
  http://www.chiro.org/ChiroZine/ABSTRACTS/A_Comparison_of_Chiropractic_Student_Knowledge.shtml
- Educational Deficiencies in Musculoskeletal Medicine
  Journal of Bone and Joint Surgery 2002 (Apr); 84–A (4): 604–608
  http://www.jbjs.org/article.aspx?Volume=84&page=604
- Musculoskeletal Knowledge: How Do You Stack Up?
  Physician and Sportsmedicine 2002 (Aug); 30 (8)
  http://www.chiro.org/ChiroZine/ABSTRACTS/Musculoskeletal_Knowledge.shtml
- Musculoskeletal Curricula in Medical Education
  Physician and Sportsmedicine 2004 (Nov); 32 (11)
  http://www.chiro.org/ChiroZine/ABSTRACTS/Musculoskeletal_Knowledge.shtml

- Adequacy of Education in Musculoskeletal Medicine
  Journal of Bone and Joint Surgery Am 2005 (Feb); 87 (2): 310–314
  http://www.chiro.org/ChiroZine/ABSTRACTS/Adequacy_of_Education.shtml
- More Evidence of Educational Inadequacies in Musculoskeletal Medicine
  Clin Orthop Relat Res 2005 (Aug); (437): 251–259
  http://www.ncbi.nlm.nih.gov/pubmed/16056057
- Doctors Likely to Encounter Children With Musculoskeletal Complaints Have Low Confidence in Their Clinical Skills
  The Journal of Pediatrics 2009 (Feb); 154 (2): 267–271
  http://www.ncbi.nlm.nih.gov/pubmed/18823907
- Orthopaedists' and Family Practitioners' Knowledge of Simple Low Back Pain Management
  Spine 2009 (Jul 1); 34 (15): 1600–1603
  http://www.chiro.org/ChiroZine/ABSTRACTS/Orthopaedists_and_Family_Practitioners.shtml

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SUMMARY:

i) WORKERS COMPENSATION STUDIES:

- A major study to assess the most appropriate use of available health care resources was reported in 1993 by the Ontario Ministry of Health. The report overwhelmingly supported the efficacy, safety, scientific validity and cost-effectiveness of chiropractic for low backpain.
- injury receives at least 75% of their care from a chiropractor that cost decreases to $12,202 and when they receive at least 90% of their care from a chiropractor the average cost declines even further to $7,632."
- Based on estimated savings per claim, dramatic savings (possibly into the billions of dollars) may be possible with increased claimant access to chiropractic treatment for specific low back and other musculoskeletal conditions."
- A retrospective study of workers' compensation claims from 1996 to 2001 was conducted to determine the use and efficacy of chiropractic care in Texas. The researchers reviewed 900,000 claims during that time period to determine if chiropractic was costeffective compared to medical treatment. They found that chiropractor treatment costs were the lowest of all providers.
- This retrospective study of Florida workers' compensation claims from 1994-1999 found that the average total cost for low-back cases treated medically was $16,998 while chiropractic care was only $7,309. Patients treated primarily by chiropractors were found to reach maximum medical improvement almost 28 days sooner that if treated by a medical doctor. Findings from this analysis of the Florida claims indicate that considerable cost savings and more efficient claims resolution may be possible with greater involvement of chiropractic treatment in specific low back cases and other specific musculoskeletal cases.
- In this study, 5000 claims from 1986 and 5000 from 1989 pertaining to injured individuals in the Utah Worker Compensation Fund were examined. The study compared costs for those who received chiropractic care and those who received medical care. From 1986 to 1989 the cost of care for chiropractic increased 12% while medical care increased 71%. The replacement of wages increased 21% for those receiving chiropractic care and 114% for those receiving medical care. Neck pain is a common ailment, with approximately 10-15% of the population suffering from it at any given time.
- The researchers in this study reviewed 1980 citations and found 13 high quality trials utilizing manipulation or manual therapy. Their review found that the benefit from manipulation was greater. The long-term data regarding spinal manipulation for chronic neck pain was not as conclusive. However, the results demonstrated a great benefit with treatment up to 104 weeks. The spinal mobilization trials also showed very good benefit at a 6 to 7 week outcome point, with 70% of patients having full recovery or important improvement at that point. The researchers attempted to determine whether the benefit could be the natural history and placebo effect and compared these trials with a separate group of controlled no-treatment patients. The researchers concluded that the benefit noted in this review exceeded the placebo effect and natural history of the no treatment group.
- In this study, researchers analyzed WorkCover Authority data from New South Wales. Of 1289 cases 30% had back problems. In 12% of the cases, chiropractic care was used for the treatment of spinal injury. The total payments for all cases using chiropractic and physiotherapy care were $25.2 million, which was 2.4% of the total payments. When 20 claims were chosen at random the average chiropractic cost of care was $299.65, while the average medical cost was $647.20. A trend in data collected indicated that when greater than 60% of total cost of treatment came from chiropractic care the number of days missed from work was 9.5. When less than 60% of total cost of treatment came from chiropractic care the number of days missed from work was 50.3.
- This study included 102 patients with acute back and/or leg pain of moderate to severe intensity and MRI evidence of disc protrusion. The patients received a maximum of 30 manipulations or simulated manipulations over a 30 day period. 28% of the manipulation group became pain-free locally vs. only 6% in the sham group. 55% of the manipulation group experienced absence of radicular symptoms compared to 20% of the no manipulation group. The manipulation group also had a significant decrease in use and prescriptions for NSAIDs.

- Researchers examined the effect of thrust manipulation on patientdiagnoses with occupational low back pain receiving worker's compensation. They stated that thrust manipulation is evidence-based, but is underutilized by physical therapists in the occupational setting. 578 patients were treated with either thrust manipulation, no-thrust manipulation or no manipulation. The thrust patients had a 66% reduction in Oswestry scores over a period of four sessions in 2.5 weeks. The thrust patients also had more improvement in both pain and disability compared to the no manipulation patients and the duration of care was shorter. The cost of physical therapy was also found to be greater in the non-thrust techniques group.

References: (Links are live)
Cost Comparisons of Chiropractic Care Versus other Health Care Provider: TEXAS WORKERS' COMPENSATION REPORT:
Chiropractic Treatment of Workers' Compensation Claimants in the State of Texas
MANGA II:
Enhanced Chiropractic Coverage Under OHIP (Ontario Health Insurance Plan) As A Means For Reducing Health Care Costs, Attaining Better Health Outcomes And Achieving Equitable Access To Health Services
Utilization, Cost, and Effects of Chiropractic Care on Medicare Program Costs
Muse and Associates. American Chiropractic Association 2001
FLORIDA WORKERS' COMPENSATION REPORT:
Trends in Chiropractic Treatment of Workers' Compensation in the State of Florida (Tallahassee, Florida: 2002) MGT of America, Inc.
State Specific Workers Compensation Studies:
Chiropractic Treatment of Workers' Compensation Claimants in the State of Texas
Executive Summary. MGT of America Feb 2003.
Chiropractic care of Florida workers' compensation claimants: Access, costs, and administrative outcome trends from 1994 to 1999
Topics in Clinical Chiropractic 2002; 9(4): 33-53
Managed Care Pre-approval and its Effect on the Cost of Utah Worker Compensation Claims
J Manipulative Physiol Ther. 1997 (Jul); 20 (6): 372-6
Preliminary Findings of Analysis of Chiropractic Utilization in the Workers' Compensation System of New South Wales, Australia
J Manipulative Physiol Ther. 1995 (Oct); 18 (8): 503-11
A non-surgical approach to the management of lumbar spinal stenosis: a prospective observational cohort study
BMC Musculoskelet Disord. 2006 (Feb 23); 7: 16
Chiropractic manipulation in the treatment of acute back pain and sciatica with disc protrusion: a randomized double-blind clinical trial of active and simulated spinal manipulations
Spine J. 2006 (Mar); 6 (2): 131-7
Chronic Mechanical Neck Pain in Adults Treated by Manual Therapy: A Systematic Review of Change Scores in Randomized Clinical Trials
J Manipulative Physiol Ther 2007 (Mar); 30 (3): 215–227
A nonsurgical approach to the management of patients with cervical radiculopathy
J Manipulative Physiol Ther. 2006 (May); 29 (4): 279-87
Efficacy Of Treating Low Back Pain And Dysfunction Secondary To Osteoarthritis: Chiropractic Care Compared With Moist Heat Alone
J Manipulative Physiol Ther. 2006 (Feb); 29 (2): 107-14
A perspective for considering the risks and benefits of spinal manipulation in patients with low back pain
Man Ther. 2006 (Nov); 11 (4): 316-20
Factors Associated With Patient Satisfaction With Chiropractic Care: Survey and Review of the Literature
J Manipulative Physiol Ther 2006 (Jul); 29 (6): 455–462
A pilot study comparing two manual therapy interventions for carpal tunnel syndrome
J Manipulative Physiol Ther. 2007 (Jan); 30 (1): 50-61
The effect of combining manual therapy with exercise on the respiratory function of normal individuals
J Manipulative Physiol Ther. 2007 (Sep); 30 (7): 509-13
Does the Evidence for Spinal Manipulation Translate into Better Outcomes in Routine Clinical Care for Patients with Occupational Low Back Pain?
Spine J. 2006 (May); 6 (3): 289-95
Symptomatic Outcomes and Perceived Satisfaction Levels of Chiropractic Patients with a Primary Diagnosis Involving Acute Neck Pain
J Manipulative Physiol Ther 2006 (May); 29 (4): 288–296
Chiropractic care for nonmusculoskeletal conditions: a systematic review with implications for whole systems research
J Altern Complement Med. 2007 (Jun); 13 (5): 491-512

Chiropractic Services in the Canadian Armed Forces: A Pilot Project
Military Medicine 2006 (Jun); 171 (6): 572–576
A population-based survey of back pain beliefs in Canada
Spine. 2006 (Aug 15); 31 (18): 2142-5
Efficacy of Spinal Manipulation and Mobilization for Low Back Pain and Neck Pain: A Systematic Review and Best Evidence Synthesis
Spine Journal 2004 (May); 4 (3): 335–356
Efficacy of Preventive Spinal Manipulation for Chronic Low-Back Pain and Related Disabilities: A Preliminary Study
J Manipulative Physiol Ther 2004 (Oct); 27 (8): 509–514
Factors Related to the Inability of Individuals With Low Back Pain to Improve With a Spinal Manipulation
Physiological Therapeutics 2004 (Feb); 84 (2): 173-190
A Randomized Clinical Trial Comparing Chiropractic Adjustments to Muscle Relaxants for Subacute Low Back Pain
J Manipulative Physiol Ther 2004 (Jul); 27 (6): 388-398
Manual Therapy and Exercise Therapy in Patients With Chronic Low Back Pain: A Randomized, Controlled Trial With 1-Year Follow-Up
SPINE (Phila Pa 1976) 2003 (Mar 15); 28 (6): 525–531
A Randomized Trial of Combined Manipulation, Stabilizing Exercises, and Physician Consultation Compared to Physician Consultations Alone for Chronic Low Back Pain
Spine (Phila Pa 1976). 2003 (Oct 1); 28 (19): 2185-91
Chronic Spinal Pain: A Randomized Clinical Trial Comparing Medication, Acupuncture, and Spinal Manipulation
Spine (Phila Pa 1976) 2003 (Jul 15); 28 (14): 1490–1502
Patterns and Perceptions of Care for Treatment of Back and Neck Pain: Results of a National Survey
Spine (Phila Pa 1976) 2003 (Feb 1); 28 (3): 292–297
Comparing the Satisfaction of Low Back Pain Patients Randomized to Receive Medical or Chiropractic Care: Results From the UCLA Low Back Pain Study
Am J Public Health 2002 (Oct); 92 (10): 1628–1633
Manual Therapy, Physical Therapy or Continued Care by a General Practitioner for Patients with Neck Pain
Annals of Internal Medicine 2002 (May 21); 136 (10): 713–722
Patient Satisfaction with the Chiropractic Clinical Encounter: Report from a Practice-Based Research Program
J Neuromusculoskeletal System 2001: 9 (4): 109–117
Patient Satisfaction with Chiropractic Physicians in an Independent Physicians Association
J Manipulative Physiol Ther 2001 (Nov); 24 (9): 556–559
Patient Characteristics, Practice Activities, and One-month Outcomes for Chronic, Recurrent Low-back Pain Treated by Chiropractors and Family Medicine Physicians: A Practice-based Feasibility Study
J Manipulative Physiol Ther 2000 (May); 23 (4): 239–245
Single-blind Randomised Controlled Trial of Chemonucleolysis and Manipulation in the Treatment of Symptomatic Lumbar Disc Herniation
European Spine Journal 2000 (Jun); 9 (3): 202–207
Chronic Spinal Pain Syndrome: A Clinical Pilot Trial Comparing Acupuncture, a Non-Steroidal Anti-Inflammatory Drug and Spinal Manipulation
J Manipulative Physiol Ther 1999 (Jul); 22 (6): 376–381
Comparative Efficacy of Conservative Medical and Chiropractic Treatments for Carpal Tunnel Syndrome: A Randomized Clinical Trial
J Manipulative Physiol Ther 1998 (Jun); 21 (5): 317–326
The Effect of Spinal Manipulation in the Treatment of Cervicogenic Headache
J Manipulative Physiol Ther 1997 (Jun); 20 (5): 326–330
Randomized Comparison of Chiropractic and Hospital Outpatient Management for Low Back Pain: Results from Extended Follow Up
British Medical Journal 1995 (Aug 5); 311 (7001): 349–351
Spinal Manipulation vs. Amitriptyline for the Treatment of Chronic Tension-Type Headaches: A Randomized Clinical Trial
J Manipulative Physiol Ther 1995 (Mar); 18 (3): 148–154
The Outcomes and Costs of Care for Acute Low Back Pain Among Patients Seen by Primary Care Practitioners, Chiropractors, and Orthopedic Surgeons
New England Journal of Medicine 1995 (Oct 5); 333 (14): 913–917
The Effectiveness and Cost-Effectiveness of Chiropractic Management of Low-Back Pain
Richmond Hill, Ontario: Kenilworth Publishing, 1993
Patient Satisfaction With Chiropractic Care
J Manipulative Physiol Ther 1993 (Jan); 16 (1): 25–32

Low Back Pain of Mechanical Origin: Randomized Comparison of Chiropractic and Hospital Outpatient Treatment
British Medical Journal 1990(Jun 2); 300 (6737): 1431–1437
Patient Evaluations of Low Back Pain Care From Family Physicians and Chiropractors
Western Journal of Medicine 1989 (Mar); 150 (3): 351–355
Satisfaction With Low Back Pain Care
Spine Journal (Official Journal of the North American Spine Society) 2008 (May); 8 (3): 510-521
Treatment of Neck Pain: Noninvasive Interventions: Results of the Bone and Joint Decade 2000–2010: Task Force on Neck Pain and Its Associated Disorders
Spine (Phila Pa 1976). 2008 (Feb 15); 33 (4 Suppl): S123–152
Nonpharmacologic Therapies for Acute and Chronic Low Back Pain: A Review of the Evidence for an American Pain Society/American College of Physicians Clinical Practice Guideline
Annals of Internal Medicine 2007 (Oct 2); 147 (7): 492–504

- Chiropractic Physicians outperforms traditional medical care for back problems by 2:1 [1]
- evidence-based, peer reviewed literature across the world singles out chiropractic manipulative therapy as a first line treatment intervention in the uncomplicated back pain patient.[i]
- In a 4-year study, researchers found that the 700,000 health-plan members with an additional chiropractic coverage benefit had significant lower annual total healthcare expenditures compared with the 1 million members of the same plan who did not have chiropractic coverage.
- Chiropractic care reduced the cost of treating back pain by 28%
- Chiropractic care reduced hospitalizations among back pain patients by 41%
- Chiropractic care reduced back surgeries by 32%
- Chiropractic care reduced the cost of medical imaging, e.g. X-Rays and/or MRI by 37%.
- In a study printed in the Journal of Occupational Medicine, August 1991, Cost per Case Comparison of Back Injury Claims of Chiropractic versus Medical Management for Conditions with Identical Diagnostic Codes, reviewing over 3,000 Worker's Compensation Claims, chiropractic care was 10-fold less expensive for chiropractic care than for medical care.
- A study appearing in the prestigious British Medical Journal, August 1995,Randomized Comparison of Chiropractic and Hospital Outpatient Management for Low Back Pain: Results from Extended Follow up, concluded that back pain patients treated by chiropractic derive more benefit and long term satisfaction than those treated by hospitals.
- Data from 85,000 Blue Cross Blue Shield beneficiaries, concludes that utilization of chiropractic reduces health care costs by 40% when compared with care initiated through a medical doctor (MD). [2]
- Much of the traditional medical treatment of the spine is clearly inefficient. Evidence from Canada, the USA, the UK and elsewhere shows that there are conflicting methods of treatment, many with little, if any scientific evidence of effectiveness, and very high costs of management.
- On the evidence, particularly the most scientifically valid clinical studies, spinal manipulation applied by chiropractors is shown to be more effective than alternative treatments for back pain.
- The literature suggests that chiropractic manipulation is safer than medical management of low-back pain, plus there is an overwhelming body of evidence indicating that chiropractic management of low-back pain is more cost-effective than medical management.
- There would be highly significant cost savings if more management of back pain was transferred from medical physicians to chiropractors. Evidence from Canada the USA and other countries suggests potential savings of many hundreds of millions annually.
- The literature clearly and consistently shows that the major savings from chiropractic management come from fewer and lower costs of auxiliary services, much fewer hospitalizations, and a highly significant reduction in chronic problems, as well as in levels and duration of disability.
- Workers' compensation studies report that injured workers with the same specific diagnosis of LBP returned to work much sooner when treated by chiropractic physicians than by medical physicians. This leads to very significant reductions in direct and indirect costs.[3,4,5,6]
- There is certainly convincing evidence in the scientific literature attesting to the efficacy and cost-effectiveness of chiropractic care over traditional medical interventions. Additionally, there is less risk to the patient from pharmaceutical measures.

[1] Flor H, Fydrich T, Turk DC. Efficacy of multidisciplinary pain treatment centers: a meta-analytic review. Pain. 1992; 49:221-230.

[2] J Manipulative Physiol Ther 2010 (Nov); 33 (9): 640–643;
Richard L. Liliedahl, MD, Michael D. Finch, PhD, David V. Axene, FSA, FCA, MAAA, Christine M. Goertz, DC, PhD

[3] *A Benefit of Spinal Manipulation as Adjunctive Therapy for Acute Low-back pain: A Stratified Controlled Trial. Hadler NM et al. Spine – 1987;12:703-706.*

[4] *Cost per Case Comparison of Back Injury Claims of Chiropractic versus medical Management for Conditions with Identical Diagnostic Codes. Ja*

[5] *An Analysis of Florida Workers' Compensation Medical Claims for Back Related Injuries. Wolk S. Foundation for Chiropractic Education and Research, Arlington, VA. – 1988.rvis KB, et al. Journal of Occupational Medicine – 1991;33:847-52.*

[6] *The Effectiveness and Cost Effectiveness of Chiropractic Management of Low-Back Pain (The Manga Report). Pran Manga and Associates*

[7] *Study of Time Loss Back Claims. Portland, OR. Workers' Compensation Board, State of Oregon, March 1971.1993) – University of Ottawa, Canada.*

[8] *Low Back Pain of Mechanical Origin: Randomized Comparison of Chiropractic and Hospital Outpatient Treatment. Meade, TW et al British Medical Journal – 1990;300:1431-1437.*

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SUMMARY:

j) LEGISLATURE : PHYSICAL THERAPY DIRECT ACCESS

A) LEGAL RESTRICTIONS FOR THE PHYSICAL THERAPIST

1) According to Indiana Statute, is it true that a Physical Therapist cannot render a diagnosis regarding a patient's condition?
   Answer: Yes

2) Is it true that a Physical Therapist cannot order essential diagnostic tests such as x-ray studies, MRI or CT scans, blood tests, or ultrasound scanning, in order to identify or diagnose a serious underlying condition?
   Answer: Yes

3) Is it true that a Physical Therapist cannot, by law, refer to a specialist such as a neurosurgeon, orthopedic surgeon, vascular surgeon, radiologist, or neurologist for diagnostic testing and/or treatment?
   Answer: Yes

B) PROFESSIONAL QUALIFICATIONS

4) What are the basic educational requirements in classroom hours for the following physical therapy professional designations?

   a) Doctor of Physical Therapy (DPT)
   Answer: 2,700 hrs.

   b) Master of Physical Therapy (MPT)
   Answer: 2,300 hrs.

   c) Bachelor of Physical Therapy (RPT)
   Answer: 2,100 hrs.

   d) Physical Therapy Assistant (PTA)
   Answer: 1,000 hrs.

5) What are the basic educational requirements in classroom hours for the professional designations of DC, MD, or DO?
   Answer: Approx. 4,800-5,000 (2 to 4 times the education of a PT

6) Considering the 2,000-4,000 classroom hour disparity, what courses do an MD, DC, or DO have that a DPT, MPT, RPT, or PTA does not?
   Answer: Comprehensive education and training in the correlation of signs & symptoms of disease entities, pathologic processes, human body-systems diagnosis, X- Ray interpretation, orthopedics, and neurology.

7) Describe the basic difference between a Physical Therapist and a Chiropractor? (Difference in philosophy is not a valid answer).
   Answer: At the Doctorate level, the Doctor of Chiropractic undergoes twice the education of the DPT, and is trained as a primary care physician, whereas the DPT, with only a modicum of diagnostic acumen is trained as a technician,. Other physical therapy designations fall below the standard set for even the DPT, (DPT: 2,700 hrs., MPT: 2,300 hrs and RPT: 2,100 hrs, respectively, vs. DC: 5,000 hrs).

8) How many hours of training in spinal manipulation do the following professional physical therapy designations have in college: DPT, MPT, RPT and PTA?

Answer: DPT: Minimal to none
MPT: None-except for weekend seminars.
RPT: None-except for weekend seminars.
PTA: None

9) With regard to educational credentials, what additional services can be rendered by a DPT compared to a MPT?

Answer: Comparatively no additional services.

10) With regard to educational credentials, what additional services can be rendered by a MPT compared to a RPT?

Answer: Comparatively no additional services.

11) With regard to educational credentials, what additional services can be rendered by a RPT compared to a PTA?

Answer: The RPT assumes responsibility for overseeing and directing the treatment of a patient undergoing rehabilitation, whereas the PTA, directly assists the RPT in the administering of modalities, and exercise routines.

12) Is it true that the "transitional" DPT degree may be obtained by undertaking study-work on line?

Answer: Yes

13) How many other healthcare professionals, rendering physician-level services, receive their doctorate degrees online?

Answer: No other healthcare professionals are able to receive their doctorate degrees on line.

C) PATIENT SAFETY - IDENTIFYING SERIOUS CONDITIONS

14) When a patient is seen first by a Physical Therapist, how does the Physical Therapist determine whether or not that patient has a condition that is treatable by physical therapy?

Answer: Generally, by means of a 5-point check "evaluation".

15) Considering the fact that a physical therapist cannot diagnose, what is their decision-making process called that sets the basis for establishing a treatment program?

Answer: "The 5-point check system".

16) If the method by which a physical therapist decides on treating a patient is by means of a 5-point check analysis, what is the difference between a PT's "Analysis" and a physician's "Diagnosis"?

Answer: PT utilizes a 5-point check system.
The DC, MD, and DO utilizes full history, physical exam, blood tests and special imaging studies (if necessary) to determine whether or not hidden underlying disease is present.

17) What is an Aortic Aneurism?

Answer: A condition characterized by a weakening in the wall of the aorta causing it to bulge, and thereby subjecting the patient to a potentially life-threatening rupture.

18) If present, how much time does it take for an abdominal aortic aneurysm to rupture?
Answer: Rupture of the aorta can occur at any time, and results in almost immediate death and especially in cases of a sudden increase in blood pressure, such as would occur should a physical therapist suddenly start a patient on an exercise program. Prompt diagnosis and surgical evaluation is crucial in order to prevent a life-threatening catastrophe.

19) How would a physical therapist know whether low back pain is due to a muscle injury, joint injury, herniated disc, kidney infection or abdominal aortic aneurism?
Answer: With no training in diagnosis, or x-ray interpretation, and an inability to order and interpret diagnostic tests, the physical therapist cannot know and could jeopardize the well-beingof the patient.

20) With ½ the education of other portal of entry healthcare providers, together with the documented deficiencies in both diagnostic knowledge and interpretive procedures, should a DPT be granted physician-status to perform physician-level services?
Answer: No

21) By current law, can a DPT, MPT, RPT, and PTA order any tests to diagnose cancer?
Answer: No

22) Generally, how is a ruptured alar ligament diagnosed?
Answer: Detailed history, physical examination, X-ray studies, MRI, and CT scan.

23) Can a DPT, MPT, RPT, or PTA be expected to competently undertake a comprehensive physical examination and order these tests, if necessary?
Answer: No

24) Can a DPT, MPT, RPT, or PTA even read an X-ray study, MRI, or CT scan?
Answer: No

25) Is it true that DPT's, MPT's, RPT's, and PTA's are not trained and tested on X-ray interpretation and diagnosis?
Answer: Yes.

26) If the DPT, MPT, RPT, or PTA is deficient in education and training how will they know if a patient has a ruptured alar ligament?
Answer: Without diagnostic acumen, the injury will not be appreciated.

27) Will the 5 point check system alert the physical therapist to the presence of an abdominal aneurysm, cancer, or ruptured alar ligament?
Answer: No. The 5-point check system is not designed as a diagnostic system.

28) Does the proposed legislation allow for the DPT, MPT, RPT, and PTA to order any tests to diagnose cancer?
Answer: No

29) Can a Massage Therapist perform Physical Therapy in Indiana after attending a total of 40 hrs of weekend courses?
Answer: No. Legal statutes are already in place regulating the education and practice of physical therapy.

30) Is it reasonable to require a Massage Therapist, wanting to practice physical therapy, to fulfill the educational requirements allowing for the specialized knowledge and state licensure for the practice of physical therapy?

Answer: Yes.

31) From the standpoint of patient safety and liability, is it reasonable to require the physical therapist, requesting direct access and permission to administer spinal manipulation, to first fulfill the appropriate state licensure requirements of education, and training required of either a doctor of chiropractic, doctor of medicine, or doctor of osteopathy?

Answer: Yes. Patient safety must be held paramount by maintaining the state licensing statutes already in place for the practice of portal-of-entry healthcare providers.

D) PROPOSED LEGISLATIVE PROPOSAL - Direct Access for Physical Therapists

32) With regard to any legislative proposal allowing for Direct Access for Physical Therapists, would the proposed legislation prevent a PT, for example, from performing spinal manipulation?

Answer: If the proposed legislation is silent on this issue, it means any PT designation may,indeed, perform spinal manipulation.

33) With regard to any proposed legislation, where in the legislation or the Physical Therapy Practice Act does it define the standards for direct access for physical therapists and their ability to diagnose or perform spinal manipulation?

Answer: The past proposals have been silent on this issue.

34) Where are the training requirements in the proposal outlining the standards to be followed regarding the ability to perform a diagnosis and spinal manipulation?

Answer: Former legislative proposals by the Indiana Physical Therapy Association had no requirements.
The proposal would have allowed DPT's, MPT's, PT's, and PTA's to diagnose and perform spinal manipulation with absolutely no training.

35) Given the fact that in a relatively short period of time an aggressive, malignant cancer can metastasize to other organs, impeding the patient's chance for survival, did proposed legislation provide for timely diagnostic tests to detect this cancer at an early stage to maximize the chance of survival?

Answer: No, it did not.

E) NATIONAL PHYSICAL THERAPY EXAMINATIOM

36) As a protection to the public, certain legal standards are in place for the various licensed professionals, who, by education, training, and proficiency testing, are permitted to perform physician level services pertaining to their profession. Is that correct?

Answer: Yes.

37) With regard to the National Physical Therapy Examination (NPTE), how many questions pertain to diagnosis?

Answer: 10

38) With regard to the NPTE, how many questions address X-ray interpretation and x-ray diagnosis?

Answer: None

39) Did all professional PT designations in Indiana take the current NPTE examination?

Answer: No

40) Do all DPTs, MPTs, PTs, and PTAs have training in spinal manipulation?
Answer: No. Over 90% have no training in spinal manipulation at all. The DPT program simply has an "Overview" of spinal manipulation in their course-work.

41) How many questions on the current and previous NPTE examination address the art and s cience of spinal manipulation?
Answer: None

42) The PTA has only 2 years of formal education yet the IPTAs proposed legislation would have allowed the PTA to administer spinal manipulation proposed lergislation allows the PTA to administer spinal manipulation - a physician level service per Medicare/Medicaid - under "supervision" of, or "incident to", the orders of a PT, MPT or DPT. Is that correct?
Answer: Yes. The proposed legislaation is silent on this issue.

F) GENERAL

43) Is it reasonable to expect competency in spinal surgery by a chiropractor who has had only 40 hours of weekend education and training in surgery?
Answer: No, of course not.

44) Do you think a Dentist should be able to perform eye surgery after attending 40 hours of weekend seminars in opthamology?
Answer: No

45) Do you think the State should allow DPTs, MPTs, PTs, and PTAs to diagnose and perform spinal manipulation without <u>any</u> training or competency testing to meet the standards already in place for DC's, DO's, and MD's?
Answer: The State should not allow spinal manipulation by untrained providers.

46) Do you know where the alar ligament is in the body?
Answer: The alar ligament is located in the area of the junction between the head upon the spine. It is a critical anatomic structure securely enveloping and binding a bony process projecting from the C2 vertebra below (odontoid or dens), and the C1 vertebra above, resulting in a mechanical fulcrum allowing for left-right rotation of the head on the spine. The spinal cord lies directly posterior, in extremely close proximity to the odontoid, as the spinal cord traverses the junction between head and neck, and connects to the base of the brain.

47) Oftentimes, blunt force trauma to the head, or whiplash-injury to the neck will rupture the alar ligament, resulting in subtle instability of this vital junction. If not appreciated by the manipulating healthcare provider, one misapplied, high velocity thrust-spinal manipulation, to C-2 will force the odontoid process to compress and irreparably damage the spinal cord causing immediate paralysis or death. Do you agree?
Answer: Yes. Rupture of the alar ligament is a very serious and potentially life-threatening injury

48) Is it reasonable to require a Massage Therapist, wanting to practice physical therapy, to fulfill the educational requirements allowing for the specialized knowledge and state licensure for the practice of physical therapy?
Answer: Yes.

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Summary:

k) LEGISLATURE: Healthcare Revision in Indiana

All healthcare plans must include Chiropractic treatment on a parity basis with Medical treatment and ensure non-discrimination against chiropractic care. A growing body of scientific research supports chiropractic treatment as a better than (or at least equal to), but much safer, first-line, and cost-effective treatment in many spinal and other musculoskeletal conditions. Consequently, cost-effective chiropractic care must be a vital component of any health care plan or reform act. This would allow Indiana citizens direct access to chiropractic services as a guaranteed, covered benefit. A wellness and prevention based-system cannot be achieved without guaranteed access to essential services delivered by a Doctor of Chiropractic. It is essential that chiropractic care be fully integrated into any delivery system that is oriented and prioritized towards the delivery of wellness care.

The U.S. Census Bureau reported that a record 50.7 million residents (which includes 9.9 million non-citizens) or 16.7% of the population were uninsured in 2009. More money per person is spent on health care in the USA than in any other nation in the world, and a greater percentage of total income in the nation is spent on health care in the USA than in any United Nations member state except for East Timor. Although not all people are insured, the USA has the third highest public healthcare expenditure per capita, because of the high cost of medical care in the country. A 2001 study in five states found that medical debt contributed to 46.2% of all personal bankruptcies and in 2007, 62.1% of filers for bankruptcies claimed high medical expenses. Since then, health costs and the numbers of uninsured and underinsured have increased.

In order to begin addressing the spiraling costs of healthcare, it is imperative that lawmakers seriously consider that all insurance plans provide the protections afforded in the PPACA and not discriminate against Chiropractors. Congress must take action to ensure that the PPACA places a greater emphasis on wellness and disease-prevention rather than only on disease-care for those that have already progressed to illness. Given the scientific evidence, chiropractic must seriously be considered as integral in this effort.

The goal must be to fully maximize the potential of chiropractic:

a) Increase the quality of health care offered;
b) Improve patient outcomes and levels of patient satisfaction;
c) Expand patient treatment options and choice of provider;
d) Improve the overall health status and quality of life of the public by providing an effective, holistic wellness approach to health care;
e) Reduce medical errors and improve patient safety (chiropractic care is inherently safer and less complicated in comparison to the use of surgical intervention, hospital stays, and the use of pharmaceuticals);
f) Expand the nation's capacity to deal with a major healthcare emergency.
g) Avoid the preemption of state laws that help ensure a patient's right to seek care from the provider of his or her choice, unless such laws are replaced by federal standards, which are clearly superior;
h) Ensure that any federally defined package of "minimum benefits" that may be established specifically includes chiropractic care provided by doctors of chiropractic;
i) Adopt a comprehensive set of patient and provider protections (Patients Bill of Rights provisions) that will be made applicable to ERISA regulated plans;
j) Ensure that the availability of chiropractic is equal to the availability of traditional medical care in all federally established or regulated plans, including managed care plans, and that any discriminatory policies adverse to chiropractic patients and providers are eliminated;
k) In pursuit of "Medical Home" or "coordination of care concepts", avoid the creation of a gatekeeper scenario that would serve as an impediment to accessing chiropractic care.

In brief summary, all insurance healthcare plans must contain the protections afforded by PPACA and measures must be instigated that will ensure non-discrimination against chiropractic care.

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