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Editorial Staff

Do cerebral potentials to magnetic stimulation of paraspinal muscles reflect changes in palpable muscle spasm, low back pain, and activity scores?

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**Objective:** Previous studies have shown that cortical evoked potentials on magnetic stimulation of muscles are influenced by muscle contraction, vibration, and muscle spasm. This study was carried out to determine whether these potentials correlate with palpatory muscle spasm, patients' symptoms, and disability in patients with low back pain.

**Methods:** A prospective observational study was performed on 13 subjects with a history of low back pain visiting an orthopedic hospital-based clinic. Patients were screened for serious pathology by an orthopedic surgeon. The patients were then evaluated for the presence of muscle spasm by one of the investigators who was blinded to the results of the evoked potential studies. Patients were asked to fill out a low back pain visual analogue scale (VAS) and a Roland-Morris Activity Scale (RMAS). Cortical evoked potentials were recorded utilizing a magnetic stimulator placed over the lumbar paraspinal muscles with the patient in the prone position. The palpatory examination, VAS, and RMAS as well as the cortical potentials were repeated after two weeks of therapy commonly used to reduce muscle spasm.

**Results:** The patients demonstrated a significant decrease in low back pain VAS and RMAS scores after the treatment compared to pre-treatment scores. There was a reduction in the amount of palpatory muscle spasm in 11 of 13 cases. The cortical pre-treatment potentials were attenuated compared to previously reported controls and showed a significant pre- and post-treatment increase in the amplitude of these potentials using multi-variant analysis (MANOVA). There was significant correlation between the changes in cortical potentials after treatment and the changes noted in paraspinal muscle spasm, VAS, and RMAS scores.

**Conclusions:** This study confirms the previous report that the amplitude of cerebral evoked potentials on magnetic stimulation of paraspinal muscles is depressed in the presence of palpable muscle spasm. The close correlation between these potentials, paraspinal muscle spasm, and clinical symptoms suggests that the measurement of muscle activity may be more important in the assessment of low back pain than is commonly accepted.

**Key Indexing Terms:** Chiropractic Manipulation; Evoked Potentials; Low Back Pain; Muscle Spasm.

Christopher J. Colloca, DC, Tony S. Keller, PhD, Robert Gunzburg, MD, PhD, Katelijne Vandeputte, MD and Arlan W. Fuhr, DC.

**Background:** Although the mechanisms of spinal manipulation (SM) are poorly understood, clinical effects are thought to be related to mechanical, neurophysiologic, and reflexogenic processes. Animal studies have identified mechanosensitive afferents in animals and clinical studies in humans have measured neuromuscular responses to SM. Few, if any, studies have identified the basic neurophysiologic mechanisms of SM in humans or animals.

**Objectives:** The purpose of this clinical investigation was to determine the feasibility of obtaining intraoperative neurophysiological recordings and to quantify mixed-nerve root action potentials in response to lumbosacral SM in a human subject undergoing lumbar spinal surgery.

**Methods:** An L4-L5 laminectomy was performed in a 62 year-old male subject. Short duration (<0.1 ms) mechanical force, manually assisted spinal manipulative thrusts (SMTs) (500 N) were delivered to the lumbosacral spine with an Activator(r) II Adjusting Instrument (AAI II). With the spine exposed, SMTs were delivered internally to the L5 mammillary process, L5-S1 joint, and to the sacral base using various force vectors. This protocol was repeated by contacting the skin overlying respective anatomical landmarks. Mixed-nerve root recordings were obtained from gas sterilized platinum bipolar hooked electrodes attached to the S1 nerve root at the level of the dorsal root ganglion during the SMTs and during a 30-second baseline period during which no SMTs were applied.

**Results:** During the active trials, mixed-nerve root action potentials were observed in response to both internal and external SMTs. Differences in the amplitude and discharge frequency were noted in response to varying segmental contact points and force vectors, and similarities were noted for internal and externally applied SMTs. Amplitudes of mixed-nerve root action potentials for internal thrusts ranged from 200-2600 mV, and 800-3500 mV for external thrusts.

**Conclusions:** Monitoring mixed-nerve root discharges in response to SMTs in human subjects in vivo undergoing lumbar surgery is feasible. Neurophysiological responses appeared sensitive to contact point and applied force vector of the SMT. Further study of the neurophysiological mechanisms of spinal manipulation in humans and animals is needed to more precisely identify the mechanisms and neural pathways involved.

**Key Indexing Terms:** Chiropractic; Low Back Pain; Lumbar Spine; Mechanoreception; Nerve Root; Neurophysiology

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The short-term effects of cervical manipulation on edge light pupil cycle time: A pilot study.

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**Background:** Edge light pupil cycle time (ELPCT) is one of the eye's light reflexes. Studies have shown ELPCT to be a measurable constant, unaffected by visual acuity, refractive error, eye color, pupil size or gender. Control of this reflex is via the autonomic nervous system. Various authors suggest that spinal manipulative techniques can produce distant effects mediated in part by alterations in autonomic tone following intervention.

**Objective:** To investigate the effects of a C1-2 high-velocity low-amplitude manipulation upon ELPCT.

Design: A single group randomized pilot study, without a control group.

Methods: Thirteen males (mean age = 24.2) without a history of eye, central or autonomic nervous system pathology had their ELPCT measured pre- and post-manipulation. The manipulation comprised a high-velocity low-amplitude rotatory thrust, localized to the C1-2 joint on the left (n = 6) or right (n = 7) determined randomly.

Results: ELPCT measures demonstrated a significant difference between pre- and post-manipulation for both eyes (p = 0.002), the right eye (p=0.027) and the left eye (p=0.046).

Conclusion: This suggests that ELPCT, which is mediated via the autonomic nervous system, can be directly influenced by high velocity manipulation to the upper cervical spine.

Key Indexing Terms: Eye; Chiropractic Manipulation; Autonomic Nervous System.

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Chiropractic biophysics digitized radiographic mensuration analysis of the anteroposterior cervicothoracic view: A reliability study.

Stephan J. Troyanovich, DC, Deed Harrison, DC, Donald D. Harrison, DC, PhD, Sanghak O. Harrison, DC, Tadeusz Janik, PhD, and Burt Holland, PhD.

Objective: To investigate the reliability of a radiographic measurement procedure that uses a computer and sonic digitizer to determine projected spinal displacements from an ideal normal position.

Design: A blind, repeated-measure design was used. Anteroposterior cervicothoracic spine radiographs were presented in random order to each of three examiners . Each film was digitized and the films were randomized for a second run.

Setting: Private, primary-care chiropractic clinic.

Main Outcome Measures: Intra-class correlation coefficients (ICC) for intra- and interexaminer reliability for measures on radiographs comparing the perpendicular distance ( $T_x$ ) from a vertical axis line drawn through the center of T4 and the center of C2, the linear distance (Vertebra<sub>apex</sub>) from the center of the vertebra most displaced from a line connecting the centers of C2 and T4, the angle (Rz) formed by the intersection of the vertical axis line and the upper thoracic line, and the angle of intersection (CDA) between the upper thoracic line and the cervical line.

Results: Intraexaminer reliability for (a)  $T_x$  distance was .99-1.00 with confidence intervals included in the range of .98-1.00, (b) Vertebra<sub>apex</sub> was .96-.97 with confidence intervals included in the range of .92-.98, (c) Rz was .94-.98 with confidence intervals included in the range of .89-.99, and (d) CDA was .92-.95 with confidence intervals included in the range of .84-.97. Interexaminer reliabilities for the three examiners ranged from .97 to .99.

Conclusions: Measures similar to those described in this study are commonly used to measure and categorize spinal displacements from true vertical alignment (i.e., scoliosis measurements). ICC values greater than .70 are considered accurate enough for use in clinical and research applications. The measures tested here would fit within these guidelines of reliability. Establishing reliability is an important first step in evaluating these measures so that future studies of validity may be undertaken.

Key Indexing Terms: Reliability; Radiography; Chiropractic.

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Clinical considerations in the chiropractic management of the patient with Marfan syndrome.

Jeffrey R. Tuling, DC, Edward T. Crowther, DC, and Phyllis McCord, DC, MD.

**Objective:** To describe the chiropractic management of a patient suffering from whiplash-associated disorder and a covert, concomitant dissecting aneurysm of the thoracic aorta due to Marfan syndrome or a related variant.

**Clinical Features:** A 25-year-old male was referred by his family physician for chiropractic assessment and treatment of neck injuries received in a motor vehicle accident. Following history, physical examination and plain film radiographic investigation, a diagnosis of whiplash-associated disorder (WAD) Grade I was generated.

**Intervention and Outcome:** The WAD Grade I was treated conservatively. Therapeutic management involved soft tissue therapy to the suspensory and paraspinal musculature of the upper back and neck. Rotary, manual style manipulative therapy of the cervical and compressive manipulative therapy of the thoracic spinal column was implemented to maintain range of motion and decrease pain. The patient achieved full recovery within a three week treatment period and was discharged from care. One week post-discharge, he underwent a routine evaluation by his family physician, where an aortic murmur was identified. Diagnostic ultrasound revealed a dissecting aneurysm at the aortic root measuring 78 mm. Immediate surgical correction was initiated with a Dacron graft. The pathology report indicated that aortic features were consistent with an old (healed) aortic dissection. There was no evidence of acute dissection. Six month follow-up revealed that surgical repair was successful in arresting further aortic dissection.

**Conclusion:** The patient had an old aortic dissection that predated the chiropractic treatment (which included manipulative therapy) for his whiplash-associated disorder. Manipulative therapy, long considered an absolute contraindication for abdominal and aortic aneurysms, did not provoke the progression of the aortic dissection or other negative sequelae. The etiology, histology, clinical features and management considerations in the treatment of this patient's condition(s) are discussed.

Key Indexing Terms: Marfan Syndrome; Chiropractic Manipulation; Aorta; Aneurysm.

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Lumbosacral transitional segments: classification, prevalence and effect on disc height.

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**Objective:** To determine the prevalence rate of lumbosacral transitional segments among chiropractic practice settings and to determine if this anomaly would affect the height of the lumbosacral disc.

**Study Design:** Retrospective review of radiographs. **Setting:** Los Angeles College of Chiropractic outpatient clinic and a private chiropractic office.

**Samples:** 20 lumbar series with lumbosacral transitional segments from the private chiropractic office, and 47 lumbar series with lumbosacral transitional segments, and 60 age- and gender-

matched control series from the college clinic.

Results: 2.3% of 882 lumbar series at the private chiropractic office and 6.5% of 786 lumbar series at the Whittier Health Center showed lumbosacral transitional segments of types II, III, or IV. The L5-S1 intervertebral disc height was significantly smaller in patients with lumbosacral transitional segments compared to those without, i.e., 11% versus 19% of total lumbar disc height. When bilateral bony fusion of L5 to the sacrum was present, the L5-S1 disc height was significantly smaller than that without bony fusion, i.e., 8% versus 12-14% of total lumbar disc height.

Conclusions: We conclude that the prevalence rate of lumbosacral transitional segments are low in chiropractic practice. In the presence of lumbosacral transitional segments, especially when there was bony fusion, the lumbosacral intervertebral disc was significantly narrower than the upper lumbar discs, which should not be considered as disc degeneration or displacement. The type of lumbosacral transitional segment present also showed a significant effect on the height of lumbosacral disc.

Key Indexing Terms: Chiropractic; Sacralization; Lumbosacral Transitional Segments; Intervertebral Disc

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Complex regional pain syndrome and chiropractic.

Jeffrey Muir, MSc, and Howard Vernon, DC.

Background: Complex regional pain syndromes (CRPS) represent curious and difficult syndromes for both patient and clinician. CRPS presents as a triad of signs and symptoms, usually following a seemingly trivial injury to a peripheral joint or appendage. The clinical triad includes severe pain, vasomotor changes in and around the affected area, and trophic changes in the affected limb. Many of the acute symptoms are similar to those seen following many acute injuries, which makes an early diagnosis often times difficult. Current treatment protocols revolve around aggressive physical therapy, plus pharmacological interventions aimed at limiting sympathetic nervous system activity.

Objective: To review the current literature on CRPS regarding symptoms, diagnosis, treatment and causal mechanisms, and to discuss alternative treatment approaches and the possible role of chiropractic care in patient rehabilitation.

Data Sources: Texts, review articles and randomized clinical trials investigating treatments, causes and epidemiology.

Conclusions: Recent research calls into question the predominant theories which view excessive sympathetic nervous system activity as the cause of CRPS. No evidence of an increase in sympathetic nervous system activity has been found, and new theories suggest that an increase in the sensitivity of neurotransmitter receptors may be the cause of CRPS. Alternatively, other research has suggested that a local inflammatory process may in fact cause CRPS. While no research has been completed examining the role of chiropractic care in the treatment of CRPS, there is reason to believe that spinal manipulation may be beneficial to CRPS patients.

Key Indexing Terms: Pain Syndromes; Reflex Sympathetic Dystrophy; Chiropractic.

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MRI of the spine and spinal cord: Imaging techniques, normal anatomy, artifacts and pitfalls.

Claude Pierre-Jerome, MD, PhD, Arzu Arslan, MD, and Svein Ivar Bekkelund, MD, PhD.

Background: MRI is widely used to evaluate the spine and spinal cord.

Objective: In this article, MRI of the spine is discussed in terms of normal anatomy, standard and advanced imaging techniques, general indications, limitations and potential for the future.

Discussion: Although it does not provide the high bony detail possible with CT, the appropriate combination of the sequences takes advantage of the different tissue characteristics to discriminate the various bony and soft tissue structures of the spine.

Conclusion: MRI enables the imaging specialist to evaluate a large anatomic region in multiple planes, and can better examine the spinal cord. Key Indexing Terms: Magnetic Resonance Imaging; Spine; Spinal Cord.

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