

# Research Abstracts From the *Journal of Manipulative and Physiological Therapeutics*

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## Elevated Production of Inflammatory Mediators in Patients With Neck Pain

*Julita Teodorczyk-Injeyan, PhD, et al.*

**Objective:** This study investigated whether the production of inflammatory mediators and chemotactic cytokines (chemokines) is altered in patients with chronic and recurrent [neck pain](#) (NP).

**Methods:** Cross-sectional data evaluating blood and serum samples were obtained from 27 NP patients and 13 asymptomatic (control) subjects recruited from a chiropractic outpatient clinic. Cell cultures were activated by lipopolysaccharide (LPS) and phytohemagglutinin for 24 to 48 hours. The levels of tumor necrosis factor  $\alpha$  (TNF- $\alpha$ ), monocyte chemotactic protein 1, also known as CCL2 (CCL2/MCP-1), and macrophage inflammatory protein 1 $\alpha$  or CCL3 (CCL3/MIP-1 $\alpha$ ) were determined by specific immunoassays. Serum levels of nitric oxide metabolites were evaluated simultaneously, in vanadium III-reduced samples, by Griess reaction.

**Results:** Low levels of constitutive (spontaneous) TNF- $\alpha$  production were present in seven of the 27 cultures from patients with NP. Both LPS-induced TNF- $\alpha$  production and inducer (LPS/phytohemagglutinin)-stimulated production of CCL2 were significantly elevated ( $P = .00$ ) in patients compared with controls. In patients, the constitutive synthesis of CCL3 occurred significantly more frequently ( $P = .00$ ) and ranged from 30 to more than 2,000 pg/mL. Finally, serum levels of nitric oxide were significantly elevated ( $P = .00$ ) in NP patients.

**Conclusions:** Production of inflammatory mediators was consistently elevated in NP patients in this study, both *in vitro* and *in vivo*, and activation of inflammatory pathways was accompanied by up-regulation of CC chemokine synthesis. This suggests that, in NP patients, CC chemokines may be involved in regulation of local inflammatory response through recruitment of immune cells to the inflamed tissue and exert pronociceptive effects.

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## Self-Rated Disability, Fear Avoidance and Nonorganic Signs in Whiplash Patients

*Howard Vernon, PhD, et al.*

**Objectives:** The purpose of this study was to determine the role of standard and novel (cervical) nonorganic signs in patients with chronic [whiplash-associated disorder](#) (WAD).

**Methods:** Chronic WAD I to III patients (>3 months) were recruited from private chiropractic practice in Canada. Subjects completed a Neck Disability Index (NDI), Tampa Scale for Kinesiophobia (TSK), pain visual analog scale, and pain diagram. Clinical and demographic data were also obtained. Nine standard nonorganic pain behavior tests and four novel cervical nonorganic simulation signs (C-NOSS) tests were applied. Bivariate correlations were obtained with the Pearson correlation coefficient. Items achieving statistical significance on univariate analysis were loaded in a sequential linear regression analysis. Post hoc analyses were conducted with analysis of variance tests of NDI and TSK scores.

**Results:** Ninety-one subjects were investigated (49 males and 42 females), with a mean age of 41.7 (SD, 14.7) years and a mean WAD duration of 9.4 (SD, 11.2) months. Because mean NDI scores were 57.5 (SD, 17.8) and mean pain scores were 68.3 (SD, 21.0), this sample represents moderate-to-severe WAD. Fair to moderately strong correlations were obtained between the NDI and the TSK, pain visual analog scale and nonorganic symptoms and signs (NOS-9) and C-NOSS scores, but not with "age," "sex" or "duration." The NOS-9 and C-NOSS scores correlated most strongly at 0.70. A multivariate model accounting for 53% of the variance of the NDI scores ( $P < .001$ ) was obtained with the TSK, pain severity, and NOS-9 scores. There was no significant correlation between C-NOSS and TSK scores. At least 25% of subjects scored either five of nine or two of four on the NOS-9 and C-NOSS tests, respectively.

**Conclusions:** Based on the findings of this study, nonorganic signs should be considered in the interpretation of self-rated disability in patients with moderate-to-severe chronic WAD.

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## The Neck Flexor Muscles and Chronic Neck Pain: Changes After Cervical Spine Mobilization

*Fabianna Jesus-Moraleida, PT, MSc, et al.*

**Objective:** The purpose of this study was to analyze changes in the recruitment of the muscles longus colli (Lco) and sternocleidomastoid (SCM) as measured by ultrasonography in patients with chronic neck pain before and immediately after a single cervical Maitland's posterior-anterior central mobilization technique.

**Methods:** This was a cross-sectional, case-control research design study. Ultrasonographic images of Lco and SCM were taken in 31 patients with chronic neck pain and matched controls during the five phases of the craniocervical flexion test before and after a Maitland's posterior-anterior central mobilization session at the cervical spine. Changes in muscle thickness during the test were calculated to infer muscle recruitment. Separate analysis of variance models for each muscle was built.

**Results:** Both groups showed increases in Lco and SCM recruitment between phases ( $F = 7.95, P < .001$ ;  $F = 21.29, P < .001$ ), with patients with chronic neck pain demonstrating lesser increases for Lco changes in thickness compared with controls, mainly at phase 5 ( $-0.09, P = .004$ ; 95% confidence interval [CI], 0.03-0.15). After the mobilization, Lco recruitment increased more significantly in patients with chronic neck pain, and previous difference between groups in phase 5 was no longer significant ( $-0.07, P = .07$ ; 95% CI,  $-0.14$  to  $0.01$ ). The SCM recruitment decreased in phase 1 for patients with chronic neck pain ( $P = .01$ ; 95% CI,  $-0.06$  to  $-0.01$ ).

Conclusion: Cervical mobilization appeared to modulate neck muscles function by increasing [deep muscle](#) and reducing superficial muscle recruitment.

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### Neck Muscle Activity During Prone Hip Extension Based on Lumbar Motion Patterns

*Paul Bruno, DC, PhD, et al.*

Objective: The objective of the current study was to investigate whether any differences exist in the activity of the cervical erector spinae and upper trapezius (TRA) muscles between asymptomatic participants who show "normal" and "abnormal" lumbar spine motion patterns during the prone [hip extension](#) (PHE) test.

Methods: Twenty-six asymptomatic participants recruited from a chiropractic college participated in the study. Surface electromyography was used to record the activity of the cervical erector spinae and upper TRA muscles as each participant performed a set of four repetitions of PHE for each leg. An examiner observed the participant perform the movement and classified him/her as "positive" or "negative" based on the presence or absence (respectively) of one of three lumbar spine motion patterns. The mean activity levels of each muscle during the positive sets of PHE were compared with those during the negative sets.

Results: The mean activity of the upper TRA ipsilateral to the side of hip extension was significantly higher in the positive group compared with the negative group (difference, 13.3%; 95% confidence interval, 0.2%-24.4%;  $P = .0465$ ). No other significant between-group differences were noted.

Conclusion: The results of this study indicate that the presence of abnormal lumbar spine motion patterns during the PHE test may be associated with altered cervicothoracic motor control strategies in asymptomatic individuals. Similar investigations using patients with neck pain are required to comment further on the generalizability and potential clinical importance of these findings.

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### Lumbar Stenosis Rates in Symptomatic Patients Using Weight-Bearing and Recumbent MRI

*John Gilbert, MD, et al.*

Objective: The purpose of this study was to determine the rate of lumbar stenosis detected via magnetic resonance imaging (MRI) in patients with symptomatic foraminal stenosis, lateral recess stenosis, or central stenosis.

Methods: A retrospective review was performed on 1,983 MRI scans from a two-year period on 1,486 symptomatic patients. Of these patients, 761 were scanned in the recumbent position using low-field (0.3 T, Airis II; Hitachi, Twinsburg, Ohio) MRI, and 725 were scanned in an upright sitting position using midfield (0.6 T) open Upright MRI (Fonar Corp, Melville, NY). In total, 986 serial scans (recumbent) and 997 serial scans (weight-bearing) were performed.

Results: Of scans performed in the recumbent position, stenoses were identified in 382 scans (38.8%), central stenosis in 119 scans (12%), lateral recess stenosis in 91 scans (9.2%), and foraminal [stenosis](#) in 327 scans (33.2%). Of scans performed in a weight-bearing position, stenoses were identified in 565 scans (56.7%), central stenosis in 136 scans (13.6%), lateral recess stenosis in 206 scans (20.7%), and

foraminal stenosis in 524 scans (52.6%).

Conclusions: The stenosis rates as indicated by MRI interpretation ranged between 38.5% (recumbent) and 56.7% (weight-bearing). These rates are higher than those reported in the medical literature for asymptomatic patients. Further study is needed to determine whether weight-bearing, compared with recumbent, MRI better informs the clinician in the diagnosis of spinal stenosis.

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## A Clinical Scale for Assessing Abdominal Muscle Coordination

*Rafael Pinto, PT, MSc, et al.*

Objective: This study evaluated the reliability and discriminatory capacity of a novel clinical scale for assessing **abdominal muscle** coordination. We investigated the interrater reliability of this tool in patients with chronic low back pain (LBP) (reliability section); the ability of this tool to discriminate healthy and LBP subjects (discriminatory section); and the association between the score and measures of pain, disability, and kinesiophobia (correlation section).

Methods: For the reliability section of this study, 14 patients with chronic LBP were included. For the discriminatory section, 10 patients with chronic LBP and 10 pain-free controls were recruited. In the correlation study, data from the 10 chronic LBP patients in the discriminatory section were used. The clinical test was conducted by a blinded examiner while the subjects attempted to independently activate transversus abdominis separate from the rest of the abdominal muscles (hollowing or draw-in maneuver). The intraclass correlation coefficients, receiver operating characteristic curve, and Pearson  $r$  correlation coefficients were calculated to assess reliability and validity.

Results: An intraclass correlation coefficient(2,1) of 0.72 (95% confidence interval, 0.33-0.90) was recorded for interrater reliability. The tool correctly identified the subject condition in 97% of the cases. The score did not correlate substantially with any clinical measures, with Pearson  $r$  ranging from 0.122 ( $P = .737$ ) to 0.493 ( $P = .148$ ).

Conclusions: This study showed that the proposed scale is a reliable tool and may be useful in discriminating patients with chronic LBP from pain-free controls. The poor correlation between the score and clinical measures may be due to the multidimensional nature of chronic LBP.

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## Tests for Screening and Diagnosis of Cervical Spine Myelopathy

*Chad Cook, PhD, PT, MBA, et al.*

Objective: The purpose of this review was to investigate the diagnostic accuracy for screening and confirmation of clinical tests for cervical spine **myelopathy**, and to investigate the quality of the studies that have investigated these values.

Methods: This study was a systematic review that used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Search terms for PubMed included *myelopathy; diagnosis, differential; sensitivity and specificity; and physical examination*. Search terms for Cumulative Index to Nursing and Allied Health Literature were limited to *myelopathy* and *sensitivity and specificity*. Qualitative assessment included report of diagnostic accuracy metrics (sensitivity, specificity, and

positive and negative likelihood ratios) and quality scores using the Quality Assessment of Diagnostic Accuracy Studies tool. Scores were created for single tests and clustered test findings.

Results: After evaluation, 12 full-text articles were selected, scored and tabulated. Nearly all of the 18 tests demonstrated high levels of specificity and low levels of sensitivity, suggesting that they are poor screening tools. Only one study was scored as high quality. One study involved clustering of test findings, but was considered low quality.

Conclusion: Nearly all of the clinical tests for CSM seem to be poor screening tools, which implies that manually-oriented clinicians may perform treatment methods in a situation of doubt or uncertainty. More high-quality studies are needed, and manual therapists need to be cognizant that the current clinical tests for CSM lack strong diagnostic accuracy measures that are necessary for clinical decision-making.

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