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Altered Central Integration of Dual Somatosensory Input After Cervical Spine Manipulation

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Objective: The aim of the current study was to investigate changes in the intrinsic inhibitory interactions within the somatosensory system subsequent to a session of spinal manipulation of dysfunctional cervical joints.

Method: Dual peripheral nerve stimulation somatosensory evoked potential (SEP) ratio technique was used in 13 subjects with a history of recurring neck stiffness and/or neck pain but no acute symptoms at the time of the study. Somatosensory evoked potentials were recorded after median and ulnar nerve stimulation at the wrist (1 millisecond square wave pulse, 2.47 Hz, 1 x motor threshold). The SEP ratios were calculated for the N9, N11, N13, P14-18, N20-P25, and P22-N30 peak complexes from SEP amplitudes obtained from simultaneous median and ulnar (MU) stimulation divided by the arithmetic sum of SEPs obtained from individual stimulation of the median (M) and ulnar (U) nerves.

Results: There was a significant decrease in the MU/M + U ratio for the cortical P22-N30 SEP component after chiropractic manipulation of the cervical spine. The P22-N30 cortical ratio change appears to be due to an increased ability to suppress the dual input, as there was also a significant decrease in the amplitude of the MU recordings for the same cortical SEP peak (P22-N30) after the manipulations. No changes were observed after a control intervention.

Conclusion: This study suggests that cervical spine manipulation may alter cortical integration of dual somatosensory input. These findings may help to elucidate the mechanisms responsible for the effective relief of pain and restoration of functional ability documented after spinal manipulation treatment.

Spinal Manipulation Impacts Cervical Spine Movement and Fitts' Task Performance

Steven Passmore, DC, MS, Jeanmarie Burke, PhD, Christopher Good, DC, MAEd, et al.

Objective: The objective of this study was to determine if active cervical range of motion (ROM)

and Fitts' task movement time differences occurred after high-velocity low-amplitude cervical spinal manipulation (SM) across various indexes of difficulty.

Methods: A single-blind randomized before-after trial was performed in a motor performance laboratory. Fifteen volunteers (21-42 years) with asymptomatic palpable intervertebral motion restriction at the C1-C2 level were randomly assigned to an SM group or to a no-intervention (NI) group. A single episode of upper cervical manipulation was performed on the SM group. Active cervical ROM and movement time were measured pre- and posttreatment in the SM group and compared to similar measurements in the NI group.

Results: In the SM group, active cervical ROM into rotation increased after the intervention (pre, 74.75° ± 7.63°; post, 78.50° ± 7.23°; t (7) = –3.07; $P < .02$). During the second trial, significant group differences were present in the SM group for movement time in direction congruent conditions ($F_{(8,48)} = 2.83$; $P < .02$; $n_p2 = .320$) and direction incongruent conditions ($F_{(8,48)} = 2.31$; $P < .05$; $n_p2 = .278$) but not for the NI group.

Conclusions: A linear relationship between indexes of difficulty and movement time as predicted by Fitts' law was observed. Significant group effects indicate that SM not only increases cervical active ROM, but also facilitates the performance of a cervical spine Fitts' task requiring rotation. This task may be used to quantify motor performance in clinically symptomatic populations with reduced ROM who are appropriate candidates for SM.

Vertebral Artery Hypoplasia: Prevalence and Reliability of Identifying and Grading Severity

Cynthia Peterson, RN, DC, MMedEd, Lee Phillips, DC, Ashleah Linden, DC, et al.

Objective: The purpose of this study is to examine the inter- and intraexaminer reliability of determining the prevalence of vertebral artery hypoplasia on magnetic resonance imaging (MRI), as well as the reliability of assigning a severity grading of mild, moderate, or marked hypoplasia.

Methods: Two chiropractic radiologists independently evaluated the MR images of 131 adult patients retrospectively for visual vertebral artery hypoplasia. Severity of hypoplastic was graded. The side of hypoplasia and sex of the patient were recorded. The process was repeated after 1 month. Descriptive statistics were calculated for prevalence, severity, and sex distribution of hypoplasia. The k statistic was calculated for the reliability of detecting and grading the hypoplasia.

Results: Interexaminer reliability was substantial for both readings (k = 0.68, 83% agreement for the first reading; k = 0.75, 86% agreement for the second reading). Interexaminer reliability for grading the severity of asymmetry was substantial (k = 0.73, 83% agreement for the first read; k = 0.69, 81% agreement for the second reading). Intraexaminer reliability readings provided a k of 0.71 (substantial) and 83% agreement for examiner 1. Examiner 2 had a k of 0.85 (almost perfect) with 92% agreement. Overall, 57 (43.5%) of the 131 patients demonstrated hypoplasia. Hypoplasia was more common in women (49%) than men (35.8%). Seven arteries demonstrated severe hypoplasia. Six of these seven patients were women.

Conclusions: Vertebral artery hypoplasia is common and can be reliably diagnosed and categorized on cervical MRI scans. Vertebral artery hypoplasia was more common in women than men in this group of patients.

Reliability of Zygapophyseal Measurements Made From MRI Scans of LBP Patients

Gregory Cramer, DC, PhD, Joe Cantu, DC, Judith Pocius, MS, et al.

Objective: The purpose of this study was to assess the reliability of measurements made of the zygapophysial (Z) joint space from the magnetic resonance imaging scans of subjects with acute low back pain using new equipment and two different methods of statistical analysis. If found to be reliable, the methods of Z joint measurement can be applied to scans taken before and after spinal manipulation in a larger study of acute low back pain subjects.

Methods: Three observers measured the central anterior-to-posterior distance of the left and right L4/L5 and L5/S1 Z joint space from five subject scans (20 digitizer measurements, rounded to 0.1 mm) on two separate occasions separated by four weeks. Observers were blinded to each other and their previous work. Intra- and interobserver reliability was calculated by means of intraclass correlation coefficients and also by mean differences using the methods of Bland and Altman (1986). A mean difference of less than ±0.4 mm was considered clinically acceptable.

Results: Intraclass correlation coefficients showed intraobserver reliabilities of 0.95 (95% confidence interval, 0.87-0.98), 0.83 (0.62-0.92), and 0.92 (0.83-0.96) for each of the three observers and interobserver reliabilities of 0.90 (0.82-0.95), 0.79 (0.61-0.90), and 0.84 (0.75-0.90) for the first and second measurements and overall reliability, respectively. The mean difference between the first and second measurements was –0.04 mm (±1.96 SD = –0.37 to 0.29), 0.23 (–0.48 to 0.94), 0.25 (–0.24 to 0.75), and 0.15 (–0.44 to 0.74) for each of the 3 observers and the overall agreement, respectively.

Conclusions: Both statistical methods were found to be useful and complementary, and showed the measurements to be highly reliable.

Effects of Ice Massage on Pressure Pain Thresholds and Electromyographic Activity Postexercise

Laura Anaya-Terroba, PT, Manuel Arroyo-Morales, MD, PT, PhD, et al.

Objective: The purpose of this study was to investigate the effects of ice massage postexercise on pressure pain thresholds (PPTs) over the quadriceps muscle and the electromyography (EMG) root mean square (RMS).

Methods: Fifteen athletes (eight females, seven males; average age, 19 ± 2 years) participated. Subjects were required to visit the laboratory on two separate occasions with a one-week interval between sessions. Participants performed five isokinetic concentric dominant knee extension contractions at 60°, 120°, 180°, and 240°/s. After exercise, they were randomly assigned to receive either an ice massage or detuned ultrasound for 15 minutes, one at each session. The PPT and RMS during maximal voluntary contraction were measured over the vastus medialis (VM), vastus lateralis (VL), and rectus femoris (RF) muscles at baseline, postexercise, and five minutes postintervention. The hypothesis of interest was the intervention x time interaction.

Results: The analysis of covariance found a significant intervention x time interaction for PPT over the VM ($F = 17.3$, $P < .001$) and VL ($F = 5.4$, $P = .03$) muscles but not over the RF ($F = 1.2$, $P = .3$), indicating an increase in PPT after the ice massage. An intervention x time interaction was found for RMS of the VL ($F = 5.8$, $P = .01$) but not of the VM ($F = 0.5$, $P = .5$) or RF ($F = 0.01$, $P = .9$) muscles, indicating an increase in RMS after the ice massage. A significant positive correlation between PPT and RMS for the VL muscle was identified ($r = 0.6$, $P = .03$).

Conclusion: Ice massage after isokinetic exercise produced an immediate increase of PPT over the VL and VM and EMG activity over the VL muscle in recreational athletes, suggesting that ice massage may result in a hypoalgesic effect and improvements in EMG activity.

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