Vertebral artery flow and spinal manipulation. A randomized, controlled and observer blinded study.
*Peter Licht, MD, Henrik Christensen, DC, Peter Højgaard, DC, Jens Marving, MD.*

**Background:** Several studies have been published on the effect of cervical rotation alone upon blood flow in the vertebral arteries. However, we have not found papers addressing the question of how spinal manipulative therapy per se affects the vertebral artery flow.

**Objective:** The aim of the present study was to investigate if any changes occur in peak flow velocity in the vertebral artery after spinal manipulative therapy as measured using the latest Doppler ultrasound technology.

**Design and setting:** A randomized, controlled and observer blinded study at a university hospital vascular laboratory.

**Participants:** 20 university students with a "biomechanical dysfunction" in the cervical spine.

**Results:** We observed no change in peak flow velocity immediately after spinal manipulative therapy and found no correlation between peak flow velocity and systolic blood pressure.

**Conclusion:** 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. Major changes in peak flow velocity might in theory explain the pathophysiology of cerebrovascular accidents following spinal manipulative therapy. However, in uncomplicated spinal manipulative therapy this potential risk factor was not prevalent.

**Key Indexing Terms:** vertebral artery; flow velocity; chiropractic manipulation therapy; doppler.
Attachments of the ligamentum nuchae to cervical posterior spinal dura and the lateral part of the occipital bone.

Barry Mitchell, PhD, B Kim Humphreys, DC, PhD, Elizabeth O’Sullivan.

Objective: To describe previously unrecorded attachments of the ligamentum nuchae to the cervical posterior spinal dura, and to posterolateral parts of the occipital bone in an anatomical study, with particular reference to the deep aspects of the suboccipital triangle and upper cervical region.

Design: Dissections of ten heads and necks from embalmed cadavers were made in the suboccipital and upper cervical region, either in whole specimens or in parasagittally sectioned specimens.

Results: In parasagittally sectioned material, continuity was observed between the ligamentum nuchae and the posterior cervical spinal dura as the latter passed deeply from the midline towards the dura, but only at the first and second cervical vertebral levels. The ligamentum nuchae also passed bilaterally on to the occipital bone as far as the sutures between the latter and the temporal bones, approaching the inferior nuchal line superiorly.

Conclusion: The present study is the first to describe the full morphology of the relationship between the ligamentum nuchae and the cervical posterior spinal dura and the lateral aspects of the occipital bone. This is of significance for understanding the biomechanics of the cervical spine, particularly rotational movements of the head in the sagittal or transverse planes. This may have implications in manipulative therapy for conditions as cervicogenic headache and for various degenerative disorders affecting the cervical spine.

Key Indexing Terms: ligamentum nuchae; morphology; cervical spinal; duramater; chiropractic.

Development of a practice-based research program.

Cheryl Hawk, DC, PhD, Cynthia Long, PhD, Karen Boulanger.
Objective: To establish an infrastructure to collect accurate data from ambulatory settings.

Design: The program was developed through an iterative model governed by a process of formative evaluation. The three iterations were needs assessment, feasibility study, and pilot project. Necessary program components were identified as infrastructure, practitioner-researcher partnership, centralized data management, and standardized quality assurance measures.

Setting and Participants: Volunteer chiropractors and their staff collected data on patients in their practices in ambulatory settings in the U.S. and Canada.

Outcome Measures: Evaluative measures were counts of participants, patients and completed forms. Standardized, validated and reliable measures collected by patient self-report were used to assess treatment outcomes. These included the SF-36 or SF-12 Health Survey, the Pain Disability Index, and the Global Well-Being Scale. For characteristics for which appropriate standardized instruments were not available, questionnaires were designed and pilot-tested before use.

Results: Information was gathered on practice and patient characteristics and treatment outcomes, but for this report only those data concerning process evaluation are reported. Through the three program iterations, 65 DCs collected data on 1,360 patients, 663 of whom were new patients. Follow-up data recorded by doctors were obtained for over 70% of patients; a maximum of 50% of patient-completed follow-up forms were collected in the three iterations.

Conclusions: This program is capable of providing data for descriptive epidemiology of ambulatory patients, and, with continued effort to maximize follow-up, may have utility in providing insight into utilization patterns and patient outcomes.

Key Indexing Terms: chiropractic; practice-based research.

The effects of high and low loading forces on measured values of lumbar stiffness.

Jane Latimer, GradDipAppSc(Manip Phty), Michael Lee, MBiomedE, Roger Adams, PhD.

Objective: One explanation for the poor reliability of manual judgements of posteroanterior (PA) stiffness may be that if manual therapists use different forces when testing, different stiffness is perceived. This study
was conducted to examine measurements of lumbar PA stiffness obtained using a device programmed to generate different loading forces.

**Subjects:** Twenty-five subjects, with no history of LBP and mean age 23.5 years, were measured.

**Methods:** Measures of lumbar PA stiffness were obtained using a mechanical device which applied a testing force of 200 N to the skin overlying the L3 spinous process. Six stiffness coefficients were determined from the force/displacement curve obtained from each subject by performing linear regressions from 30-80 N, 30-150 N, 30-200 N, and from 30-83.3 N, 83.3-136.7 N, and 136.7-200 N. Intraclass correlation coefficients and repeated measures analysis of variance (ANOVA) were used to analyze the data.

**Results:** While moderate reliability (ICC 2,1=0.67) was found for stiffness measures arising from increasingly wide force-interval regressions (30-80 N, 30-150 N, 300-200 N), poor reliability (ICC (2,1)=0.39) was found for stiffness measures arising from same width, higher force regressions (30-83.3 N, 83-137 N, 137-200 N). In both cases there were significant differences between the obtained K stiffness values corresponding to different force intervals.

**Conclusion:** These results show that if therapists push harder, different levels of stiffness will be felt. Studies using instrumented measurement of spinal stiffness to obtain ’K’ values should report the force intervals used. Also, revised protocols for manually judging PA stiffness should ensure that stiffness is assessed by sampling specified force intervals rather than the raters determining their own force limits.

**Key Indexing Terms:** spine; stiffness; tests and measurements.

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**The use of learning and study strategies inventory as predictor for success or failure on National Board of Chiropractic Examiner testing of Part I.**

*Roger Kevin Pringle, DC, Jay Lee.*

**Introduction:** The need for each chiropractic student to pass the National Chiropractic Board of Examiners (NCBE) exams is of great importance in their educational process. To date, no literature has evaluated the effectiveness of any outcome in predicting the success or failure on the NCBE exams. The Learning and Study Strategies Inventory (LASSI) was developed for the purpose of assessing students in areas related to
learning and studying strategies. In this study, the LASSI and NCBE Part 1 scores, and entering and cumulative grade point averages were used to assess for correlations related to failure and success on NCBE scores.

**Methods:** The LASSI was administered to a group of Tri-6 students at Texas Chiropractic College following their completion of Part 1 of NCBE exams. The tests were grade by the investigator, and NCBE scores were obtained through the registrar. The scores were analyzed using SPSS 6.0.1 for Windows, and appropriate statistical procedures were performed.

**Results:** Moderately high correlations were found with NCBE scores and each component of the LASSI. There were also moderately high correlations found with the NCBE scores and cumulative grade point averages. Low correlations were found with NCBE scores and entering grade point averages.

**Conclusions:** Due to the high correlation of NCBE scores and the LASSI scores, it is recommended that the introduction of this test to Tri-1 students and follow-up correlations be performed with NCBE scores, grade point averages and LASSI scores. An elective course for students that perform poorly on LASSI could be developed to aide students weak in study skills and strategies. The need for further studies to include the evaluation of the students put through the LASSI and preparation course with their NCBE scores.

**Key Indexing Terms:** chiropractic; medical education; licensure.

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**Raymond Nimmo and the evolution of trigger point therapy, 1929-1986.**

*Jeffrey Cohen, DC, Russell Gibbons, LittD (hc).*

Dr. Raymond Nimmo (1904-86) was the definitive chiropractic pioneer in the now widely-accepted field of soft tissue and trigger point therapy. This paper explores how Nimmo was able to make the radical conceptual leap from moving bones to working with muscles that move the bones. Also discussed are the neurophysiological explanations that Nimmo evolved in the 1950’s for the trigger point phenomenon, formulations which are still regarded as highly sophisticated half a century later. Finally, the paper describes how Nimmo, with a basic chiropractic education absent much of the background in the biological and physical sciences of today’s preparation, was able to combine his clinical experiences and intellectual formulation to arrive at a theory which became widely accepted.
Objective: To compare the current knowledge of 3-D spinal mechanics and abnormal equilibrium states with chiropractic motion theories, chiropractic vertebral letter listing theories, and chiropractic technique theories.

Data Collection: A hand search of available reference texts and a computer search of literature from the indexed medicus sources were collected with an emphasis on 3-D studies of human spinal movements, segmental instability, Euler buckling of the spine, and chiropractic theories concerning vertebral movements.

Results: Previous spinal coupling results based upon 2-D radiographic studies are inadequate and inaccurate. Therefore, the validity of any chiropractic technique procedure which bases their listing, motion analysis or adjusting style off of the 2-D radiograph and coupling studies must be questioned. We have identified four types of spinal subluxations (displacements) in the biomechanical literature: 1) posture main motion and associated segmental coupling, 2) Euler buckling viewed in the AP view, 3) snap through viewed in the lateral view, and 4) segmental instability.

Conclusions: Full three-dimensional investigations of spinal coupling patterns have shown that the vertebrae rotate and translate in all three axes and that previous theories of spinal coupling based upon 2-D studies are inaccurate and invalid. Previous chiropractic letter listings (PRI, PLS, etc.) of spinal displacements are inadequate and invalid. Only one of the four types of biomechanical displacements, segmental instability, is consistent with the traditional chiropractic theory of segmental spinal displacements; and, in general, this does not respond well to care. In general, vertebrae displacement must be viewed in the context of equilibrium configurations and one vertebra can not be displaced as an individual misalignment. Validity questions arise for any technique methods utilizing letter listings of displacement taken from motion palpation or 2-D radiographic analysis.
Key Indexing Terms: chiropractic; instability; posture; x-ray.

Treatment of symptomatic lumbar disc herniation utilizing activator methods chiropractic technique.

Bradley Polkinghorn, DC, Christopher Colloca, DC.

Objective: To describe a case of symptomatic lumbar disc herniation, successfully treated via chiropractic intervention utilizing Activator Methods Chiropractic Technique (AMCT).

Clinical Features: A 26-year-old male suffered from a chronic multi-symptom complex comprised of low back pain, left groin pain, left leg pain, left foot drop and associated muscle weakness with atrophy. Symptoms has persisted for over two years, following an athletic injury. Magnetic resonance imaging (MRI) evaluation revealed a 6 mm. focal central disc protrusion with accompanying deformation of the thecal sac, consistent with the presenting symptomatology. Prior to chiropractic presentation, lumbar spinal surgery was recommended to the patient as the appropriate medical management for optimal outcome.

Intervention and Outcome: The patient elected to pursue chiropractic treatment in an effort to resolve his condition via conservative management. Chiropractic intervention consisted of mechanical-force, manually-assisted (MFMA) short-lever adjusting procedures, rendered via an Activator Adjusting Instrument (AAI). The patient responded favorably and his multi-symptom complex resolved within 90 days of treatment. No residuals or recurrences were noted at examination over one year later.

Conclusion: This report suggests that chiropractic treatment of lumbar disc disorders may be effectively implemented, in certain cases, via MFMA adjusting procedures utilizing an AAI. We speculate that the use of an AAI, combined with activator methodology, may provide definitive benefits over side-posture manipulation of the lumbar spine in treatment of resistive disc lesions, due to the lack of torsional stress imposed upon the disc during instrumental spinal adjustment. Further study should be made in this regard, in order to determine the safest, as well as most effective, method to treat lumbar disc lesions in a chiropractic setting.

Key Indexing Terms: chiropractic; intervertebral disc; low back pain; sciatica.
Chiropractic Utilization of Lumbar Magnetic Resonance Imaging: How accurate are we in its usage when compared to other specialties?

Scott Kilmer, DC.

Objective: To determine, through the review of lumbar MRIs, which specialty ordering these scans was more successful and accurate in coming up with "positive findings" that would warrant the use of the modality. Such data can demonstrate to MCOs and insurance companies that chiropractors have a good working knowledge of when to use this test and that the profession deserves the right of direct access to MRI.

Design: 702 lumbar MRIs taken over three years were reviewed. A list of seven criteria was made: (1) disc derangement; (2) stenosis; (3) trauma; (4) tumors; (5) hematologic and vascular; (6) infection; and (7) metabolic/endocrine disorders. Scans found to have one of the seven categories were listed as "positive findings." The number of positives were then entered under each separate specialty group and a percentage was calculated for each.

Results: This study showed that DCs fared better than all providers except for oncologists and general surgeons. Chiropractors fared 2.42% better than orthopedists, and 10.06% better than general practitioners, whom, ironically, DCs must at times rely on for authorization of MRIs in certain managed care situations.

Conclusion: It would be fruitful to conduct similar studies of this type, this obtaining a larger data base of information reflecting more accurate numbers nationwide and documenting that chiropractors have a working knowledge of when to use this imaging modality.

Key Indexing Terms: chiropractic; magnetic resonance imaging; cost control; managed care programs; overutilization of health services; low back pain.

Management of a patient with calcium pyrophosphate deposition diseases and meniscal tear of the knee: A case report.

Joel Alcantara, DC, John McDaniel, DC, Gregory Plaugher, DC, and Joey Alcantara, DC.
Objective: To describe the chiropractic management of a patient suffering from a right lateral meniscus tear concurrent with calcium pyrophosphate dihydrate (CPPD) deposition disease.

Clinical Features: A 51-year-old male bus driver suffered from a complaint of right knee pain (rated 7 on a 1-10 pain scale). The knee pain had a gradual onset and increased during use of the bus brakes and gas pedal. Palpatory tenderness was noted at the right lateral knee joint line and the lateroinferior margin of the patella. Active resistive range of motion (ROM) in the right knee during extension was painful throughout the full ROM, while passive ROM was restricted in flexion at 1100. A positive McMurray’s Test reproduced pain at the right knee. Radiographic analysis revealed CPPD deposition disease, and magnetic resonance imaging (MRI) revealed a probable “parrot’s beak” tear in the posterior horn of the right lateral meniscus.

Intervention and Outcome: The patient was treated via a conservative approach. The patient was instructed to not place the right knee under weight bearing activities and to not return to work for five days. Initial treatments involved the use of ice and interferential electrical stimulation using a chronic pain protocol, along with glucosamine sulfate supplementation. One week after treatment initiation, home and gym bicycling, weight lifting for general fitness and general knee strengthening exercises were prescribed. After 11 treatments over the course of 20 days, the patient’s knee pain decreased to 2/10 based on the pain rating scale. Three months after the initial treatment, with continued care as described, the patient’s knee pain had a regular status of 3/10 with occasional flare-ups with pain rating at 7/10. Approximately five months after initial treatment, the patient was scheduled for a follow up visit. He did not appear for his appointment and was lost from care. Approximately 17 months later (from initial care), the patient returned for treatment due to reoccurrence. Physical examination at that time revealed knee pain rated at 3/10 but negative for pain upon palpation, negative McMurray’s test and full right knee range of motion without pain.

Conclusion: The management of a patient suffering from right knee pain with an associated diagnosis of CPPD deposition disease and meniscal tear is presented. A patient suffering from this uncommon metabolic condition can be managed by conservative means. The pathophysiology, clinical features and management considerations in the treatment of the patient’s condition(s) are also discussed.

Key Indexing Terms: calcium pyrophosphate deposition disease; meniscus; knee; chiropractic.