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## LUMBAR SPINE

### MRI findings

Spine J. 2014 Mar 15. pii: S1529-9430(14)00251-4. doi: 10.1016/j.spinee.2014.03.010.

#### **Interrater and intrarater agreements of magnetic resonance imaging findings in the lumbar spine: significant variability across degenerative conditions.**

Fu MC1, Buerba RA1, Long WD 3rd1, Blizzard DJ2, Lischuk AW3, Haims AH3, Grauer JN4.

#### **Abstract**

**BACKGROUND CONTEXT:** Magnetic resonance imaging (MRI) is frequently used in the evaluation of degenerative conditions in the lumbar spine. The relative interrater and intrarater agreements of MRI findings across different pathologic conditions are underexplored, as most studies are focused on specific findings.

**PURPOSE:** The purpose of this study was to characterize the interrater and intrarater agreements of MRI findings used to assess the degenerative lumbar spine.

**STUDY DESIGN:** A retrospective diagnostic study at a large academic medical center was undertaken with a panel of orthopedic surgeons and musculoskeletal radiologists to assess lumbar MRIs using standardized criteria.

**PATIENT SAMPLE:** Seventy-five subjects who underwent routine lumbar spine MRI at our institution were included.

**OUTCOME MEASURES:** Each MRI study was assessed for 10 lumbar degenerative findings using standardized criteria. Lumbar vertebral levels were assessed independently, where applicable, for a total of 52 data points collected per study.

**METHODS:** T2-weighted axial and sagittal MRI sequences were presented in random order to the four reviewers (two orthopedic spine surgeons and two musculoskeletal radiologists) independently to determine interrater agreement. The first 10 studies were reevaluated at the end to determine intrarater agreement. Images were assessed using standardized and pilot-tested criteria to assess disc degeneration, stenosis, and other degenerative changes. Interrater and intrarater absolute percent agreements were calculated. To highlight the most clinically important MRI disagreements, a modified agreement analysis was also performed (in which disagreements between the lowest two severity grades for applicable conditions were ignored). Fleiss kappa coefficients for interrater agreement were determined.

**RESULTS:** The overall absolute and modified interrater agreements were 76.9% and 93.5%, respectively. The absolute and modified intrarater agreements were 81.3% and 92.7%, respectively. Average Fleiss kappa coefficient was 0.431, suggesting moderate overall agreement. However, when stratified by condition, absolute interrater agreement ranged from 65.1% to 92.0%. Disc hydration, disc space height, and bone marrow changes exhibited the lowest absolute interrater agreements. The absolute intrarater agreement had a narrower range, from 74.5% to 91.5%. Fleiss kappa coefficients ranged from fair-to-substantial agreement (0.282-0.618).

**CONCLUSIONS:** Even in a study using standardized evaluation criteria, there was significant variability in the interrater and intrarater agreements of MRI in assessing different degenerative conditions of the lumbar spine. Clinicians should be aware of the condition-specific diagnostic limitations of MRI interpretation.

PMID: 24642053

## Radiculopathy analysis

Spine J. 2013 Dec 8. pii: S1529-9430(13)01964-5. doi: 10.1016/j.spinee.2013.11.049.

### Diagnostic accuracy of history taking to assess lumbosacral nerve root compression.

Verwoerd AJ1, Peul WC2, Willemsen SP3, Koes BW4, Vleggeert-Lankamp CL5, El Barzouhi A5, Luijsterburg PA4, Verhagen AP4.

#### Abstract

##### **BACKGROUND CONTEXT:**

The diagnosis of sciatica is primarily based on history and physical examination. Most physical tests used in isolation show poor diagnostic accuracy. Little is known about the diagnostic accuracy of history items.

##### **PURPOSE:**

To assess the diagnostic accuracy of history taking for the presence of lumbosacral nerve root compression or disc herniation on magnetic resonance imaging in patients with sciatica.

##### **STUDY DESIGN:**

Cross-sectional diagnostic study.

##### **PATIENT SAMPLE:**

A total of 395 adult patients with severe disabling radicular leg pain of 6 to 12 weeks duration were included.

##### **OUTCOME MEASURES:**

Lumbosacral nerve root compression and disc herniation on magnetic resonance imaging were independently assessed by two neuroradiologists and one neurosurgeon blinded to any clinical information.

##### **METHODS:**

Data were prospectively collected in nine hospitals. History was taken according to a standardized protocol. There were no study-specific conflicts of interest.

##### **RESULTS:**

Exploring the diagnostic odds ratio of 20 history items revealed a significant contribution in diagnosing nerve root compression for "male sex," "pain worse in leg than in back," and "a non-sudden onset." A significant contribution to the diagnosis of a herniated disc was found for "body mass index <30," "a non-sudden onset," and "sensory loss." Multivariate logistic regression analysis of six history items pre-selected from the literature (age, gender, pain worse in leg than in back, sensory loss, muscle weakness, and more pain on coughing/sneezing/straining) revealed an area under the receiver operating characteristic curve of 0.65 (95% confidence interval, 0.58-0.71) for the model diagnosing nerve root compression and an area under the receiver operating characteristic curve of 0.66 (95% confidence interval, 0.58-0.74) for the model diagnosing disc herniation.

##### **CONCLUSIONS:**

A few history items used in isolation had significant diagnostic value and the diagnostic accuracy of a model with six pre-selected items was poor.

**KEYWORDS:** Diagnosis; Disc herniation; Magnetic resonance imaging; Medical history taking; Nerve root compression; Sciatica; Sensitivity; Specificity

PMID: 24325881

## Stenosis-lumbar extension

### Research article

#### **Diagnostic value of the lumbar extension-loading test in patients with lumbar spinal stenosis: a cross-sectional study**

**Naoto Takahashi, Shin-ichi Kikuchi, Shoji Yabuki, Koji Otani and Shin-ichi Konno**

BMC Musculoskeletal Disorders 2014, **15**:259 doi:10.1186/1471-2474-15-259 Published: 31 July 2014

### **Abstract**

#### **Background**

The gait-loading test is a well known, important test with which to assess the involved spinal level in patients with lumbar spinal stenosis. The lumbar extension-loading test also functions as a diagnostic loading test in patients with lumbar spinal stenosis; however, its efficacy remains uncertain. The purpose of this study was to compare the diagnostic value of the lumbar extension-loading test with that of the gait-loading test in patients with lumbar spinal stenosis.

#### **Methods**

A total of 116 consecutive patients (62 men and 54 women) diagnosed with lumbar spinal stenosis were included in this cross-sectional study of the lumbar extension-loading test. Subjective symptoms and objective neurological findings (motor, sensory, and reflex) were examined before and after the lumbar extension-loading and gait-loading tests. The efficacy of the lumbar extension-loading test for establishment of a correct diagnosis of the involved spinal level was assessed and compared with that of the gait-loading test.

#### **Results**

There were no significant differences between the lumbar extension-loading test and the gait-loading test in terms of subjective symptoms, objective neurological findings, or changes in the involved spinal level before and after each loading test.

#### **Conclusions**

The lumbar extension-loading test is useful for assessment of lumbar spinal stenosis pathology and is capable of accurately determining the involved spinal level.

## Spondylo classification

Spine J. 2014 Apr 3. pii: S1529-9430(14)00353-2. doi: 10.1016/j.spinee.2014.03.045.

### Clinical and radiographic degenerative spondylolisthesis (CARDS) classification.

Kepler CK1, Hilibrand AS2, Sayadipour A2, Koerner JD2, Rihn JA2, Radcliff KE2, Vaccaro AR2, Albert TJ2, Anderson DG2.

#### Abstract

##### BACKGROUND CONTEXT:

Lumbar degenerative spondylolisthesis (DS) is a common, acquired condition leading to disabling back and/or leg pain. Although surgery is common used to treat patients with severe symptoms, there are no universally accepted treatment guidelines. Wide variation in vertebral translation, disc collapse, sagittal alignment, and vertebral mobility suggests this is a heterogeneous disease. A classification scheme would be useful to differentiate homogenous subgroups that may benefit from different treatment strategies.

##### PURPOSE:

To develop and test the reliability of a simple, clinically useful classification scheme for lumbar DS.

##### STUDY DESIGN:

Retrospective case series.

##### PATIENT SAMPLE:

One hundred twenty-six patients.

##### OUTCOME MEASURES:

Proposed radiographic classification system.

##### METHODS:

A classification system is proposed that considers disc space height, sagittal alignment and translation, and the absence or presence of unilateral or bilateral leg pain. Test cases were graded by six observers to establish interobserver reliability and regraded in a different order 1 month later to establish intraobserver reliability using Kappa analysis. To establish the relative prevalence of each subtype, a series of 100 consecutive patients presenting with L4-L5 DS were classified.

##### RESULTS:

Four radiographic subtypes were identified: Type A: advanced Disc space collapse without kyphosis; Type B: disc partially preserved with translation of 5 mm or less; Type C: disc partially preserved with translation of more than 5 mm; and Type D: kyphotic alignment. The leg pain modifier 0 denotes no leg pain, 1 denotes unilateral leg pain, and 2 represents bilateral leg pain. The Kappa value describing interobserver reliability was 0.82, representing near-perfect agreement. Intraobserver reliability analysis demonstrated Kappa=0.83, representing near-perfect agreement. Grading of the consecutive series of 100 patients revealed the following distribution: 16% Type A, 37% Type B, 33% Type C, and 14% Type D.

##### CONCLUSIONS:

A new radiographic and clinical classification scheme for lumbar DS with high inter- and intraobserver reliabilites is proposed. Use of this classification scheme should facilitate communication to enhance the quality of outcomes research on DS.

##### KEYWORDS:

Classification system; Degenerative spondylolisthesis; Iatrogenic destabilization; Lumbar degenerative spondylolisthesis; Lumbar spinal fusion; Spondylolisthesis

PMID: 24704503

## Disc

### Disc degeneration

Spine (Phila Pa 1976). 2014 Aug 1;39(17):1365-72. doi: 10.1097/BRS.0000000000000389.

#### **ISSLS Prize Winner: Mechanical Influences in Progressive Intervertebral Disc Degeneration.**

Stefanakis M1, Luo J, Pollintine P, Dolan P, Adams MA.

#### **Abstract**

##### **STUDY DESIGN:**

Mechanical study on cadaver motion segments.

##### **OBJECTIVE:**

To determine whether high gradients of compressive stress within the intervertebral disc are associated with progressive disc degeneration.

##### **SUMMARY OF BACKGROUND DATA:**

Mechanical loading can initiate disc degeneration but may be unimportant in disease progression, because degenerative changes cause the disc to be increasingly "stress-shielded" by the neural arch. However, the most typical feature of advanced disc degeneration (delamination and collapse of the annulus) may not depend on absolute values of compressive stress but on gradients of compressive stress that act to shear annulus lamellae.

##### **METHODS:**

A total of 191 motion segments (T7-T8 to L5-S1) were dissected from 42 cadavers aged 19 to 92 years. Each was subjected to approximately 1 kN compression, while intradiscal stresses were measured by pulling a pressure transducer along the disc's midsagittal diameter. "Stress gradients" in the annulus were quantified as the average rate of increase in compressive stress (MPa/mm) between the nucleus and the region of maximum stress in the anterior or posterior annulus. Measurements were repeated before and after creep loading and in simulated flexed and erect postures. Disc degeneration was assessed macroscopically on a scale of 1 to 4.

##### **RESULTS:**

As grade of disc degeneration increased from 2 to 4, nucleus pressure decreased by an average 68%, and maximum compressive stress in the annulus decreased by 48% to 64%, depending on location and posture. In contrast, stress gradients in the annulus increased by an average 75% in the anterior annulus (in flexed posture) and by 108% in the posterior annulus (in erect posture). Spearman rank correlation showed that these increases were statistically significant.

##### **CONCLUSION:**

Despite stress-shielding by the neural arch, gradients of compressive stress increase with increasing grade of disc degeneration. Stress gradients act to shear adjacent lamellae and can explain progressive annulus delamination and collapse.

##### **LEVEL OF EVIDENCE:**

N/A.

PMID: 24831499

## **Molecular interactions**

Spine (Phila Pa 1976). 2014 Aug 1;39(17):1355-64. doi: 10.1097/BRS.0000000000000372.

### **Molecular interactions between human cartilaginous endplates and nucleus pulposus cells: a preliminary investigation.**

Neidlinger-Wilke C1, Boldt A, Brochhausen C, Galbusera F, Carstens C, Copf F, Schultheiss M, Lazary A, Brayda-Bruno M, Ignatius A, Wilke HJ.

#### **Abstract**

##### **STUDY DESIGN:**

Conditioned media (CM) of cartilaginous endplates (CEPs) of intervertebral discs were analyzed in a bioassay with regard to their influence on matrix turnover and inflammatory factors on nucleus pulposus (NP) cells of the same patient. CEP tissue underwent further histological and ultrastructural analysis.

##### **OBJECTIVE:**

To identify possible interactions between the CEP and the disc via molecular factors that may influence disc matrix degradation and to determine degenerative changes of CEP tissue.

##### **SUMMARY OF BACKGROUND DATA:**

Impaired endplate permeability due to degeneration and calcification is considered to be a key contributor to disc degeneration. An upregulation of metalloproteinases and inflammatory cytokines has been observed in degenerated intervertebral discs. Possibly, the CEP contributes to the regulation of disc matrix degradation via molecular interactions with the disc tissue.

##### **METHODS:**

CEP and NP cells from the same patients (n = 6) were investigated in a bioassay with regard to their influence on matrix turnover and inflammatory factors. We determined gene expression of NP cells in alginate beads that were exposed to CM of CEP punches (CEP-CM) from the same patients. The CEP-CMs were analyzed by protein array for inflammatory cytokines. Further CEP samples underwent histological (n = 15) and ultrastructural analysis (n = 8) to determine alterations of cell and matrix structure.

##### **RESULTS:**

NP cells exposed to their donor-corresponding CEP-CM significantly upregulated interleukins (IL-6, IL-8) and matrix metalloproteinase (MMP-3, MMP-13) expression, and significantly decreased aggrecan and collagen type 2 expression. Proinflammatory cytokines were identified in the CEP-CM. The occurrence of apoptotic cells and degraded matrix fragments varied strongly between donors.

##### **CONCLUSION:**

Our results indicate interactions between the CEP and the NP tissue via molecular factors that upregulate matrix degrading enzymes and inflammatory cytokines and thereby influence the pathophysiology of disc degeneration. Ongoing investigations will further identify the regulative role of potential molecular factors that are responsible for these degenerative alterations.

##### **LEVEL OF EVIDENCE:**

N/A.

PMID: 24831500

## End plates

Spine (Phila Pa 1976). 2014 Aug 1;39(17):E1035-41. doi: 10.1097/BRS.0000000000000419.

### **Effects of sagittal endplate shape on lumbar segmental mobility as evaluated by kinetic magnetic resonance imaging.**

Li YI, Lord E, Cohen Y, Ruangchainikom M, Wang B, Lv G, Wang JC.

#### **Abstract**

##### **STUDY DESIGN:**

Retrospective analysis using kinetic magnetic resonance imaging.

##### **OBJECTIVE:**

To investigate relationships between vertebral endplate remodeling, Modic changes, disc degeneration, and lumbar segmental mobility.

##### **SUMMARY OF BACKGROUND DATA:**

Previous studies have shown that disc degeneration and vertebral endplate Modic changes are associated with differences in spinal motion, however, the effects of vertebral endplate morphology on lumbar segmental motion have not been fully investigated.

##### **METHODS:**

A total of 420 patients underwent kinetic magnetic resonance imaging of 2100 lumbar motion segments. Sagittal endplate shapes (concave, flat, irregular), Modic changes (types, 0-3), and disc degeneration (grade, I-V) were assessed along with translational and angular motion of vertebral segments in flexion, extension, and neutral positions.

##### **RESULTS:**

The most common findings were concave endplate shape (63.24%), type 2 Modic change (71.79%), and grade II disc degeneration (40.33%). Flat, irregular endplates were more common at L1-L2, L4-L5, and L5-S1 than L2-L3 and L3-L4. Types 1, 2, and 3 Modic changes increased in frequency according to endplate shape: concave less than flat less than irregular. Type 0 was observed to decrease with the change of endplate shape from flat to concave to irregular. Vertebral levels with irregular endplates had more disc generation than those with flat; levels with flat endplates had significantly more disc degeneration than those with concave. Translational motion of the lumbar segment was greatest at levels with irregular endplates and decreased at those with flat and then concaves endplates. Angular motion was least at levels with irregular endplates and increased at levels with flat, then concave endplates.

##### **CONCLUSION:**

The degree of pathogenic lumbar segmental motion is associated with remodeling of the sagittal endplate. Endplate remodeling may occur as an adaptation to restrain abnormal movement of the lumbar segment.

##### **LEVEL OF EVIDENCE:**

N/A.

PMID: 24859573

## Trauma and degeneration

### The Spine Journal

Volume 14, Issue 7, Pages 1256–1264, July 1, 2014 DOI: <http://dx.doi.org/10.1016/j.spinee.2013.07.488>

### Severity and pattern of post-traumatic intervertebral disc degeneration depend on the type of injury

Stefan Dudli, PhD , Stephen J. Ferguson, PhD, Daniel Haschtmann, MD

#### Abstract

##### Background context

The burst fracture of a vertebra is the result of a complex loading procedure and is often associated with intervertebral disc (IVD) degeneration. Likewise, the presumed etiologies are (i) the structural perturbation of the IVD/end plate, (ii) the impact of loading energy alone, and (iii) the depressurization of the nucleus pulposus.

##### Purpose

To describe the pathogenesis of post-traumatic disc degeneration (DD) by comparing the severity and patterns of degeneration with different injury models.

##### Study design

New data from an in vitro organ culture study are compared with the previous work on the same model system.

##### Methods

To investigate in detail the contribution of each factor (i–iii) to DD, we extended our previous work to compare three different segmental trauma processes in a rabbit full-organ in vitro model: burst fracture (Group A, etiologies i–iii), equienergetic loading without a fracture (Group B, ii), and endplate puncturing (Group C, iii). DD markers (apoptosis, necrosis, matrix remodeling, inflammation) were monitored up to 28 days posttrauma. Gene transcription data were subjected to principal component analysis and agglomerative hierarchical clustering to identify and compare pathologic patterns.

##### Results

Only Group A showed the full profile of DD: reduced glycosaminoglycan content, increased caspase-3/7 and lactate dehydrogenase (LDH) activity, and elevated messenger RNA of catabolic (matrix metalloproteinase-1, -3, -13) and proinflammatory (tumor necrosis factor- $\alpha$ , interleukin [IL]-6, IL-8, and monocyte chemoattractant protein-1) genes. In Group B, only catabolic and proinflammatory genes were slightly upregulated. In Group C, LDH but not caspase-3/7 activity was increased. Catabolic and proinflammatory genes were upregulated, although less compared with Group A. Principal component analysis revealed different transcription patterns for Group C.

##### Conclusions

The structural perturbation of the end plate/IVD, but not the loading energy or nuclear depressurization, promotes DD. In addition, end-plate puncturing triggers a different pathogenesis, consistent with a more continuous matrix remodeling process.

Keywords: Disc degeneration, In vitro, Post-traumatic, Etiology, Burst fracture, Pattern

## LBP

### Adolescents and LBP

Eur Spine J. 2014 Jul 29.

#### **Low back pain in children and adolescents: a systematic review and meta-analysis evaluating the effectiveness of conservative interventions.**

Michaleff ZA1, Kamper SJ, Maher CG, Evans R, Broderick C, Henschke N.

#### **Abstract**

##### **PURPOSE:**

To identify and evaluate the effectiveness of conservative treatment approaches used in children and adolescents to manage and prevent low back pain (LBP).

##### **METHODS:**

Five electronic databases and the reference lists of systematic reviews were searched for relevant studies. Randomised controlled trials (RCTs) were considered eligible for inclusion if they enrolled a sample of children or adolescents (<18 years old) and evaluated the effectiveness of any conservative intervention to treat or prevent LBP. Two authors independently screened search results, extracted data, assessed risk of bias using the PEDro scale, and rated the quality of evidence using the GRADE criteria.

##### **RESULTS:**

Four RCTs on intervention and eleven RCTs on prevention of LBP were included. All included studies had a high risk of bias scoring  $\leq 7$  on the PEDro scale. For the treatment of LBP, a supervised exercise program compared to no treatment improved the average pain intensity over the past month by 2.9 points (95 % CI 1.6-4.1) measured by a 0-10 scale (2 studies; n = 125). For the prevention of LBP, there was moderate quality evidence to suggest back education and promotion programs are not effective in reducing LBP prevalence in children and adolescents.

##### **CONCLUSIONS:**

While exercise interventions appear to be promising to treat LBP in children and adolescents, there is a dearth of research data relevant to paediatric populations. Future studies conducted in children and adolescents with LBP should incorporate what has been learnt from adult LBP research and be of rigorous methodological quality.

PMID: 25070788

## Electrodiagnostic and radiculopathy

Eur Spine J. 2014 Jul 22.

### **The prognostic value of electrodiagnostic testing in patients with sciatica receiving physical therapy.**

Savage NJ1, Fritz JM, Kircher JC, Thackeray A.

#### **Abstract**

##### **PURPOSE:**

To investigate the prognostic value of electrodiagnostic testing in patients with sciatica receiving physical therapy.

##### **METHODS:**

Electrodiagnostic testing was performed on 38 patients with sciatica participating in a randomized trial comparing different physical therapy interventions. Patients were grouped and analyzed according to the presence or absence of radiculopathy based on electrodiagnostic testing. Longitudinal data analysis was conducted using multilevel growth modeling with ten waves of data collected from baseline through the treatment and post-treatment periods up to 6 months. The primary outcome measure was changes in low back pain-related disability assessed using the Roland and Morris disability questionnaire (RMDQ).

##### **RESULTS:**

Patients with radiculopathy (n = 19) had statistically significant and clinically meaningful improvements in RMDQ scores at every post-treatment follow-up occasion regardless of treatment received. The final multilevel growth model revealed improvements in RMDQ scores in patients with radiculopathy at the 6-week (-8.1, 95 % CI -12.6 to -2.6; P = 0.006) and 6-month (-4.1, 95 % CI -7.4 to -0.7; P = 0.020) follow-up occasions compared to patients without radiculopathy. Treatment group was not a significant predictive factor at any follow-up occasion. An interaction between electrodiagnostic status and time revealed faster weekly improvements in RMDQ scores in patients with radiculopathy at the 6-week (-0.72, 95 % CI -1.4 to -0.04; P = 0.040) through the 16-week (-0.30, 95 % CI, -0.57 to -0.04; P = 0.028) follow-up occasions compared to patients without radiculopathy.

##### **CONCLUSIONS:**

The presence of lumbosacral radiculopathy identified with electrodiagnostic testing is a favorable prognostic factor for recovery in low back pain-related disability regardless of physical therapy treatment received.

PMID: 25047652

## **LBP and movement limitations**

Spine J. 2014 Jul 1;14(7):1291-9. doi: 10.1016/j.spinee.2013.11.051. Epub 2013 Dec 9.

**Chronic low back pain sufferers exhibit freezing-like behaviors when asked to move their trunk as fast as possible.**

Bourigua I1, Simoneau EM2, Leteneur S3, Gillet C2, Ido G4, Barbier F2.

### **Abstract**

#### **BACKGROUND CONTEXT:**

The effect of chronic low back pain (CLBP) on the kinematic parameters of trunk motion has received much more interest in this last decade. However, there are no descriptions of the motor strategies that occur when patients perform trunk movements in the three anatomical planes at different pace conditions.

#### **PURPOSE:**

To investigate motor strategies used by CLBP patients and asymptomatic people while performing different go and back trunk movements in an upright standing position.

#### **STUDY DESIGN:**

A comparative study.

#### **PATIENT SAMPLE:**

The control group (CG, n=33) included 14 men and 19 women with no history of low back pain, and the chronic low back pain group (CLBPG, n=49) included 21 men and 28 women.

#### **OUTCOME MEASURES:**

Kinematic data were analyzed during six trunk movements: flexion, extension, left and right lateral bendings, and rotations under two pace conditions (preferred and fast paces).

#### **METHODS:**

A three-dimensional optoelectronic motion analysis system was used to assess static (trunk inclinations and base of support) and dynamic (range of motion [ROM] and mean angular velocity of the trunk) parameters during the go and back phases of trunk movements.

#### **RESULTS:**

In the initial position, CLBPG showed a more forward-tilted trunk inclination ( $2.1^{\circ} \pm 1.1^{\circ}$ ,  $p=.013$ ) compared with CG. The base of support was significantly higher in CG ( $+22.7$  cm<sup>2</sup>,  $p=.009$ ) during the fast pace when compared with the preferred pace. Regardless of the pace condition, ROM and mean angular velocity of the trunk were significantly lower in CLBPG for all examined movements and the pace condition did not significantly alter ROM. At the preferred pace, both groups displayed the same motor strategy: they all went faster during the second phase of movement than during the first phase. However, at the fast pace, while CG was going faster during the first phase than during the second, CLBPG maintained the same motor strategy as at the preferred pace.

#### **CONCLUSIONS:**

Contrary to CG who changed its motor behavior from a preferred pace to a fast pace, CLBPG exhibited freezing-like behaviors. This original result highlights the importance of studying the velocity. The use of this parameter may improve the diagnosis of CLBP patients and could be a key indicator for treatment progress and long-term monitoring.

**KEYWORDS:** Chronic low back pain; Diagnostic; Motor strategy; ROM; Trunk; Velocity

PMID: 24333457

## **Multidisciplinary approach**

Eur Spine J. 2014 Jul 27.

### **A multidisciplinary rehabilitation programme improves disability, kinesiophobia and walking ability in subjects with chronic low back pain: results of a randomised controlled pilot study.**

Monticone M1, Ambrosini E, Rocca B, Magni S, Brivio F, Ferrante S.

#### **Abstract**

##### **PURPOSE:**

To evaluate the effect of a multidisciplinary rehabilitation programme on disability, kinesiophobia, catastrophizing, pain, quality of life and gait disturbances in patients with chronic low back pain (CLBP).

##### **METHODS:**

This was a parallel-group, randomised, superiority-controlled pilot study in which 20 patients were randomly assigned to a programme consisting of motor training (spinal stabilising exercises plus usual-care) and cognitive-behavioural therapy (experimental group, 10 subjects) or usual-care alone (control group, 10 subjects). Before treatment, 8 weeks later (post-treatment), and 3 months after the end of treatment, the Oswestry Disability Index, the Tampa Scale for Kinesiophobia, the Pain Catastrophizing Scale, a pain numerical rating scale, and the Short-Form Health Survey were assessed. Spatio-temporal gait parameters were also measured by means of an electronic walking mat. A linear mixed model for repeated measures was used for each outcome measure.

##### **RESULTS:**

The programme had significant group ( $p = 0.027$ ), time ( $p < 0.001$ ), and time-by-group interaction ( $p < 0.001$ ) effects on disability, with the experimental group showing an improvement after training of about 61 % (25 % in the control group). The analyses of kinesiophobia, catastrophizing, and the quality of life also revealed significant time, group, and time-by-group interaction effects in favour of the experimental group, and there was a significant effect of time on pain. Both groups showed a general improvement in gait parameters, with the experimental group increasing cadence significantly more.

##### **CONCLUSION:**

The multidisciplinary rehabilitation programme including cognitive-behavioural therapy was superior to the exercise programme in reducing disability, kinesiophobia, catastrophizing, and enhancing the quality of life and gait cadence of patients with CLBP.

PMID: 25064093

## **Fear avoidance**

Spine J. 2014 Mar 12. pii: S1529-9430(14)00234-4. doi: 10.1016/j.spinee.2014.02.033.

### **Fear-avoidance beliefs-a moderator of treatment efficacy in patients with low back pain: a systematic review.**

Wertli MM1, Rasmussen-Barr E2, Held U3, Weiser S4, Bachmann LM3, Brunner F5.

#### **Abstract**

##### **BACKGROUND CONTEXT:**

Psychological factors are believed to influence the development of chronic low back pain. To date, it is not known how fear-avoidance beliefs (FABs) influence the treatment efficacy in low back pain.

##### **PURPOSE:**

To summarize the evidence examining the influence of FABs measured with the Fear-Avoidance Belief Questionnaire or the Tampa Scale of Kinesiophobia on treatment outcomes in patients with low back pain.

##### **STUDY DESIGN/SETTING:**

This is a systematic review.

##### **PATIENT SAMPLE:**

Patients with low back pain.

##### **OUTCOME MEASURES:**

Work-related outcomes and perceived measures including return to work, pain, and disability.

##### **METHODS:**

In January 2013, the following databases were searched: BIOSIS, CINAHL, Cochrane Library, Embase, OTSeeker, PeDRO, PsycInfo, PubMed/Medline, Scopus, and Web of Science. A hand search of the six most often retrieved journals and a bibliography search completed the search. Study eligibility criteria, participants, and interventions: research studies that included patients with low back pain who participated in randomized controlled trials (RCTs) investigating nonoperative treatment efficacy. Out of 646 records, 78 articles were assessed in full text and 17 RCTs were included. Study quality was high in five studies and moderate in 12 studies.

##### **RESULTS:**

In patients with low back pain of up to 6 months duration, high FABs were associated with more pain and/or disability (4 RCTs) and less return to work (3 RCTs) (GRADE high-quality evidence, 831 patients vs. 322 in nonpredictive studies). A decrease in FAB values during treatment was associated with less pain and disability at follow-up (GRADE moderate evidence, 2 RCTs with moderate quality, 242 patients). Interventions that addressed FABs were more effective than control groups based on biomedical concepts (GRADE moderate evidence, 1,051 vs. 227 patients in studies without moderating effects). In chronic patients with LBP, the findings were less consistent. Two studies found baseline FABs to be associated with more pain and disability and less return to work (339 patients), whereas 3 others (832 patients) found none (GRADE low evidence). Heterogeneity of the studies impeded a pooling of the results.

##### **CONCLUSIONS:**

Evidence suggests that FABs are associated with poor treatment outcome in patients with LBP of less than 6 months, and thus early treatment, including interventions to reduce FABs, may avoid delayed recovery and chronicity. Patients with high FABs are more likely to improve when FABs are addressed in treatments than when these beliefs are ignored, and treatment strategies should be modified if FABs are present.

PMID: 24614254

## Conservative care

*Spine J.* 2013 Oct 18. pii: S1529-9430(13)01579-9. doi: 10.1016/j.spinee.2013.09.039.

### **Predicting outcomes of neuroreflexotherapy in patients with subacute or chronic neck or low back pain.**

Royuela A1, Kovacs FM2, Campillo C3, Casamitjana M4, Muriel A5, Abraira V6.

#### **Abstract**

##### **BACKGROUND CONTEXT:**

In the context of shared decision-making, a valid estimation of the probability that a given patient will improve after a specific treatment is valuable.

##### **PURPOSE:**

To develop models that predict the improvement of spinal pain, referred pain, and disability in patients with subacute or chronic neck or low back pain undergoing a conservative treatment.

##### **STUDY DESIGN AND SETTING:**

Analysis of data from a prospective registry in routine practice.

##### **PATIENT SAMPLE:**

All patients who had been discharged after receiving a conservative treatment within the Spanish National Health Service (SNHS) (n=8,778).

##### **OUTCOME MEASURES:**

Spinal pain, referred pain, and disability were assessed before the conservative treatment and at discharge by the use of previously validated methods.

##### **METHODS:**

Improvement in spinal pain, referred pain, and disability was defined as a reduction in score greater than the minimal clinically important change. A predictive model that included demographic, clinical, and work-related variables was developed for each outcome using multivariate logistic regression. Missing data were addressed using multiple imputation. Discrimination and calibration were assessed for each model. The models were validated by bootstrap, and nomograms were developed.

##### **RESULTS:**

The following variables showed a predictive value in the three models: baseline scores for pain and disability, pain duration, having undergone X-ray, having undergone spine surgery, and receiving financial assistance for neck or low back pain. Discrimination of the three models ranged from slight to moderate, and calibration was good.

##### **CONCLUSIONS:**

A registry in routine practice can be used to develop models that estimate the probability of improvement for each individual patient undergoing a specific form of treatment. Generalizing this approach to other treatments can be valuable for shared decision making.

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##### **KEYWORDS:**

Back pain; Calibration; Disability; Multiple imputation; Neuroreflexotherapy; Predictive model

PMID: 24345468

## Surgery

### Resolution of radicular symptoms

*Spine (Phila Pa 1976)*. 2014 Apr 15;39(8):E529-36. doi: 10.1097/BRS.0000000000000240.

#### **How fast pain, numbness, and paresthesia resolves after lumbar nerve root decompression: a retrospective study of patient's self-reported computerized pain drawing.**

Huang P1, Sengupta DK.

#### **Abstract**

##### **STUDY DESIGN:**

A single-center retrospective study.

##### **OBJECTIVE:**

To compare the speed of recovery of different sensory symptoms, pain, numbness, and paresthesia, after lumbar nerve root decompression.

##### **SUMMARY OF BACKGROUND DATA:**

Lumbar radiculopathy is characterized by different sensory symptoms like pain, numbness, and paresthesia, which may resolve at different rates after surgical decompression.

##### **METHODS:**

Eighty-five cases with predominant lumbar radiculopathy treated surgically were reviewed. Oswestry Disability Index score, 36-Item Short Form Health Survey scores (Physical Component Summary and Mental Component Summary), and pain drawing at preoperative and at 6 weeks, 3 months, 6 months, and 1-year follow-up were reviewed. Recovery rate between different sensory symptoms were compared in all patients, and between the short-term compression (<6 mo) and long-term compression groups.

##### **RESULTS:**

At baseline, 73 (85.8%) patients had pain, 63 (74.1%) had numbness, and 38 (44.7%) had paresthesia; 28 (32.9%) had all these 3 component of sensory symptoms. Mean pain score improved fastest (55.3% at 6 wk); further resolution until 1 year was slow and not significant compared with each previous visit. Both numbness and paresthesia scores showed a trend of faster recovery during the initial 6-week period (20.5% and 24%, respectively); paresthesia recovery reached a plateau at 3 months postoperatively, but numbness continued a slow recovery until 1-year follow-up. Both Oswestry Disability Index score and Physical Component Summary scores ( $54.02 \pm 1.87$  and  $26.29 \pm 0.93$ , respectively, at baseline) improved significantly compared with each previous visits at 6 weeks and 3 months postoperatively, but further improvement was insignificant. Mental Component Summary showed a similar trend but smaller improvement. The short-term compression group had faster recovery of pain than the long-term compression group.

##### **CONCLUSION:**

In lumbar radiculopathy patients after surgical decompression, pain recovers fastest, in the first 6 weeks postoperatively, followed by paresthesia recovery that plateaus at 3 months postoperatively. Numbness recovers at a slower pace but continues until 1 year.

##### **LEVEL OF EVIDENCE: 4**

## Variation

### The Spine Journal

#### Differences in the surgical treatment of recurrent lumbar disc herniation among spine surgeons in the United States

Thomas E. Mroz, MD , Robert M. Quencer, MD. Published online: January 27, 2014

DOI: <http://dx.doi.org/10.1016/j.spinee.2014.01.037>

#### Abstract

**Background context:** There are often multiple surgical treatment options for a spinal pathology. In addition, there is a lack of data that define differences in surgical treatment among surgeons in the United States.

**Purpose:** To assess the surgical treatment patterns among neurologic and orthopedic spine surgeons in the United States for the treatment of one- and two-time recurrent lumbar disc herniation.

**Patient sample:** Electronic survey delivered to 2,560 orthopedic and neurologic surgeons in the United States.

**Outcome measures:** The response data were analyzed to assess the differences among respondents over various demographic variables. The probability of disagreement is reported for various surgeon subgroups.

**Methods:** A survey of clinical and radiographic case scenarios that included a one- and two-time lumbar disc herniation was electronically delivered to 2,560 orthopedic and neurologic surgeons in the United States. The surgical treatment options were revision microdiscectomy, revision microdiscectomy with in situ fusion, revision microdiscectomy with posterolateral fusion using pedicle screws, revision microdiscectomy with posterior lumbar interbody fusion/transforaminal lumbar interbody fusion (PLIF/TLIF), anterior lumbar interbody fusion (ALIF) with percutaneous screws, ALIF with open posterior instrumentation, or none of these. Significance of  $p=.01$  was used to account for multiple comparisons.

**Results:** Four hundred forty-five surgeons (18%) completed the survey. Surgeons in practice for 15+ years were more likely to select revision microdiscectomy compared with surgeons with fewer years in practice who were more likely to select revision microdiscectomy with PLIF/TLIF ( $p<.001$ ). Similarly, those surgeons performing 200+ surgeries per year were more likely to select revision microdiscectomy with PLIF/TLIF than those performing fewer surgeries ( $p=.003$ ). No significant differences were identified for region, specialty, fellowship training, or practice type. Overall, there was a 69% and 22% probability that two randomly selected spine surgeons would disagree on the surgical treatment of two- and one-time recurrent disc herniations, respectively. This probability of disagreement was consistent over multiple variables including geographic, practice type, fellowship training, and annual case volume.

**Conclusions:** Significant differences exist among US spine surgeons in the surgical treatment of recurrent lumbar disc herniations. It will become increasingly important to understand the underlying reasons for these differences and to define the most cost-effective surgical strategies for these common lumbar pathologies as the United States moves closer to a value-based health-care system.

**Keywords:** Disc herniation, Practice trends, Electronic survey, Surgeon differences, Demographics, Geographic heterogeneity, Cost effectiveness, Access to care

## Total disc replacement results

The Spine Journal Volume 14, Issue 8, Pages 1417–1431, August 1, 2014

### Mid to long-term results of total lumbar disc replacement: prospective analysis with 5 to 10-year follow-up

Christoph J. Siepe, MD, PhD Michael H. Mayer, MD, PhD DOI: <http://dx.doi.org/10.1016/j.spinee.2013.08.028>

#### Abstract

**Background context:** The role of fusion of lumbar motion segments for the treatment of intractable low back pain (LBP) from degenerative disc disease (DDD) without deformities or instabilities remains controversially debated. Total lumbar disc replacement (TDR) has been used as an alternative in a highly selected patient cohort. However, the amount of long-term follow-up (FU) data on TDR is limited. In the United States, insurers have refused to reimburse surgeons for TDRs for fear of delayed complications, revisions, and unknown secondary costs, leading to a drastic decline in TDR numbers.

**Purpose:** To assess the mid- and long-term clinical efficacy as well as patient safety of TDR in terms of perioperative complication and reoperation rates.

**Study design/setting:** Prospective, single-center clinical investigation of TDR with ProDisc II (Synthes, Paoli, PA, USA) for the treatment of LBP from lumbar DDD that has proven unresponsive to conservative therapy.

**Patient sample:** Patients with a minimum of 5-year FU after TDR, performed for the treatment of intractable and predominant ( $\geq 80\%$ ) axial LBP resulting from DDD without any deformities or instabilities.

**Outcome measures:** Visual analog scale (VAS), Oswestry Disability Index (ODI), and patient satisfaction rates (three-scale outcome rating); complication and reoperation rates as well as elapsed time until revision surgery; patient's professional activity/employment status.

**Methods:** Clinical outcome scores were acquired within the framework of an ongoing prospective clinical trial. Patients were examined preoperatively, 3, 6, and 12 months postoperatively, annually from then onward. The data acquisition was performed by members of the clinic's spine unit including medical staff, research assistants, and research nurses who were not involved in the process of pre- or postoperative decision-making.

**Results:** The initial cohort consisted of 201 patients; 181 patients were available for final FU, resembling a 90.0% FU rate after a mean FU of 7.4 years (range 5.0–10.8 years). The overall results revealed a highly significant improvement from baseline VAS and ODI levels at all postoperative FU stages ( $p < .0001$ ). VAS scores demonstrated a slight (from VAS 2.6 to 3.3) but statistically significant deterioration from 48 months onward ( $p < .05$ ). Patient satisfaction rates remained stable throughout the entire postoperative course, with 63.6% of patients reporting a highly satisfactory or a satisfactory (22.7%) outcome, whereas 13.7% of patients were not satisfied. The overall complication rate was 14.4% ( $N=26/181$ ). The incidence of revision surgeries for general and/or device-related complications was 7.2% ( $N=13/181$ ). Two-level TDRs demonstrated a significant improvement of VAS and ODI scores in comparison to baseline levels ( $p < .05$ ). Nevertheless, the results were significantly inferior in comparison to one-level cases and were associated with higher complication (11.9% vs. 27.6%;  $p=.03$ ) and inferior satisfaction rates ( $p < .003$ ).

**Conclusions:** Despite the fact that the current data comprises the early experiences and learning curve associated with a new surgical technique, the results demonstrate satisfactory and maintained mid- to long-term clinical results after a mean FU of 7.4 years. Patient safety was proven with acceptable complication and reoperation rates. Fear of excessive late complications or reoperations following the primary TDR procedure cannot be substantiated with the present data. In carefully selected cases, TDR can be considered a viable treatment alternative to lumbar fusion for which spine communities around the world seem to have accepted mediocre clinical results as well as obvious and significant drawbacks.

**Keywords:** Disc replacement, Arthroplasty, Artificial disc, Lumbar spine, Long term results, Outcome,

## Complications

## **PELVIC GIRDLE**

### **Coccyx pain**

#### **Clinical Decision Making for the Evaluation and Management of Coccydynia: 2 Case Reports**

**Authors:** Lee N. Marinko, PT, ScD, OCS1, Matthew Pecci, MD2

#### **AFFILIATIONS:**

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**Published:** *Journal of Orthopaedic & Sports Physical Therapy*, 2014, **Volume:** 44 **Issue:** 8 **Pages:** 615-621 doi:10.2519/jospt.2014.4850

#### **Study Design**

Case report

#### **Background**

Coccydynia is a painful condition of the sacrococcygeal region, with symptoms associated with sitting and rising from a seated position. There is no gold standard for diagnosis of this condition; however, coccyx mobility assessment, pain provocation testing, and imaging have been proposed as reasonable diagnostic approaches. Once correctly diagnosed, treatment options for coccydynia include conservative management and surgical excision. The purpose of this report is to describe the different but successful clinical management strategies of 2 patients with coccydynia.

#### **Case Description**

Two women, 26 and 31 years of age, presented to physical therapy with persistent coccygeal pain that increased with prolonged sitting and intensified when transitioning from sit to stand. One patient had a traumatic onset of symptoms, in contrast to the other patient, for whom prolonged sitting was the precipitating factor. Both individuals were considered to have hypomobility of the sacrococcygeal joint, as assessed through intrarectal mobility testing, which also reproduced their symptoms. In both patients, examination of the lumbar spine was negative for alleviation or reproduction of symptoms. The patient with a traumatic onset of symptoms was referred to physical therapy at the onset of her symptoms, whereas the patient with a nontraumatic onset of symptoms was initially treated with a cortisone injection and, when symptoms returned 1 year later, was referred to physical therapy. Both individuals underwent manual therapy to the sacrococcygeal joint over 3 treatment sessions.

#### **Outcomes**

The patient with traumatic onset of symptoms had almost complete resolution of symptoms, whereas the patient with a nontraumatic onset only had temporary relief. This patient required further diagnostic examination and surgical excision.

#### **Discussion**

Although the mechanisms of injury were different, both patients presented with similar clinical symptoms, and both were considered to have coccydynia through coccyx mobility assessment and pain provocation testing. Successful clinical outcomes were achieved in both cases; however, the interventions were significantly different.

**Level of Evidence** Therapy, level 4.

**Keyword:** coccyx, manual therapy, musculoskeletal imaging, physical therapy

## VISCERA

### Dysmenorrhea

Reprod Health. 2014 Jul 26;11(1):58.

#### **The experience of dysmenorrhoea among Ghanaian senior high and university students: pain characteristics and effects.**

Aziato L, Dedey F, Clegg-Lamptey JN.

#### **Abstract**

##### **BACKGROUND:**

Dysmenorrhoea is a common problem of women at the reproductive age and may have negative effect on the education of females at various stages on the educational ladder. Context and purpose: This study sought to gain an in-depth understanding of the experience of dysmenorrhoea and its effect on female students in a secondary and a tertiary institution in Accra, Ghana.

##### **METHODS:**

The study employed a descriptive phenomenology design and was conducted at a University and a Senior High School (SHS) in Accra. Purposive and snowball sampling techniques were used to recruit participants and data was saturated with 16 participants. Concurrent analysis was done by applying the processes of content analysis and the NVivo software was used to manage the data.

##### **RESULTS:**

It was realized that dysmenorrhoea is associated with symptoms such as diarrhoea, headache and vomiting. Pain may start one week to the day of menstruation and the severity differed across the days of menstruation. The effect of dysmenorrhoea included activity intolerance, altered emotion and interaction, altered sleep pattern, absenteeism and inattentiveness, wishes and regrets, and misconceptions.

##### **CONCLUSIONS:**

It was concluded that severe dysmenorrhoea has a debilitating effect on female students and is associated with misconceptions that could result in drastic action with fatal consequences. Thus, there is the need to enhance education on dysmenorrhoea, and an aggressive step should be taken to effectively manage dysmenorrhoea.

PMID: 25064081

## GI pain and abuse

*J Trop Pediatr.* 2014 Jul 23. pii: fmu035.

### **Association Between Functional Gastrointestinal Diseases and Exposure to Abuse in Teenagers.**

Devanarayana NM1, Rajindrajith S2, Perera MS3, Nishanthanie SW3, Karunanayake A4, Benninga MA5.

#### **Abstract**

**Purpose:** Abdominal pain-predominant functional gastrointestinal diseases (AP-FGD) are common in children and commonly attributed to exposure to child abuse. However, this relationship has not been studied in teenagers, and the main objective of the current study was to assess it.

**Method:** Teenagers were recruited from four randomly selected schools in Western province of Sri Lanka. Data were collected using a validated self-administered questionnaire. AP-FGD were diagnosed using Rome III criteria. A total of 1850 teenagers aged 13-18 years were included. Three hundred and five (16.5%) had AP-FGD.

**Findings:** AP-FGD were significantly higher in those exposed to sexual (34.0%), emotional (25.0%) and physical (20.2%) abuse, than in those not abused (13.0%,  $p < 0.001$ ). Those with AP-FGD exposed to abuse had a higher severity score for bowel symptoms (30.8% vs. 24.7% in not abused,  $p < 0.05$ ).

**Conclusions:** This study highlights the importance of identifying exposure to abuse in management of teenagers with AP-FGD.

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#### **KEYWORDS:**

abdominal pain; abuse; child; functional gastrointestinal disorder; somatization

PMID: 25059210

## THORACIC SPINE

### T spine sidebending mechanics

Spine J. 2013 Dec 10. pii: S1529-9430(13)01969-4. doi: 10.1016/j.spinee.2013.11.054.

#### Kinematics of the thoracic spine in trunk lateral bending: in vivo three-dimensional analysis.

Fujimori T1, Iwasaki M2, Nagamoto Y2, Matsuo Y2, Ishii T3, Sugiura T2, Kashii M2, Murase T2, Sugamoto K4, Yoshikawa H2.

#### Abstract

**BACKGROUND CONTEXT:** In vivo three-dimensional kinematics of the thoracic spine in trunk lateral bending with an intact rib cage and soft tissues has not been well documented. There is no quantitative data in the literature for lateral bending in consecutive thoracic spinal segments, and there has not been consensus on the patterns of coupled motion with lateral bending.

**PURPOSE:** To demonstrate segmental ranges of motion (ROMs) in lateral bending and coupled motions of the thoracic spine.

**STUDY DESIGN:** In vivo three-dimensional biomechanics study of the thoracic spine.

**PATIENT SAMPLE:** Fifteen healthy male volunteers.

**OUTCOME MEASURES:** Computed analysis by using voxel-based registration.

**METHODS:** Participants underwent computed tomography of the thoracic spine in three supine positions: neutral, right maximum lateral bending, and left maximum lateral bending. The relative motions of vertebrae were calculated by automatically superimposing an image of vertebrae in a neutral position over images in bending positions, using voxel-based registration. Mean values of lateral bending were compared among the upper (T1-T2 to T3-T4), the middle-upper (T4-T5 to T6-T7), the middle-lower (T7-T8 to T9-T10), and the lower (T10-T11 to T12-L1) parts of the spine.

**RESULTS:** At lateral bending, the mean ROM ( $\pm$ standard deviation) of T1 with respect to L1 was  $15.6^\circ \pm 6.3^\circ$  for lateral bending and  $6.2^\circ \pm 4.8^\circ$  for coupled axial rotation in the same direction as lateral bending. The mean lateral bending of each spinal segment with respect to the inferior adjacent vertebra was  $1.4^\circ \pm 1.3^\circ$  at T1-T2,  $1.3^\circ \pm 1.2^\circ$  at T2-T3,  $1.4^\circ \pm 1.3^\circ$  at T3-T4,  $0.9^\circ \pm 0.9^\circ$  at T4-T5,  $0.8^\circ \pm 1.0^\circ$  at T5-T6,  $1.1^\circ \pm 1.1^\circ$  at T6-T7,  $1.7^\circ \pm 1.2^\circ$  at T7-T8,  $1.3^\circ \pm 1.2^\circ$  at T8-T9,  $1.6^\circ \pm 0.7^\circ$  at T9-T10,  $1.8^\circ \pm 0.8^\circ$  at T10-T11,  $2.3^\circ \pm 1.0^\circ$  at T11-T12, and  $2.2^\circ \pm 0.8^\circ$  at T12-L1. The smallest and the largest amounts of lateral bending were observed in the middle-upper and the lower parts, respectively. There was no significant difference in lateral bending between the upper and the middle-lower parts. Coupled axial rotation of each segment was generally observed in the same direction as lateral bending. However, high variability was found at the T2-T3 to T5-T6 segments. Coupled flexion was observed at the upper and middle parts, and coupled extension was observed at the lower part.

**CONCLUSIONS:** This study revealed in vivo three-dimensional motions of consecutive thoracic spinal segments in trunk lateral bending. The thoracolumbar segments significantly contributed to lateral bending. Coupled axial rotation generally occurred in the same direction with lateral bending. However, more variability was observed in the direction of coupled axial rotation at T2-T3 to T5-T6 segments in the supine position. These results are useful for understanding normal kinematics of the thoracic spine.

**KEYWORDS:** Biomechanics; Coupled motion; In vivo three-dimensional; Lateral bending; Scoliosis; Thoracic spine

PMID: 24333460

## CERVICAL SPINE

### Alignment and surgery

Spine J. 2014 Jul 1;14(7):1228-34. doi: 10.1016/j.spinee.2013.09.043. Epub 2013 Oct 23.

#### Sagittal alignment as a predictor of clinical adjacent segment pathology requiring surgery after anterior cervical arthrodesis.

Park MS<sup>1</sup>, Kelly MP<sup>2</sup>, Lee DH<sup>3</sup>, Min WK<sup>4</sup>, Rahman RK<sup>5</sup>, Riew KD<sup>6</sup>.

#### Author information

#### Abstract

**BACKGROUND CONTEXT:** Postoperative malalignment of the cervical spine may alter cervical spine mechanics and put patients at risk for clinical adjacent segment pathology requiring surgery.

**PURPOSE:** To investigate whether a relationship exists between cervical spine sagittal alignment and clinical adjacent segment pathology requiring surgery (CASP-S) following anterior cervical fusion (ACF).

**STUDY DESIGN:** Retrospective matched study.

**PATIENT SAMPLE:** A total of 122 patients undergoing ACF between 1996 and 2008 were identified, with a minimum of 2 years of follow-up.

**OUTCOME MEASURES:** Radiographs were reviewed to measure the sagittal alignment using C2 and C7 sagittal plumb lines, distance from the fusion mass plumb line to the C2 and C7 plumb lines, the alignment of the fusion mass, caudally adjacent disc angle, the sagittal slope angle of the superior end plate of the vertebra caudally adjacent to the fusion mass, T1 sagittal angle, overall cervical sagittal alignment, and curve patterns by Katsuura classification.

**METHODS:** A total of 122 patients undergoing ACF between 1996 and 2008 were identified, with a minimum of 1 year of follow-up. Patients were divided into groups according to the development of CASP (control/CASP-S) and by number/location of levels fused. Radiographs were reviewed to measure the sagittal alignment using C2 and C7 sagittal plumb lines, distance from the fusion mass plumb line to the C2 and C7 plumb lines, the alignment of the fusion mass, caudally adjacent disc angle, the sagittal slope angle of the superior end plate of the vertebra caudally adjacent to the fusion mass, T1 sagittal angle, overall cervical sagittal alignment, and curve patterns by Katsuura classification. Appropriate statistical tests were performed to calculate relationships between the variables and the development of CASP-S. No funds were received in support of this work. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this article.

**RESULTS:** The groups were similar with regard to demographic and surgical variables. Lordosis was preserved in 82% (50/61) of the control group but in only 66% (40/61) of the CASP-S group ( $p=.033$ ). More patients with a straight curve pattern developed CASP-S. The distance from the C2 to the C7 plumb line and T1 sagittal slope angle were lower in the CASP-S group with C5-C6 fusions compared with the control group. Also, the distance from C5-C6 fusion mass to C7 plumb line and C7 sagittal slope angle were lower in the CASP-S group with C5-C6 fusions.

**CONCLUSIONS:** Our results suggest that malalignment of the cervical spine following an ACF at C5-C6 has an effect on the development of clinical adjacent segment pathology requiring surgery.

**KEYWORDS:** ACDF; Adjacent segment degeneration; Anterior fusion; Cervical spine; Clinical adjacent segment pathology; Kyphosis; Plumb line; Sagittal alignment; Sagittal angle; T1 sagittal slope

## UPPER C SPINE

### Vertebral artery damage during surgery

The Spine Journal Volume 14, Issue 8, Pages 1520–1525, August 1, 2014

#### Vertebral artery injuries in cervical spine surgery

David J. Lunardini, MD , Mark S. Eskander, MD, Jesse L. Even, MD, James T. Dunlap, MD, Antonia F. Chen, MD, MBA, Joon Y. Lee, MD, Timothy W. Ward, MD, James D. Kang, MD, William F. Donaldson, MD

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Published Online: January 10, 2014 DOI: <http://dx.doi.org/10.1016/j.spinee.2013.09.016>

#### Abstract

**Background context:** Vertebral artery injuries (VAIs) are rare but serious complications of cervical spine surgery, with the potential to cause catastrophic bleeding, permanent neurologic impairment, and even death. The present literature regarding incidence of this complication largely comprises a single surgeon or small multicenter case series.

**Purpose:** We sought to gather a large sample of high-volume surgeons to adequately characterize the incidence and risk factors for VAI, management strategies used, and patient outcomes after VAI.

**Study design:** The study was constructed as a cross-sectional study comprising all cervical spine patients operated on by the members of the international Cervical Spine Research Society (CSRS).

**Patient sample:** All patients who have undergone cervical spine surgery by a current member of CSRS as of the spring of 2012.

**Outcome measures:** For each surgeon surveyed, we collected self-reported measures to include the number of cervical cases performed in the surgeon's career, the number of VAIs encountered, the stage of the case during which the injury occurred, the management strategies used, and the overall patient outcome after injury.

**Methods:** An anonymous 10-question web-based survey was distributed to the members of the CSRS. Statistical analysis was performed using Student *t* tests for numerical outcomes and chi-squared analysis for categorical variables.

**Results:** One hundred forty-one CSRS members (of 195 total, 72%) responded to the survey, accounting for a total of 163,324 cervical spine surgeries performed. The overall incidence of VAI was 0.07% (111/163,324). Posterior instrumentation of the upper cervical spine (32.4%), anterior corpectomy (23.4%), and posterior exposure of the cervical spine (11.7%) were the most common stages of the case to result in an injury to the vertebral artery. Discectomy (9%) and anterior exposure of the spine (7.2%) were also common time points for an arterial injury. One-fifth (22/111) of all VAI involved an anomalous course of the vertebral artery. The most common management of VAI was by direct tamponade. The outcomes of VAIs included no permanent sequelae in 90% of patients, permanent neurologic sequelae in 5.5%, and death in 4.5%. Surgeons at academic and private centers had nearly identical rates of VAIs. However, surgeons who had performed 300 or fewer cervical spine surgeries in their career had a VAI incidence of 0.33% compared with 0.06% in those with greater than 300 lifetime cases ( $p=.028$ ).

**Conclusions:** The overall incidence of VAI during cervical spine surgery reported from this survey was 0.07%. Less experienced surgeons had a higher rate of VAI compared with their more experienced peers. The results of VAI are highly variable, resulting in no permanent harm most of the time; however, permanent neurologic injury or death occur in 10% of cases.

**Keywords:** Cervical spine, Surgery, Complications, Vertebral artery injury

## Fractured odontoid

Spine J. 2014 Mar 22. pii: S1529-9430(14)00303-9. doi: 10.1016/j.spinee.2014.03.029.

### Atlantoaxial instability in acute odontoid fractures is associated with nonunion and mortality.

Evaniew N1, Yarascavitch B2, Madden K3, Ghert M4, Drew B4, Bhandari M5, Kwok D4.

#### Abstract

##### **BACKGROUND CONTEXT:**

Odontoid fractures are the most common geriatric cervical spine fractures. Nonunion rates have been reported to be up to 40% and mortality up to 35%, and poor functional outcomes are common. Atlantoaxial instability (AAI) is a plausible prognostic factor, but its role has not been previously examined.

##### **PURPOSE:**

To determine the effect of severe AAI on the outcomes of nonunion and mortality in patients with acute odontoid fractures.

##### **STUDY DESIGN:**

Retrospective cohort/single institution.

##### **PATIENT SAMPLE:**

One hundred twenty-four consecutive patients with acute odontoid fractures.

##### **OUTCOME MEASURES:**

Rates of nonunion and mortality.

##### **METHODS:**

Two independent blinded reviewers measured AAI using postinjury computed tomography scans. Patients were classified as having "severe" or "minimal" AAI on the basis of greater versus less than or equal to 50% mean sublaxation across each C1-C2 facet joint. Rates of nonunion and mortality were compared using independent samples t tests and adjusted for age, displacement, and subtype using binary logistic regression.

##### **RESULTS:**

One hundred seven patients had minimal AAI and 17 had severe AAI. Mean follow-up was 4.4 months (standard deviation=4.6). Patients with severe AAI were more likely to experience nonunion (29% vs. 10%, respectively;  $p=.03$ ) and mortality (35% vs. 14%, respectively;  $p=.03$ ) regardless of treatment modality. Fracture displacement correlated with AAI ( $r^2=0.65$ ). When adjusted for patient age, the odds ratio of nonunion with severe AAI approached significance at 3.3 (95% confidence interval [CI]: 0.9-11.7). Mortality prediction with AAI approached a twofold increased risk (odds ratio=2.1; 95% CI: 0.6-6.8). In patients with Type-II fractures, the odds of mortality with severe AAI approached a threefold higher risk (odds ratio=3.3; 95% CI: 0.9-12.3).

##### **CONCLUSIONS:**

Patients with acute odontoid fractures and severe AAI may be more likely to experience nonunion and mortality, suggesting the possibility that aggressive management could be warranted. Further investigation with a large prospective study including patient-important functional outcomes is justified.

**KEYWORDS:** Cervical; Mortality; Nonunion; Odontoid; Spine; Trauma

PMID: 24662216

## Arthritis

Spine J. 2013 Nov 19. pii: S1529-9430(13)01724-5. doi: 10.1016/j.spinee.2013.10.054.

### Acute neck pain caused by arthritis of the lateral atlantoaxial joint.

Kobayashi T1, Miyakoshi N2, Konno N3, Abe E4, Ishikawa Y2, Shimada Y2.

#### Abstract

##### **BACKGROUND CONTEXT:**

Many diseases can cause acute neck pain in elderly individuals. We conducted the present prospective study based on the hypothesis that arthritis of the lateral atlantoaxial joint may be involved in acute neck pain in elderly patients with limited neck rotation.

##### **PURPOSE:**

To clarify whether the lateral atlantoaxial joint is involved in acute neck pain among elderly individuals by conducting lateral atlantoaxial joint puncture.

##### **STUDY DESIGN:**

A prospective study.

##### **PATIENT SAMPLE:**

Twenty-seven patients (13 men, 14 women) aged 50 years or more who provided consent for atlantoaxial joint puncture met the following four inclusion criteria: acute neck pain with limited cervical rotation of less than 20° as the chief complaint; visual analog scale pain score of 70 mm or more at initial visit; tenderness in the paraspinal muscle of upper cervical vertebrae; and serum C-reactive protein level of 0.5 mg/dl or more.

##### **OUTCOME MEASURES:**

Visual analog scale pain score and radiologic findings.

##### **METHODS:**

Patients underwent puncture of the lateral atlantoaxial joint and were evaluated clinically and radiologically.

##### **RESULTS:**

Computed tomography obtained before puncture showed calcification of the transverse ligament of the atlas in the posterior dens in 22 patients (81.5%), calcification in the longus colli in 2 patients (7.4%), and no calcification in 3 patients (11.1%). Of 27 patients who underwent lateral atlantoaxial joint puncture, joint fluid was collected from 16 patients (59.3%) and calcium pyrophosphate dihydrate crystals were identified in 10 patients (62.5%). For the entire patient population, mean VAS score before puncture was 81.9±16.3 mm, significantly improving to 35.6±24.4 mm by 30 minutes after puncture (p<.001).

##### **CONCLUSIONS:**

The results of this study suggest that crystal-induced arthritis (pseudogout) of the lateral atlantoaxial joint may be closely involved with acute neck pain in the elderly.

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##### **KEYWORDS:**

Acute neck pain; Calcification; Calcium pyrophosphate dihydrate; Lateral atlantoaxial joint; Pseudogout; Puncture

PMID: 24262860

## CRANIUM/TMJ

### Disc pliability

AJNR Am J Neuroradiol. 2014 Jul;35(7):1412-7. doi: 10.3174/ajnr.A3880. Epub 2014 Apr 17.

### **Comparison of the T2 Relaxation Time of the Temporomandibular Joint Articular Disk between Patients with Temporomandibular Disorders and Asymptomatic Volunteers.**

Kakimoto N1, Shimamoto H2, Chindasombatjaroen J3, Tsujimoto T2, Tomita S2, Hasegawa Y4, Murakami S2, Furukawa S2.

#### **Abstract**

##### **BACKGROUND AND PURPOSE:**

T2 relaxation time is a quantitative MR imaging parameter used to detect degenerated cartilage in the knee and lumbar intervertebral disks. We measured the T2 relaxation time of the articular disk of the temporomandibular joint in patients with temporomandibular disorders and asymptomatic volunteers to demonstrate an association between T2 relaxation time and temporomandibular disorder MR imaging findings.

##### **MATERIALS AND METHODS:**

One hundred forty-four patients with temporomandibular disorders and 17 volunteers were enrolled in this study. An 8-echo spin-echo sequence for measuring the T2 relaxation times was performed in the closed mouth position, and the T2 relaxation time of the entire articular disk was measured. Patients were classified according to the articular disk location and function, articular disk configuration, presence of joint effusion, osteoarthritis, and bone marrow abnormalities.

##### **RESULTS:**

The T2 relaxation time of the entire articular disk was  $29.3 \pm 3.8$  ms in the volunteer group and  $30.7 \pm 5.1$  ms in the patient group ( $P = .177$ ). When subgroups were analyzed, however, the T2 relaxation times of the entire articular disk in the anterior disk displacement without reduction group, the marked or extensive joint effusion group, the osteoarthritis-positive group, and the bone marrow abnormality-positive group were significantly longer than those in the volunteer group ( $P < .05$ ).

##### **CONCLUSIONS:**

The T2 relaxation times of the articular disk of the temporomandibular joint in patients with progressive temporomandibular disorders were longer than those of healthy volunteers.

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PMID: 24742804

## HEADACHES

### TP's and upper C spine mobility and HA

#### Journal of Bodywork and Movement Therapies

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Published Online: February 06, 2014 DOI: <http://dx.doi.org/10.1016/j.jbmt.2014.01.006>

#### Abstract

##### Objectives

To evaluate the association between episodic migraines and the prevalence of myofascial trigger points (MTrPs) in the sternocleidomastoid and upper trapezius, forward head posture (FHP), neck range of motion (ROM) and cervical facet joint stiffness.

##### Methods

20 physiotherapy students with episodic migraines and 20 age- and sex matched healthy controls were included in this observational case-control study. Demographics and headache status were evaluated through questionnaires. Active neck ROM, presence of MTrPs, and cervical facet joint mobility were assessed by physical examination. FHP was measured using a lateral digital photograph taken in a sitting position.

##### Results

No significant differences were found in neck ROM measurements and FHP between the migraine and control groups. Significant differences were found in the prevalence of cervical facet joints stiffness in Occiput-C1 ( $\chi^2 = 4.444$ ,  $p = 0.035$ ) and C1-C2 ( $\chi^2 = 10.157$ ,  $p = 0.001$ ), but not in other segments. Significant differences were found in the prevalence of active and latent MTrPs between the migraine and control subjects in the right trapezius ( $\chi^2 = 11.649$ ,  $p = 0.003$ ) and right sternocleidomastoid ( $\chi^2 = 8.485$ ,  $p = 0.014$ ).

##### Conclusions

Our findings support the hypothesis that the prevalence of MTrPs in neck muscles and hypomobility in the upper cervical facet joints are associated with migraines.

**Keywords:** Forward head posture, Migraine, Myofascial trigger points, Neck mobility, Facet joints mobility

## Vestibular

### HA and BPPV

Ann Otol Rhinol Laryngol. 2014 Jul 11. pii: 0003489414539921.

#### **Headache During a Cluster of Benign Paroxysmal Positional Vertigo Attacks.**

Pollak L1, Pollak E2.

##### **Abstract**

##### **OBJECTIVE:**

In view of patients' recurrent complaints, we were interested in investigating the frequency and headache characteristics in patients during a benign paroxysmal positional vertigo (BPPV) cluster.

##### **METHODS:**

Patients with BPPV treated at an outpatient dizziness clinic were interviewed about the presence of headache; its quality, localization, severity, time course, and aggravating and alleviating factors; and headache-related disability during their present vertigo cluster.

##### **RESULTS:**

Among 152 patients with BPPV, 53 (34.8%) reported headache associated with vertigo. According to The International Classification of Headache Disorders, 8 (15%) patients could be classified as migraine without aura (1.1), 14 (26%) were classified as infrequent episodic tension-type headache associated with pericranial tenderness (2.1.1), 23 (43%) were classified as infrequent episodic tension-type headache without pericranial tenderness (2.1.2), 6 (11%) had cervicogenic headache (11.2.1), and in 2 (4%) patients, the headache could not be specified (14.2). Fifty-two age-matched BPPV patients without headache did not differ in history of headaches, BPPV history, or background diseases. The distribution of canal involvement and number of treatment maneuvers was also similar in both groups.

##### **CONCLUSION:**

Headache is frequent in BPPV. The most common is tension-type headache, followed by migraine and cervicogenic headache. Head pain seems to be an independently associated epiphenomenon of BPPV that can worsen patients' distress.

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**KEYWORDS:** BPPV; headache  
PMID: 25015924

## SHOULDER GIRDLE

### Shoulder girdle motions

Man Ther. 2014 Jul 3. pii: S1356-689X(14)00124-6. doi: 10.1016/j.math.2014.06.006.

#### **A new description of scapulothoracic motion during arm movements in healthy subjects.**

Roren A1, Lefevre-Colau MM1, Poiraudeau S2, Fayad F3, Pasqui V4, Roby-Brami A5.

#### **Abstract**

**Purpose:** The participation of scapula motion in arm movement is clinically well known and recent three dimensional (3D) analyses using kinematic techniques have confirmed its importance. Scapular motion relative to the thorax has a theoretical maximum of 6 degrees of freedom (DoF), resulting from rotations at both clavicular joints (3 rotational DoF each). However, most recent kinematic studies have only analysed the 3D rotations of the scapula relative to the thorax. In the present study, the 3D translations of the barycentre of the scapula were considered in order to complete the description of movement at the shoulder complex.

**Methods:** Eight healthy subjects performed arm elevation in the sagittal and frontal planes, simulated activities of daily living (hair combing and back washing) and maximum voluntary scapula movement (forward and backward rolling). Measurements were recorded using a 6 DoF electromagnetic device and the acromial method of analysis was used.

**Results:** The results showed that 3D scapular rotations and translation of its barycentre were functionally consistent for all tasks. A principal component analysis (PCA) yielded three factors, explaining 97.6% of the variance. The first two factors (protraction and shrug, according to clinical descriptions) combined rotations and translations, consistent with the hypothesis that the scapula rolls over the curved thoracic surface. The third factor related to lateral-medial rotation, thus representing rotation in the plane tangential to the thorax.

**Conclusions:** The PCA suggested that scapular motion can be described using these 3 DoF. This should be studied in a larger group of individuals, including patients with pathological conditions.

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#### **KEYWORDS:**

Clavicle; Kinematics; Protraction; Scapula rotation

PMID: 25034959

## GLENOHUMERAL/SHOULDER

### Evaluation scales

#### Evaluative Measurement Properties of the Patient-Specific Functional Scale for Primary Shoulder Complaints in Physical Therapy Practice

**Authors:** Marije L.S. Koehorst, MSc1, Emiel van Trijffel, MSc1,2, Robert Lindeboom, PhD2

**Published:** *Journal of Orthopaedic & Sports Physical Therapy*, 2014, **Volume:** 44 **Issue:** 8 **Pages:** 595-603

#### Study Design

Clinical measurement, longitudinal.

#### Objectives

To assess the test-retest reliability, construct validity, and responsiveness of the Patient-Specific Functional Scale (PSFS) in patients with a primary shoulder complaint.

#### Background

Health measurement outcomes have become increasingly important for evaluating treatment. Patient-specific questionnaires are useful tools for determining treatment goals and evaluating treatment in individual patients. These questionnaires have not yet been validated in patients with nonspecific shoulder pain.

#### Methods

Patients completed the PSFS, the numeric pain rating scale, and the Shoulder Pain and Disability Index at baseline, and after 1 week and 4 to 6 weeks. Test-retest reliability was determined using intraclass correlation coefficients. To assess convergent validity, change scores of the PSFS were correlated with the numeric pain rating scale and Shoulder Pain and Disability Index change scores. Responsiveness was assessed by calculating the area under the curve, the minimal clinically important change, and minimal detectable change, using the global rating of change as an external criterion.

#### Results

Fifty patients (37 men; mean age, 47.7 years) participated in the study. Reliability was high (intraclass correlation coefficient = 0.87; 95% confidence interval [CI]: 0.72, 0.94). The correlations between the change scores of the PSFS and those of the Shoulder Pain and Disability Index and numeric pain rating scale were 0.45 (95% CI: 0.17, 0.80) and 0.55 (95% CI: 0.29, 0.73), respectively. The area under the curve for the PSFS was 0.67 (95% CI: 0.51, 0.83). The minimal detectable change and minimal clinically important change were 0.97 and 1.29 points, respectively.

#### Conclusion

These results suggest that the PSFS is a reliable, valid, and responsive instrument that can be used as an evaluative instrument in patients with a primary shoulder complaint. *J Orthop Sports Phys Ther* 2014;44(8):595–603. Epub 16 July 2014. doi:10.2519/jospt.2014.5133

**Keyword:** clinimetric evaluation, disability, function, patient-specific scales

Read More: [http://www.jospt.org/doi/abs/10.2519/jospt.2014.5133#.U9v\\_PFbOhhM](http://www.jospt.org/doi/abs/10.2519/jospt.2014.5133#.U9v_PFbOhhM)

## IMPINGMENTS

### Fear avoidance

Phys Ther. 2014 Jul 24.

#### **Influence of Fear-Avoidance Beliefs on Disability in Patients With Subacromial Shoulder Pain in Primary Care: A Secondary Analysis.**

Kromer TO1, Sieben JM2, de Bie RA3, Bastiaenen CH4.

#### **Abstract**

##### **BACKGROUND:**

Little information exists about the role of fear-avoidance beliefs and catastrophizing in subacromial pain syndrome.

##### **OBJECTIVE:**

To investigate the associations between pain, catastrophizing, fear, and disability, and the contribution of fear-avoidance beliefs to disability at baseline and at three months.

##### **DESIGN:**

Cross sectional and longitudinal analysis.

##### **METHODS:**

Baseline demographic and clinical data including fear avoidance beliefs and catastrophizing of ninety patients were assessed for this analysis. Disability was measured with the shoulder pain and disability index at baseline and at three months. First, bivariate and partial correlations were calculated between pain, fear avoidance beliefs, catastrophizing, and disability, based on the fear avoidance model. Second, the contribution of fear-avoidance beliefs to disability at baseline and at three months was analysed with hierarchical regression analyses.

##### **RESULTS:**

Correlations between clinical variables and disability were largely in line with the fear avoidance model. Regression analyses identified a significant contribution of fear-avoidance beliefs to baseline disability but not to disability at three months.

##### **LIMITATIONS:**

We investigated patients with subacromial pain syndrome; therefore results should be transferred with caution to other diagnoses. We further used a modified version of the fear avoidance beliefs questionnaire which was not validated for this patient group.

##### **CONCLUSIONS:**

Fear-avoidance beliefs contribute significantly to baseline disability but not to disability change scores after three months. Duration of complaints and baseline disability were the main influencing factors on disability change scores. Although our results help to improve our understanding of the role of fear avoidance beliefs, further studies are needed to fully understand the influence of psychological and clinical factors on the development of disability in patients with subacromial shoulder pain.

PMID: 25060955

## ROTATOR CUFF

### Complications

J Shoulder Elbow Surg. 2014 Jul;23(7):1073-80.doi:10.1016/j.jse.2014.01.001.Epub 2014 Apr 13.

#### **Specific patient-related prognostic factors for rotator cuff repair: a systematic review.**

Lambers Heerspink FO1, Dorrestijn O2, van Raay JJ3, Diercks RL2.

#### **Abstract**

##### **BACKGROUND:**

Many studies that describe factors affecting outcome in primary rotator cuff repair (RCR) have been published, but so far there is no review that summarizes them. This systematic review was conducted to identify prognostic factors influencing functional (clinical) outcome and radiologically proven cuff integrity after RCR.

##### **METHODS:**

A literature search was conducted up to July 2013 for prospective studies that describe prognostic factors affecting outcome in primary RCR. Inclusion criteria were open or arthroscopic repair of a full-thickness supraspinatus or infraspinatus tear. Included outcome measures were shoulder function and cuff integrity. Studies describing revision surgery, muscle transpositions, and subscapular or partial-thickness tears and those with retrospectively collected data were excluded, as were studies without linear or multivariate regression. The literature search resulted in 662 hits, and 12 of those studies were included in this review.

##### **RESULTS:**

Moderate evidence was found for increasing age, larger tear size, and additional biceps or acromioclavicular procedures to have a negative influence on cuff integrity at follow-up as well as for Workers' Compensation Board status to have a negative influence on functional outcome after RCR. There is limited evidence that performance of an additional acromioclavicular procedure has a negative influence on functional outcome. There was insufficient evidence for other described prognostic factors.

##### **CONCLUSION:**

Several patient-specific factors influencing functional and radiologic outcome after RCR have been identified. These factors can guide orthopedic surgeons in their decision-making process as to whether to operate on their patients.

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##### **KEYWORDS:**

Prognostic factors; cuff integrity; functional outcome; rotator cuff repair; systematic review

PMID: 24725900

## Long head of biceps and RTC

*Journal of Shoulder and Elbow Surgery* Volume 23, Issue 8, Pages 1099–1106, August 2014

### **The severity of the long head biceps tendinopathy in patients with chronic rotator cuff tears: macroscopic versus microscopic results**

Po-Ting Wu, MD, I-Ming Jou, MD, PhD, Cheng-Chang Yang, MSc, Chii-Jeng Lin, MD, PhD, Chyun-Yu Yang, MD, PhD, Fong-Chin Su, PhD, Wei-Ren Su, MD, MSc 

Published Online: February 03, 2014 DOI: <http://dx.doi.org/10.1016/j.jse.2013.11.013>

#### **Abstract**

##### **Background**

This study investigated the histopathology of the long head of biceps (LHB) tendon and correlated the findings with the macroscopic appearances of the LHB and the size of rotator cuff tears (RCTs) in patients with chronic RCTs.

##### **Methods**

We compared biopsy specimens from LHBs in 34 patients with chronic RCTs and grossly normal LHBs in 8 patients undergoing shoulder hemiarthroplasty (controls). Duration of preoperative symptoms, the severity of RCTs, and macroscopic appearance of LHBs were recorded, classified, and compared with the histologic grading and apoptosis index of terminal deoxynucleotide transferase-mediated biotin-deoxy uridine triphosphate nick-end labeling (TUNEL) assays of LHBs.

##### **Results**

In the RCT group, there were 8 partial-thickness tears with 5 macroscopic LHB lesions, 12 full-thickness tears with 8 macroscopic LHB lesions, and 14 massive tears with 13 macroscopic LHB lesions. There were 6 LHB subluxations. However, the macroscopic grading and the symptom duration were not correlated with the severity of the histology. In patients with massive tears, no matter what the macroscopic appearance of the LHB, the proportion of end-stage (grade 4) histologic LHB tendinopathy significantly increased (85.7%,  $P < .05$ ) compared with patients with other types of RCTs. There was a consistently high incidence of advanced LHB histology (grade 3 or higher) in each classification of RCTs (75.0%-100.0%). The 8 patients in the control group showed milder histopathology (grade 1 or 2). The apoptosis index significantly increased as the tendinopathy progressed ( $P < .05$ ).

##### **Conclusions**

The macroscopic pathology of LHB may not fully reflect the severity of tendinopathy, and the coexisting size of RCTs plays a role in the severity of LHB tendinopathy.

##### **Level of evidence:**

Basic Science Study, Histology

## Comorbidities

### Journal of Shoulder and Elbow Surgery

#### Comorbidities in rotator cuff disease: a case-control study

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Published Online: March 04, 2014 DOI: <http://dx.doi.org/10.1016/j.jse.2013.12.019>

#### Abstract

##### Background

Rotator cuff disease is a common condition in the general population, but relatively little is known about its associated risk factors.

##### Materials and methods

We have undertaken a large case-control study using The Health Improvement Network database to assess and to quantify the relative contributions of some constitutional and environmental risk factors for rotator cuff disease in the community. Our data set included 5000 patients with rotator cuff disease who were individually matched with a single control by age, sex, and general practice (primary care practice).

##### Results

The median age at diagnosis was 55 years (interquartile range, 44-65 years). Multivariate analysis showed that the risk factors associated with rotator cuff disease were Achilles tendinitis (odds ratio [OR] = 1.78), trigger finger (OR = 1.99), lateral epicondylitis (OR = 1.71), and carpal tunnel syndrome (OR = 1.55). Oral corticosteroid therapy (OR = 2.03), oral antidiabetic use (OR = 1.66), insulin use (OR = 1.77), and “overweight” body mass index of 25.1 to 30 (OR = 1.15) were also significantly associated. Current or previous smoking history, body mass index of greater than 30, any alcohol intake, medial epicondylitis, de Quervain syndrome, cubital tunnel syndrome, and rheumatoid arthritis were not found to be associated with rotator cuff disease.

##### Conclusions

We have identified a number of comorbidities and risk factors for rotator cuff disease. These include lateral epicondylitis, carpal tunnel syndrome, trigger finger, Achilles tendinitis, oral corticosteroid use, and diabetes mellitus. The findings should alert the clinician to comorbid pathologic processes and guide future research into the etiology of this condition.

**Level of evidence:** [Level III](#), [Case-Control Design](#), [Epidemiology Study](#)

**Keywords:** [Rotator cuff](#), [epidemiology](#), [case control](#), [tendinitis](#)

## RC massive tears

*J Shoulder Elbow Surg.* 2014 Apr 9. pii: S1058-2746(14)00041-X. doi:10.1016/j.jse.2014.01.010.

### **Long-term successful arthroscopic repair of large and massive rotator cuff tears with a functional and degradable reinforcement device.**

Proctor CS.

#### **Abstract**

##### **BACKGROUND:**

Rotator cuff repair is a procedure with varying outcomes, and there has been subsequent interest in devices that reinforce the repair and enhance structural and functional outcomes. The objective of this study was to determine these outcomes for arthroscopic repair of large and massive rotator cuff tears augmented with a synthetic absorbable mesh designed specifically for reinforcement of tendon repair by imaging and clinical assessments.

##### **MATERIALS AND METHODS:**

Consecutive arthroscopic repairs were performed on 18 patients with large to massive rotator cuff tears by use of a poly-l-lactic acid synthetic patch as a reinforcement device and fixation with 4 sutures. Patients were assessed preoperatively and at 6 months, 12 months, and a mean of 42 months after surgery by the American Shoulder and Elbow Surgeons (ASES) shoulder score to evaluate clinical performance and at 12 months by ultrasound to assess structural repair.

##### **RESULTS:**

Ultrasound showed that 15 of 18 patients had intact rotator cuff repair at 12 months; at 42 months, an additional patient had a failed repair. Patients showed improvement in the ASES shoulder score from 25 preoperatively to 71 at 12 months and 70 at 42 months after surgery. Patients with intact rotator cuff (n = 14) at 42 months had an ASES shoulder score of 82.

##### **DISCUSSION:**

The poly-l-lactic acid bioabsorbable patch designed specifically to reinforce the surgical repair of tendons supported successful repair of large to massive rotator cuff tears in 83% of patients at 12 months after surgery and 78% of patients at 42 months after surgery, with substantial functional improvement.

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##### **KEYWORDS:**

Rotator cuff tear; arthroscopic reconstruction; augmentation; bioabsorbable; graft; reinforcement; synthetic

PMID: 24725892

## DISLOCATIONS

### Impact of dislocations

J Shoulder Elbow Surg. 2014 Jul 10. pii: S1058-2746(14)00247-X. doi:0.1016/j.jse.2014.05.007.

#### **Incidence of and risk factors for traumatic anterior shoulder dislocation: an epidemiologic study in high-school rugby players.**

Kawasaki T1, Ota C2, Urayama S3, Maki N4, Nagayama M5, Kaketa T5, Takazawa Y5, Kaneko K5.

#### **Abstract**

##### **BACKGROUND:**

The incidence of reinjuries due to glenohumeral instability and the major risk factors for primary anterior shoulder dislocation in youth rugby players have been unclear.

##### **PURPOSE:**

The purpose of this study was to investigate the incidence, mechanisms, and intrinsic risk factors of shoulder dislocation in elite high-school rugby union teams during the 2012 season.

##### **METHODS:**

A total of 378 male rugby players from 7 high-school teams were investigated by use of self-administered preseason and postseason questionnaires.

##### **RESULTS:**

The prevalence of a history of shoulder dislocation was 14.8%, and there were 21 events of primary shoulder dislocation of the 74 overall shoulder injuries that were sustained during the season (3.2 events per 1000 player-hours of match exposure). During the season, 54.3% of the shoulders with at least one episode of shoulder dislocation had reinjury. This study also indicated that the persistence of glenohumeral instability might affect the player's self-assessed condition, regardless of the incidence during the current season. By a multivariate logistic regression method, a history of shoulder dislocation on the opposite side before the season was found to be a risk factor for contralateral primary shoulder dislocation (odds ratio, 3.56; 95% confidence interval, 1.27-9.97;  $P = .02$ ).

##### **CONCLUSIONS:**

High-school rugby players with a history of shoulder dislocation are not playing at full capacity and also have a significant rate of reinjury as well as a high risk of dislocating the other shoulder. These findings may be helpful in deciding on the proper treatment of primary anterior shoulder dislocation in young rugby players.

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##### **KEYWORDS:**

Rugby; dislocation; epidemiology; glenohumeral instability; high school; shoulder injury

PMID: 25017313

## Replacements

### Allergies and impact on results

The Journal of Arthroplasty DOI: <http://dx.doi.org/10.1016/j.arth.2014.02.040>

### Patient Reported Allergies Are a Risk Factor for Poor Outcomes in Total Hip and Knee Arthroplasty

Christopher M. Graves, MD, Jesse E. Otero, MD, PhD, Yubo Gao, PhD, Devon D. Goetz, MD, Melissa D. Willenborg, MD, John J. Callaghan, MD

#### Abstract

##### Method:

We evaluated 459 patients undergoing THA or TKA who completed preoperative and postoperative WOMAC and/or SF36 surveys. Medical comorbidities and reported allergies were also recorded. Evaluation of surveys was compared for patients with or without 4 or more reported allergies using statistical methods.

##### Findings:

Patients with 4 or more reported allergies had less improvement on SF36 Physical Component Score ( $\Delta$ PCS = 4.2) than those with 0–3 allergies ( $\Delta$ PCS = 10.0,  $P = 0.0002$ ). Regression analysis showed that this change was independent of self-reported comorbidities. Patients reporting 4 or more allergies also had less improvement in WOMAC function ( $\Delta$ F = 21.4) than those with 0–3 allergies ( $\Delta$ F = 27.2,  $P = 0.036$ ). Similar nonsignificant trends occurred in SF36 mental and WOMAC pain and stiffness scores.

**Keywords:** Allergies, outcomes, SF36, WOMAC, satisfaction

## Impingement

### Soccer players' hips

Arch Orthop Trauma Surg. 2014 Aug;134(8):1135-41. doi: 10.1007/s00402-014-2008-6. Epub 2014 May 25.

#### **Comparative study of the femoroacetabular impingement (FAI) prevalence in male semiprofessional and amateur soccer players.**

Lahner M1, Walter PA, von Schulze Pellengahr C, Hagen M, von Engelhardt LV, Lukas C.

#### **Abstract**

##### **INTRODUCTION:**

Femoroacetabular impingement (FAI) represents a novel approach to the mechanical etiology of hip osteoarthritis. The cam-type femoroacetabular impingement deformity occurs frequently in young male athletes. The aim of our study was to evaluate the prevalence of FAI in male semiprofessional soccer players using clinical examination and magnetic resonance imaging (MRI), compared to amateur soccer players. In MRI, the  $\alpha$  angle of Nötzli is determined for quantifying FAI.

##### **MATERIALS AND METHODS:**

According to power analysis, a total of 22 asymptomatic semiprofessional soccer players with a median of 23.3 years of age (range 18-30 years) and 22 male amateur soccer players with a median of 22.5 years of age (control group, range 18-29 years) underwent an MRI to measure the hip  $\alpha$  angle of Nötzli. The  $\alpha$  angle of the kicking legs of the semiprofessional group and the amateur group were analyzed. The study group was moreover evaluated by the Hip Outcome Score (HOS) and a clinical hip examination including range of motion (ROM) and impingement tests.

##### **RESULTS:**

In the semiprofessional group, 19 soccer players had a right kicking leg and 1 soccer player had a left kicking leg. 2 soccer players kicked with two feet. In the semi-professional group, the mean value of the  $\alpha$  angle of the kicking leg ( $57.3 \pm 8.2^\circ$ ) was significantly higher than in the amateur group ( $51.7 \pm 4.8^\circ$ ,  $P = 0.008$ ). In the semi-professional group, 15 (62.5 %) of 24 kicking legs had an increased  $\alpha$  angle  $>55^\circ$ , while 5 (27.3 %) kicking legs of the amateur group had an  $\alpha$  angle  $>55^\circ$ . Five semi professional soccer players had findings in clinical examination, whereof 4 had an increased  $\alpha$  angle  $>55^\circ$ . No participant of the amateur group showed pathological results in the clinical examination ( $P = 0.0484$ ). Overall, semiprofessional soccer players had a higher proportion of an increased  $\alpha$  angle than the amateur group.

##### **CONCLUSIONS:**

Semiprofessional players have a higher prevalence of an increased  $\alpha$  angle in the kicking leg than the amateur group at the same age. The kicking leg is predisposed for FAI.

PMID: 24858466

## KNEE

### Men and women and knee pain

Osteoarthritis Cartilage. 2014 Jul 4. pii: S1063-4584(14)01153-4. doi: 0.1016/j.joca.2014.06.030.

#### Examining sex differences in knee pain: the Multicenter Osteoarthritis Study.

Glass N1, Segal NA1, Sluka KA1, Torner JC1, Nevitt MC2, Felson DT3, Bradley LA4, Neogi T3, Lewis CE4, Frey-Law LA5.

#### Abstract

##### OBJECTIVE:

To determine whether women experience greater knee pain severity than men at equivalent levels of radiographic knee osteoarthritis (OA).

##### DESIGN AND METHODS:

A cross-sectional analysis of 2712 individuals (60% women) without knee replacement or a recent steroid injection. Sex differences in pain severity at each Kellgren-Lawrence (KL) grade were assessed by knee using visual analog scale (VAS) scale and Western Ontario and McMaster Universities Arthritis Index (WOMAC) with and without adjustment for age, analgesic use, Body mass index (BMI), clinic site, comorbid conditions, depression score, education, race, and widespread pain (WSP) using generalized estimating equations. Effect sizes (Cohen's d) were also calculated. Analyses were repeated in those with and without patellofemoral OA (PFOA).

##### RESULTS:

Women reported higher VAS pain at all KL grades in unadjusted analyses ( $d = 0.21-0.31$ ,  $P < 0.0001-0.0038$ ) and in analyses adjusted for all covariates except WSP ( $d = 0.16-0.22$ ,  $P < 0.0001-0.0472$ ). Pain severity differences further decreased with adjustment for WSP ( $d = 0.10-0.18$ ) and were significant for KL grade  $\leq 2$  ( $P = 0.0015$ ) and 2 ( $P = 0.0200$ ). Presence compared with absence of WSP was associated with significantly greater knee pain at all KL grades ( $d = 0.32-0.52$ ,  $P < 0.0001-0.0008$ ). In knees with PFOA, VAS pain severity sex differences were greater at each KL grade ( $d = 0.45-0.62$ ,  $P = 0.0006-0.0030$ ) and remained significant for all KL grades in adjusted analyses ( $d = 0.31-0.57$ ,  $P = 0.0013-0.0361$ ). Results using WOMAC were similar.

##### CONCLUSIONS:

Women reported greater knee pain than men regardless of KL grade, though effect sizes were generally small. These differences increased in the presence of PFOA. The strong contribution of WSP to sex differences in knee pain suggests that central sensitivity plays a role in these differences.

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##### KEYWORDS:

Knee osteoarthritis; Knee pain; Sex differences

PMID: 24999111

## Meniscus

### Long term impact of articular cartilage surgery

## Functional Outcomes After Surgical Management of Articular Cartilage Lesions in the Knee: A Systematic Literature Review to Guide Postoperative Rehabilitation

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**Published:** *Journal of Orthopaedic & Sports Physical Therapy*, 2014, **Volume:** 44 **Issue:** 8 **Pages:** 565-A10  
doi:10.2519/jospt.2014.4844

### Study Design

Systematic literature review.

### Objective

To systematically review the literature relative to muscle performance, knee joint biomechanics, and performance-based functional outcomes following articular cartilage repair and restoration surgical procedures in the knee.

### Background

Articular cartilage injuries are associated with functional limitations, poor quality of life, and the potential for long-term disability. This review systematically evaluates evidence related to muscle performance, joint biomechanics, and performance-based functional outcomes following articular cartilage procedures, and discusses their implications for rehabilitation.

### Methods

The online databases of PubMed (MEDLINE), CINAHL, SPORTDiscus, and Scopus were searched (inception to September 2013). Studies pertaining to muscle performance, knee joint biomechanics, and performance-based measures of function following articular cartilage procedure in the knee were included.

### Results

Sixteen articles met the specified inclusion criteria. Seven studies evaluated muscle performance, all showing persistent deficits in quadriceps femoris muscle strength for up to 7 years postprocedure. Quadriceps femoris strength deficits of greater than 20% were noted in 33% and 26% of individuals at 1 and 2 years following microfracture and autologous chondrocyte implantation (ACI), respectively. Two studies evaluated knee mechanics post-ACI, showing persistent deficits in knee kinematics and kinetics for up to 12 months postprocedure compared to uninjured individuals. Seven studies showed improved functional capacity (6-minute walk test) over time, and 3 studies showed persistent performance deficits during higher-level activities (single-leg hop test) for up to 6 years postprocedure. Five studies comparing weight-bearing protocols (accelerated versus traditional/current practice) following ACI found few differences between the groups in function and gait mechanics; however, persistent gait alterations were observed in both groups compared to uninjured individuals.

### Conclusion

Significant quadriceps femoris strength deficits, gait deviations, and functional deficits persist for 5 to 7 years following ACI and microfracture surgical procedures. Future research regarding rehabilitation interventions to help mitigate these deficits is warranted.

**Keyword:** autologous chondrocyte implantation, gait, microfracture, strength

**Effects of non-surgical joint distraction in the treatment of severe knee osteoarthritis**

Khosro Khademi-Kalantari, PhD, PT, Somayeh Mahmoodi Aghdam, MSc, PT, Alireza Akbarzadeh Baghban, PhD, Mehdi Rezayi, PhD, Abbas Rahimi, PhD, PT, Sedighesadat Naimee, PhD, PT

**Summary**

**Purpose**

The aim of this study was to evaluate the clinical results of non surgical knee distraction in patients with severe knee osteoarthritis.

**Method**

Forty female patients with severe knee osteoarthritis were randomly divided in two groups. A standard physiotherapy treatment was applied to both groups and in one group it was accompanied with 20 min knee joint distraction. The patients were treated for 10 sessions. Clinical examination consisted of functional examination, completion of a quality of life questionnaire, pain scale, and assessment of joint mobility and joint edema.

**Result**

The standard physiotherapy treatment accompanied by knee distraction resulted in significantly higher improvement in pain ( $P = 0.004$ ), functional ability ( $P = 0.02$ ), quality of life ( $P = 0.002$ ) and knee flexion range of motion ( $p = 0.02$ ) compared to the standard physiotherapy treatment alone post treatment and after 1 month follow up.

**Conclusion**

Adding knee distraction to standard physiotherapy treatment can result in further improvement in pain relief, increased functional ability and better quality of life in patients with severe knee osteoarthritis.

**Keywords:** Knee, Osteoarthritis, Distraction, Pain, Function

## OSTEOARTHRITIS/KNEE

### Sensitization

Eur J Pain. 2014 Aug;18(7):1024-31. doi: 10.1002/j.1532-2149.2013.00447.x.Epub 2013 Dec 24.

### **Facilitation of pain sensitization in knee osteoarthritis and persistent post-operative pain: A cross-sectional study.**

Skou ST1, Graven-Nielsen T, Rasmussen S, Simonsen OH, Laursen MB, Arendt-Nielsen L.

#### **Abstract**

##### **BACKGROUND:**

Around 20% of patients with osteoarthritis (OA) have chronic post-operative pain after total knee arthroplasty (TKA) and often undergo revision surgery with unfavourable pain outcome. This study compared sensitization in pain patients with knee OA and after revision TKA (re-TKA).

##### **METHODS:**

Median pressure pain thresholds (PPTs) assessed from the most affected knee (localized sensitization) were used to subgroup 53 patients with OA pain and 20 patients with pain after re-TKA: group 1: OA and high-knee PPT; group 2: OA and low-knee PPT; group 3: re-TKA and high-knee PPT; group 4: re-TKA and low-knee PPT. Clinical pain intensity was assessed using a visual analogue scale (VAS). Bilateral PPTs were measured from the lower leg and forearm (spreading sensitization). Furthermore, the pain intensities evoked by 10 repeated pressure pain stimuli (temporal summation) at the knee and lower leg were assessed on an electronic VAS.

##### **RESULTS:**

The mean clinical pain intensity was not significantly different between groups. The PPTs from both lower leg and forearm were significantly lower in group 4 compared to groups 1, 2, and 3 and in groups 2 and 3 compared to group 1 ( $p < 0.05$ ). Temporal summations from the knee and lower leg were significantly facilitated in groups 3 and 4 compared to groups 1 and 2 ( $p < 0.05$ ).

##### **CONCLUSIONS:**

Despite similar pain intensities, facilitated temporal summation is worse in re-TKA than in OA and patients with high local knee hyperalgesia show more prominent spreading sensitization. The study suggests that sensitization should be considered in knee OA especially before re-TKA.

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PMID: 24375931

## **FOOT AND ANKLE**

### Cavus foot

J Am Acad Orthop Surg. 2014 Aug;22(8):512-520.

#### **Subtle Cavus Foot: Diagnosis and Management.**

Deben SE, Pomeroy GC.

#### **Abstract**

##### **Purpose:**

The subtle cavovarus foot (SCF) is a mild malalignment caused by either primary hindfoot varus or a plantarflexed first ray, resulting in a typical constellation of symptoms because of altered foot mechanics. Key clinical signs are a peek-a-boo heel and a positive Coleman block test. The cavovarus position places lateral ankle soft-tissue structures, such as the anterior talofibular ligament and the peroneal tendons, on stretch during normal gait. This can lead to common conditions such as lateral ankle instability, peroneal tendon tears, and stress fractures of the lateral metatarsals and cuboid. The gait cycle is altered because a greater proportion of time is spent with the transverse tarsal joints locked due to the overall varus foot position. In contradistinction to physiologic valgus at heel strike, which maintains the transverse tarsal joints unlocked and affords approximately 50% force dissipation, the increased rigidity of the foot causes a maldistribution of forces that leads to accelerated wear of the midfoot joints and increased stresses along the plantar fascia and the Achilles tendon insertion.

##### **Conclusions:**

Successful nonsurgical management requires correction of the biomechanical anomaly; surgical management of a subtle cavovarus foot typically is part of a comprehensive plan for correcting the symptoms and the malalignment.

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PMID: 25063749

## Dorsiflexion and knee flexion

BMC Musculoskelet Disord. 2014 Jul 23;15(1):246.

### The influence of knee position on ankle dorsiflexion - a biometric study.

Baumbach SF, Brumann M, Binder J, Mutschler W, Regauer M, Polzer H.

#### Abstract

##### BACKGROUND:

Musculus gastrocnemius tightness (MGT) can be diagnosed by comparing ankle dorsiflexion (ADF) with the knee extended and flexed. Although various measurement techniques exist, the degree of knee flexion needed to eliminate the effect of the gastrocnemius on ADF is still unknown. The aim of this study was to identify the minimal degree of knee flexion required to eliminate the restricting effect of the musculus gastrocnemius on ADF.

##### METHODS:

Bilateral ADF of 20 asymptomatic volunteers aged 18-40 years (50% female) was assessed prospectively at six different degrees of knee flexion (0[degree sign], 20[degree sign], 30[degree sign], 45[degree sign], 60[degree sign], 75[degree sign], Lunge). Tests were performed following a standardized protocol, non weightbearing and weightbearing, by two observers. Statistics comprised of descriptive statistics, t-tests, repeated measurement ANOVA and ICC.

##### RESULTS:

20 individuals with a mean age of 27 +/- 4 years were tested. No significant side to side differences were observed. The average ADF [95% confidence interval] for non weightbearing was 4[degree sign] [1[degree sign]-8[degree sign]] with the knee extended and 20[degree sign] [16[degree sign]-24[degree sign]] for the knee 75[degree sign] flexed. Mean weightbearing ADF was 25[degree sign] [22[degree sign]-28[degree sign]] for the knee extended and 39[degree sign] [36[degree sign]-42[degree sign]] for the knee 75[degree sign] flexed. The mean differences between 20[degree sign] knee flexion and full extension were 15[degree sign] [12[degree sign]-18[degree sign]] non weightbearing and 13[degree sign] [11[degree sign]-16[degree sign]] weightbearing. Significant differences of ADF were only found between full extension and 20[degree sign] of knee flexion. Further knee flexion did not increase ADF.

##### CONCLUSION:

Knee flexion of 20[degree sign] fully eliminates the ADF restraining effect of the gastrocnemius. This knowledge is essential to design a standardized clinical examination assessing MGT.

PMID: 25053374

## Orthotics

### Shock absorbing inserts

#### Pressure Pain Sensitivity Changes After Use of Shock-Absorbing Insoles Among Young Soccer Players Training on Artificial Turf: A Randomized Controlled Trial

**Authors:** Pascal Madeleine, PhD, DSc1, Brian P. Hoj, MSc1, César Fernández-de-las-Peñas, PT, DSc1,2, Michael S. Rathleff, PT, PhD3, Søren Kaalund, MD4,5

**Published:** *Journal of Orthopaedic & Sports Physical Therapy*, 2014, **Volume:** 44 **Issue:** 8 **Pages:** 587-594  
doi:10.2519/jospt.2014.5117PDFPDF Plus

#### Study Design

Prospective, randomized, controlled single-blind intervention trial.

#### Objectives

Shock-absorbing insoles (SAIs), compared with usual insoles, were hypothesized to result in larger increases in pressure pain threshold (PPT) after 3 weeks of use.

#### Background

Shock-absorbing insoles can decrease self-reported pain among young soccer players training on artificial turf. However, nothing is known about the underlying changes in pain sensitivity assessed by PPT.

#### Methods

Seventy-five players were included from the youth teams of under 15, under 17, and under 19 years of age, playing for the Aalborg Boldspilklub (AaB) professional sports club. After a randomization stratified by team and age, players were divided into 2 groups, one that received SAIs and a control group that used their usual insoles. Assessments were made in both groups after 3 weeks of training on artificial turf (baseline) and 3 weeks later (follow-up). The primary outcome was change in PPTs from baseline to follow-up, with PPTs measured over 13 locations on the plantar surface of the foot, leg, and low back of the nonpreferred kicking leg.

#### Results

A significantly larger increase was found in PPTs from baseline to follow-up for the SAI group compared with the control group (mean difference, 62 kPa; 95% confidence interval [CI]: 40, 85 kPa). The PPTs increased significantly more among the SAI group compared with the control group ( $P < .05$ ) for the abductor digiti minimi (mean difference, 82 kPa; 95% CI: 6, 157 kPa), tibialis anterior (mean difference, 125 kPa; 95% CI: 20, 230 kPa), medial gastrocnemius (mean difference, 83 kPa; 95% CI: -6, 171 kPa), and erector spinae (mean difference, 86 kPa; 95% CI: -17, 188 kPa).

#### Conclusion

The use of SAIs resulted in increased PPTs after 3 weeks of training on artificial turf compared with controls, suggesting a protective role of SAIs in pressure sensitivity and pain perception. *J Orthop Sports Phys Ther* 2014;44(8):587-594. Epub 16 July 2014. doi:10.2519/jospt.2014.5117

**Keyword:** football, insoles, pain, training

## ANKLE/INSTABILITY

### Syndesmosis

Foot Ankle Int. 2014 Jul 18. pii: 1071100714543646.

#### **The Lambda Sign: A New Radiographic Indicator of Latent Syndesmosis Instability.**

Ryan LP1, Hills MC2, Chang J3, Wilson CD3.

#### **Abstract**

##### **BACKGROUND:**

Latent syndesmotic instability is a common cause of chronic ankle pain. The diagnosis is not readily apparent on static imaging as the fibula remains reduced. The hypothesis of this study was that a previously undescribed novel finding on coronal MRI (lambda sign) is an independent indicator of latent syndesmosis instability. We also report on the utility of classic radiographic and physical exam findings.

##### **METHODS:**

A total of 23 patients with latent syndesmotic instability diagnosed via arthroscopy (group I) were compared to a cohort of 40 patients who were found to have a stable syndesmosis during arthroscopy for unrelated conditions (group II). A retrospective chart review was performed evaluating their clinical history, preoperative physical examination, and radiologic findings. The lambda sign is a high intensity signal seen on coronal MR imaging that resembles the Greek letter lambda.

##### **RESULTS:**

All of the physical exam findings tested were statistically significant. Pain at the syndesmosis had the highest sensitivity (83%), while pain reproduced with the proximal squeeze test resulted in the highest specificity (89%). The external rotation stress test had the highest positive predictive value (75%). Of the radiographic examinations performed, only the lambda sign was found to have statistical significance with a sensitivity of 75% and a specificity of 63%. The presence of a lambda sign on the MRI of patients with physical exam findings suggestive of syndesmotic pain was highly sensitive (75%) and specific (85%).

##### **CONCLUSION:**

The lambda sign noted on the coronal MRI was both sensitive and specific for injuries involving greater than 2 mm of diastasis on arthroscopic stress examination of the syndesmosis. While neither the lambda sign nor any other finding on physical or radiographic examination represented an independent predictor of syndesmotic instability, the presence of a lambda sign in concert with positive physical exam findings might help health care providers determine which patients might benefit from operative intervention or referral.

##### **LEVEL OF EVIDENCE:**

Level III, case control study.

##### **KEYWORDS:**

external rotation stress test; instability; lambda sign; proximal squeeze test; syndesmosis; tibiofibular clear space; tibiofibular overlap

PMID: 25037708

## MANUAL THERAPY

### Manual therapy's value

Clin J Pain. 2014 Aug;30(8):730-6. doi: 10.1097/AJP.0000000000000000.

#### **Costs and Utilities of Manual Therapy and Orthopedic Standard Care for Low-prioritized Orthopedic Outpatients of Working Age: A Cost Consequence Analysis.**

Lilje SC1, Persson UB, Tangen ST, Kåsamoen S, Skillgate E.

#### **Abstract**

##### **OBJECTIVES:**

Treatment for musculoskeletal disorders in primary care in Sweden is generally initiated with advice and medication. Second-line therapy is physiotherapy and/or injection and radiography; third-line therapy is referral to an orthopedist. Manual therapy is not routine. It is a challenge to identify patients who benefit from treatment by different specialists. The current referral strategy probably contributes to long waiting lists in orthopedic departments, which is costly and implies prolonged suffering for the patients. The aim of this health economic evaluation was to compare costs and outcomes from naprapathic manual therapy (NMT) with orthopedic standard care for common, low-prioritized, nonsurgical musculoskeletal disorders, after second-line treatment.

##### **MATERIALS AND METHODS:**

Diagnose Related Groups were used to define the costs, and the SF-36 was encoded to evaluate the outcomes in cost per quality adjusted life years gained.

##### **RESULTS:**

Results from a 12 months' follow-up showed significantly larger improvement for the NMT than for orthopedic standard care, significantly lower mean cost per patient; 5427 SEK (\*Price level 2009; 1 Euro=106,213 SEK; 1 US Dollar=76,457 SEK) (95% confidence interval, 3693-7161) compared to 14298 SEK (95% confidence interval, 8322-20,274), and more gains in outcomes in cost per quality adjusted life years per patient (0.066 compared with 0.026). Thus the result is "dominant."

##### **DISCUSSION:**

It is plausible that improved outcomes and reasonable cost savings for low-prioritized nonsurgical outpatients would be attainable if NMT were available as an additional standard care option in orthopedic outpatient clinics.

PMID: 24042345

## Age and manipulations

J Man Manip Ther. Feb 2011; 19(1): 20–25.doi: [10.1179/106698110X12804993426929](https://doi.org/10.1179/106698110X12804993426929)

PMCID: PMC3172953

### **Patient expectations of benefit from common interventions for low back pain and effects on outcome: secondary analysis of a clinical trial of manual therapy interventions**

Mark D Bishop,<sup>1,2</sup> Joel E Bialosky,<sup>1,2</sup> and Josh A Cleland<sup>3,4</sup>

#### **Abstract**

##### **Objectives**

The purpose of this secondary analysis was 1) to examine patient expectations related to a variety of common interventions for low back pain (LBP) and 2) to determine the influence that specific expectations about spinal manipulation might have had on self-report of disability.

##### **Methods**

We collected patients' expectations about the benefit of specific interventions for low back pain. We also collected patients' general expectations about treatment and tested the relationships among the expectation of benefit from an intervention, receiving that intervention and disability-related outcomes.

##### **Results**

Patients expected exercise and manual therapy interventions to provide more benefit than surgery and medication. There was a statistical association between expecting relief from thrust techniques and receiving thrust techniques, related to meeting the general expectation for treatment (chi-square: 15.5,  $P = 0.008$ ). This was not the case for patients who expected relief from thrust techniques but did not receive it (chi-square: 6.9,  $P = 0.4$ ). Logistic regression modeling was used to predict change in disability at treatment visit 5. When controlling for whether the general expectations for treatment were met, intervention assignment and the interaction between intervention assignment and expectations regarding thrust techniques, the parsimonious model only included intervention as the significant contributor to the model ( $P < 0.001$ ). The adjusted odds ratio of success comparing thrust techniques to non-thrust in this study was 41.2 (11.0, 201.7).

##### **Discussion**

The findings of this secondary analysis indicate that patients seeking intervention for LBP expect active interventions and manual therapy to significantly help improve their pain more than interventions like traction, rest, surgery, or medication. Additionally, in patients who meet the clinical prediction rule for good prognosis when managed with thrust techniques, treating with thrust techniques is more important than matching treatment to patient expectation.

**Keywords:** Expectations, Spinal manipulation, Low back pain

## Manipulation vs. exercise

Spine J. 2013 Nov 10. pii: S1529-9430(13)01630-6. doi: 10.1016/j.spinee.2013.10.035.

### Spinal manipulative therapy and exercise for seniors with chronic neck pain.

Maiers M1, Bronfort G2, Evans R2, Hartvigsen J3, Svendsen K4, Bracha Y5, Schulz C2, Schulz K6, Grimm R7.

#### Abstract

##### **BACKGROUND CONTEXT:**

Neck pain, common among the elderly population, has considerable implications on health and quality of life. Evidence supports the use of spinal manipulative therapy (SMT) and exercise to treat neck pain; however, no studies to date have evaluated the effectiveness of these therapies specifically in seniors.

##### **PURPOSE:**

To assess the relative effectiveness of SMT and supervised rehabilitative exercise, both in combination with and compared to home exercise (HE) alone for neck pain in individuals ages 65 years or older.

##### **STUDY DESIGN/SETTING:**

Randomized clinical trial.

##### **PATIENT SAMPLE:**

Individuals 65 years of age or older with a primary complaint of mechanical neck pain, rated  $\geq 3$  (0-10) for 12 weeks or longer in duration.

##### **OUTCOME MEASURES:**

Patient self-report outcomes were collected at baseline and 4, 12, 26, and 52 weeks after randomization. The primary outcome was pain, measured by an 11-box numerical rating scale. Secondary outcomes included disability (Neck Disability Index), general health status (Medical Outcomes Study Short Form-36), satisfaction (7-point scale), improvement (9-point scale), and medication use (days per week).

##### **METHODS:**

This study was funded by the US Department of Health and Human Services, Health Resources and Services Administration. Linear mixed model analyses were used for comparisons at individual time points and for short- and long-term analyses. Blinded evaluations of objective outcomes were performed at baseline and 12 weeks. Adverse event data were collected at each treatment visit.

##### **RESULTS:**

A total of 241 participants were randomized, with 95% reporting primary outcome data at all time points. After 12 weeks of treatment, the SMT with home exercise group demonstrated a 10% greater decrease in pain compared with the HE-alone group, and 5% change over supervised plus home exercise. A decrease in pain favoring supervised plus HE over HE alone did not reach statistical significance. Compared with the HE group, both combination groups reported greater improvement at week 12 and more satisfaction at all time points. Multivariate longitudinal analysis incorporating primary and secondary patient-rated outcomes showed that the SMT with HE group was superior to the HE-alone group in both the short- and long-term. No serious adverse events were observed as a result of the study treatments.

##### **CONCLUSIONS:**

SMT with HE resulted in greater pain reduction after 12 weeks of treatment compared with both supervised plus HE and HE alone. Supervised exercise sessions added little benefit to the HE-alone program.

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**KEYWORDS:** Elderly; Exercise; Improvement; Neck pain; Satisfaction; Spinal manipulative therapy

PMID: 24225010

## AP cervical mobilization and BP

### Blood Pressure and Heart Rate Response to Posteriorly Directed Pressure Applied to the Cervical Spine in Young, Pain-Free Individuals: A Randomized, Repeated-Measures, Double-Blind, Placebo-Controlled Study

**Authors:** Emmanuel Yung, PT, DPT, MA, OCS, FAAOMPT1–3, Michael Wong, PT, DPT, OCS, FAAOMPT3–5, Haddie Williams, PT, DPT, ATC7, Kyle Mache, PT, DPT6

**Published:** *Journal of Orthopaedic & Sports Physical Therapy*, 2014, **Volume:** 44 **Issue:** 8 **Pages:** 622-626  
doi:10.2519/jospt.2014.4820 PDFPDF Plus

#### Objectives

To compare the blood pressure (BP) and heart rate (HR) response of healthy volunteers to posteriorly directed (anterior-to-posterior [AP]) pressure applied to the cervical spine versus placebo.

#### Background

Manual therapists employ cervical spine AP mobilizations for various cervical-shoulder pain conditions. However, there is a paucity of literature describing the procedure, cardiovascular response, and safety profile.

#### Methods

Thirty-nine (25 female) healthy participants (mean  $\pm$  SD age,  $24.7 \pm 1.9$  years) were randomly assigned to 1 of 2 groups. Group 1 received a placebo, consisting of light touch applied to the right C6 costal process. Group 2 received AP pressure at the same location. Blood pressure and HR were measured prior to, during, and after the application of AP pressure. One-way analysis of variance and paired-difference statistics were used for data analysis.

#### Results

There was no statistically significant difference between groups for mean systolic BP, mean diastolic BP, and mean HR ( $P > .05$ ) for all time points. Within-group comparisons indicated statistically significant differences between baseline and post-AP pressure HR ( $-2.8$  bpm; 95% confidence interval:  $-4.6, -1.1$ ) and between baseline and post-AP pressure systolic BP ( $-2.4$  mmHg; 95% confidence interval:  $-3.7, -1.0$ ) in the AP group, and between baseline and postplacebo systolic BP ( $-2.6$  mmHg; 95% confidence interval:  $-4.2, -1.0$ ) in the placebo group. No participants reported any adverse reactions or side effects within 24 hours of testing.

#### Conclusion

AP pressure caused a statistically significant physiologic response that resulted in a minor drop in HR (without causing asystole or vasodepression) after the procedure, whereas this cardiovascular change did not occur for those in the placebo group. Within both groups, there was a small but statistically significant reduction in systolic BP following the procedure.

*J Orthop Sports Phys Ther* 2014;44(8):622–626. Epub 16 July 2014. doi:10.2519/jospt.2014.4820

**Keyword:** cardiovascular, manual therapy, mobilization, neck

## Dose manipulations

Spine J. 2014 Jul 1;14(7):1106-16. doi: 10.1016/j.spinee.2013.07.468. Epub 2013 Oct 16.

### Dose-response and efficacy of spinal manipulation for care of chronic low back pain: a randomized controlled trial.

Haas M1, Vavrek D2, Peterson D3, Polissar N4, Neradilek MB4.

#### Author information

#### Abstract

**BACKGROUND CONTEXT:** There have been no full-scale trials of the optimal number of visits for the care of any condition with spinal manipulation.

**PURPOSE:** To identify the dose-response relationship between visits to a chiropractor for spinal manipulation and chronic low back pain (cLBP) outcomes and to determine the efficacy of manipulation by comparison with a light massage control.

**STUDY DESIGN/SETTING:** Practice-based randomized controlled trial.

**PATIENT SAMPLE:** Four hundred participants with cLBP.

**OUTCOME MEASURES:** The primary cLBP outcomes were the 100-point modified Von Korff pain intensity and functional disability scales evaluated at the 12- and 24-week primary end points. Secondary outcomes included days with pain and functional disability, pain unpleasantness, global perceived improvement, medication use, and general health status.

**METHODS:** One hundred participants with cLBP were randomized to each of four dose levels of care: 0, 6, 12, or 18 sessions of spinal manipulation from a chiropractor. Participants were treated three times per week for 6 weeks. At sessions when manipulation was not assigned, they received a focused light massage control. Covariate-adjusted linear dose effects and comparisons with the no-manipulation control group were evaluated at 6, 12, 18, 24, 39, and 52 weeks.

**RESULTS:** For the primary outcomes, mean pain and disability improvement in the manipulation groups were 20 points by 12 weeks and sustainable to 52 weeks. Linear dose-response effects were small, reaching about two points per six manipulation sessions at 12 and 52 weeks for both variables ( $p < .025$ ). At 12 weeks, the greatest differences from the no-manipulation control were found for 12 sessions (8.6 pain and 7.6 disability points,  $p < .025$ ); at 24 weeks, differences were negligible; and at 52 weeks, the greatest group differences were seen for 18 visits (5.9 pain and 8.8 disability points,  $p < .025$ ).

**CONCLUSIONS:** The number of spinal manipulation visits had modest effects on cLBP outcomes above those of 18 hands-on visits to a chiropractor. Overall, 12 visits yielded the most favorable results but was not well distinguished from other dose levels.

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**KEYWORDS:** Chiropractic; Chronic low back pain; Dose-response; Randomized controlled trial; Spinal manipulation

**Comment in** Short-term dosing of manual therapies for chronic low back pain. [Spine J. 2014]

PMID: 24139233

## STM

### Hip STM with labral tear

#### Myofascial Treatment for Patients With Acetabular Labral Tears: A Single-Subject Research Design Study

**Authors:** Glenn E. Cashman, DC, MSc1, W. Ben Mortenson, OT, PhD2, Michael K. Gilbert, MD, FRCS(C), MEd3

**Published:** *Journal of Orthopaedic & Sports Physical Therapy*, 2014, **Volume:** 44 **Issue:** 8 **Pages:** 604-614  
doi:10.2519/jospt.2014.5095

#### Study Design

Single-subject research design using 4 consecutive patients.

#### Objective

To assess whether treatment using soft tissue therapy (ART or Active Release Technique), stretching, and strengthening of the hip abductors, hip external rotators, and tensor fascia latae muscles reduces pain and improves self-reported hip function in patients with acetabular labral tears who also have posterolateral hip pain of suspected myofascial origin.

#### Background

Acetabular labral tears cause pain in some but not all patients. Pain commonly presents anteriorly but may also present posteriorly and laterally. The standard of care is arthroscopic repair, which helps many but not all patients. It is possible that these patients may present with extra-articular contributions to their pain, such as myofascial pain, making their clinical presentation more complex. No previous study has assessed soft tissue therapy as a treatment option for this subset of patients.

#### Methods

This A-B-A design used repeated measures of the Hip Outcome Score and visual analog scale for pain. Four patients were treated for 6 to 8 weeks, using a combination of soft tissue therapy, stretching, and strengthening for the hip abductors, external rotators, and tensor fascia latae. Data were assessed visually, statistically, and by comparing mean differences before and after intervention.

#### Results

All 4 patients experienced both statistically significant and clinically meaningful improvement in posterolateral hip pain and hip-related function. Three patients also experienced reduction in anteromedial hip pain.

#### Conclusion

Myofascial hip pain may contribute to hip-related symptoms and disability in patients with acetabular labral tears and posterolateral hip pain. These patients may benefit from soft tissue therapy combined with stretching and strengthening exercises targeting the hip abductors, tensor fascia latae, and hip external rotator muscles.

**Level of Evidence:** Therapy, level 4. *J Orthop Sports Phys Ther* 2014;44(8):604–614. Epub 16 July 2014.  
doi:10.2519/jospt.2014.5095

**Keyword:** Active Release Technique, ART, connective/soft tissue techniques, hip, manual therapy

## Scar tissue and acupuncture

Journal of Acupuncture and Meridian Studies

### The Successful Treatment of Pain Associated with Scar Tissue Using Acupuncture

Sheng Fang 

Oriental Medicine Department, Oregon College of Oriental Medicine (OCOM), Portland, OR, USA

Published Online: July 07, 2014 DOI: <http://dx.doi.org/10.1016/j.jams.2014.05.001>

**Study Design:** In this case report, a 48-year-old female who had suffered severe scar pain for 3 months was treated with acupuncture using the Wei Ci technique (surrounding the dragon). Scar tissue usually forms after deep trauma, such as piercings, burns, and surgery, to the dermis. In Chinese Medicine, scar tissue causes local Qi and blood stagnation which lead to pain.

**Methods:** The Wei Ci technique (surrounding the dragon) and distal points Hegu-LI-4, Taichong-LIV-3, Zusanli-ST-36 were used. The patient received a total of eight treatments in 5 weeks.

**Results:** The scar pain decreased from 7 to 1 or 2 on a Likert scale of 0–10, with 0 being no pain and 10 being the worst pain.

**Conclusions:** Acupuncture may have a good short-term pain-relieving effect on scar pain but its long-term scar-pain-relieving effects are still unclear.

**Keywords:** acupuncture, pain, scar, Wei Ci

## Core

### Multifidus and LBP

*Spine (Phila Pa 1976)*. 2014 Aug 1;39(17):1417-25. doi: 10.1097/BRS.0000000000000424.

#### **The relationship of lumbar multifidus muscle morphology to previous, current, and future low back pain: a 9-year population-based prospective cohort study.**

Hebert JJ1, Kjaer P, Fritz JM, Walker BF.

##### **Abstract**

##### **STUDY DESIGN:**

Population based prospective cohort study.

##### **OBJECTIVE:**

We explored the cross-sectional relationships between lumbar multifidus (LM) intramuscular adipose tissue (IMAT) infiltration and low back pain (LBP) at 3 successive time points and investigated the role of IMAT in predicting the occurrence of LBP after 5 and 9 years.

##### **SUMMARY OF BACKGROUND DATA:**

Although LBP is a major source of disease burden, the biological determinants of LBP are poorly understood.

##### **METHODS:**

Participants were 40-year-old adults randomly sampled from a Danish population and followed up at 45 and 49 years of age. At each time point, participants underwent magnetic resonance imaging and reported ever having had LBP, LBP in the previous year, nontrivial LBP in the previous year, or a history of pain radiating into the legs. Pixel intensity and frequencies from T1-weighted magnetic resonance images identified the greatest proportion of LM IMAT at the L4 and L5 spinal levels. IMAT infiltration was categorized as normal/mild, moderate, or severe based on tertile divisions. Associations were explored with crude and adjusted odds ratios (aORs) from logistic regression models. Model covariates included sex, body mass index, and occupational and leisure time physical activity.

##### **RESULTS:**

A total of 401 participants were enrolled, with 331 (83%) and 286 (71%) participants followed up at 5 and 9 years, respectively. The cross-sectional analyses demonstrated that at the age of 40 years, participants with severe IMAT infiltration demonstrated increased odds of ever experiencing LBP (aOR [95% confidence interval, 95% CI] = 3.16 [1.45-6.89]), nontrivial LBP (aOR [95% CI] = 2.82 [1.36-5.81]), LBP in the past year (aOR [95% CI] = 1.95 [1.07-3.53]), and leg pain (aOR [95% CI] = 2.08 [1.19-3.62]). There were no consistent cross-sectional associations between LBP/leg pain and LM IMAT at 45 or 49 years of age and LM IMAT did not predict future LBP or leg pain.

**CONCLUSION:** Relationship between LM IMAT and LBP/leg pain inconsistent and may be modified by age.

PMID: 24859576

## US and abdominals

Journal of Bodywork and Movement Therapies DOI: <http://dx.doi.org/10.1016/j.jbmt.2014.05.009>

### Reliability of ultrasound thickness measurement of the abdominal muscles during clinical isometric endurance tests

[Shabnam ShahAli](#), PhD, PT , [Amir Massoud Arab](#), PhD, PT , [Saeed Talebian](#), PhD, PT, [Esmail Ebrahimi](#), PhD, PT, [Andia Bahmani](#), MSc, PT1, [Noureddin Karimi](#), PhD, PT1, [Hoda Nabavi](#), MSc in Biomedical Engineering

#### Summary

**Purpose:** The study was designed to evaluate the intra-examiner reliability of ultrasound (US) thickness measurement of abdominal muscles activity when supine lying and during two isometric endurance tests in subjects with and without Low back pain (LBP).

**Methods:** A total of 19 women (9 with LBP, 10 without LBP) participated in the study. Within-day reliability of the US thickness measurements at supine lying and the two isometric endurance tests were assessed in all subjects. The intra-class correlation coefficient (ICC) was used to assess the relative reliability of thickness measurement. The standard error of measurement (SEM), minimal detectable change (MDC) and the coefficient of variation (CV) were used to evaluate the absolute reliability.

**Findings:** Results indicated high ICC scores (0.73–0.99) and also small SEM and MDC scores for within-day reliability assessment. The Bland-Altman plots of agreement in US measurement of the abdominal muscles during the two isometric endurance tests demonstrated that 95% of the observations fall between the limits of agreement for test and retest measurements. Together the results indicate high intra-tester reliability for the US measurement of the thickness of abdominal muscles in all the positions tested.

**Conclusions:** According to the study's findings, US imaging can be used as a reliable method for assessment of abdominal muscles activity in supine lying and the two isometric endurance tests employed, in participants with and without LBP.

**Keywords:** [Ultrasound](#), [Reliability](#), [Abdominal muscles](#), [Physical endurance](#)

## Posture

### Backpacks' impact on L 4 & 5 discs

Eur Spine J. 2014 Jul;23(7):1407-13. doi: 10.1007/s00586-014-3247-5. Epub 2014 Mar 12.

### **Body posture and backpack loading: an upright magnetic resonance imaging study of the adult lumbar spine.**

Shymon S1, Hargens AR, Minkoff LA, Chang DG.

#### **Abstract**

##### **PURPOSE:**

Axial loading of the spine while supine, simulating upright posture, decreases intervertebral disc (IVD) height and lumbar length and increases lumbar lordosis. The purpose of this study is to measure the adult lumbar spine's response to upright posture and a backpack load using upright magnetic resonance imaging (MRI). We hypothesize that higher spinal loads, while upright and with a backpack, will compress lumbar length and IVD height as well as decrease lumbar lordosis.

##### **METHODS:**

Six volunteers ( $45 \pm 6$  years) underwent 0.6 T MRI scans of the lumbar spine while supine, upright, and upright with a 10 % body weight (BW) backpack. Main outcomes were IVD height, lumbar spinal length (distance between anterior-superior corners of L1 and S1), and lumbar lordosis (Cobb angle between the superior endplates of L1 and S1).

##### **RESULTS:**

The 10 % BW load significantly compressed the L4-L5 and L5-S1 IVDs relative to supine ( $p < 0.05$ ). The upright and upright plus 10 % BW backpack conditions significantly compressed the anterior height of L5-S1 relative to supine ( $p < 0.05$ ), but did not significantly change the lumbar length or lumbar lordosis.

##### **CONCLUSIONS:**

The L4-L5 and L5-S1 IVDs compress, particularly anteriorly, when transitioning from supine to upright position with a 10 % BW backpack. This study is the first radiographic analysis to describe the adult lumbar spine wearing common backpack loads. The novel upright MRI protocol described allows for functional, in vivo, loaded measurements of the spine that enables the study of spinal biomechanics and therapeutic interventions.

PMID: 24619606

## Scoliosis

## Aerobic

### The Spine Journal

#### Functional aerobic exercise capacity limitation in adolescent idiopathic scoliosis

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Published Online: February 03, 2014 DOI: <http://dx.doi.org/10.1016/j.spinee.2014.01.041>

#### Abstract

**Background context:** Exercise limitation has been described in patients with adolescent idiopathic scoliosis (AIS); however, whether the walking performance is impaired in these patients should be elucidated.

**Purpose:** Thus, we aimed to evaluate the physiologic responses to the incremental shuttle walk test (ISWT) in patients with AIS.

**Study design/setting:** Cross-sectional study.

**Patient sample:** Twenty-nine patients with AIS and 20 healthy adolescents aged between 11 and 18 years old.

**Outcome measures:** Oxygen uptake ( $VO_2$ ), incremental shuttle walk distance (ISWD),  $\Delta VO_2/\Delta$ walking velocity,  $\Delta HR/\Delta VO_2$ ,  $\Delta VE/\Delta VCO_2$ , and linearized  $\Delta$ tidal volume ( $VT$ )/ $\Delta \ln VE$ , forced expiratory volume in the first second of expiration (FEV1), and forced vital capacity (FVC).

**Methods:** We performed two ISWTs, and the data used were acquired in the second test. We also evaluated the lung function and respiratory muscle strength through spirometry test and manovacuometry, respectively. All authors confirm that there are no conflicts of interest. To compare the means or medians of variables between patients and healthy subjects, we used the unpaired  $t$  test or Mann-Whitney  $U$  test, respectively. The correlations were assessed by Pearson or Spearman coefficients according to the distribution of the studied variables. The probability of alpha error was set at 5% for all analyses.

**Results:** Adolescent idiopathic scoliosis patients showed significant lower values of ISWD,  $VO_2$ , and ventilation at the end of the ISWT, as well as lower FEV1 and FVC; they also presented significantly shallower slope of  $\Delta VT/\Delta \ln VE$ , whereas  $VO_2$  related significantly with ISWD ( $r=0.80$ ), FVC ( $r=0.78$ ), FEV1 ( $r=0.73$ ), and  $\Delta VT/\Delta \ln VE$  ( $r=0.58$ ).

**Conclusions:** Adolescent idiopathic scoliosis correlated to walking limitation and was associated to reduced pulmonary function and worse breathing pattern during exercise. Our results suggest that walking-based aerobic exercises should be encouraged in these patients.

**Keywords:** Exercise limitation, Lung function, Adolescent idiopathic scoliosis, Spine, Respiratory muscles, Cardiovascular deconditioning

## ATHLETICS

### Cycling handlebars

J Back Musculoskelet Rehabil. 2014 Jul 24.

#### **The influence of handlebar-hands position on spinal posture in professional cyclists.**

Muyor JM., Faculty of Education Sciences, Nursing and Physiotherapy. Laboratory of Kinesiology, Biomechanics and Ergonomics (KIBIOMER Lab), University of Almería, Spain.

#### **Abstract**

##### **BACKGROUND AND OBJECTIVE:**

Systematic repetition or prolonged posture in specific postures adopted during training could generate modifications on the sagittal spinal curvatures. Spinal alteration in its physiologic curvatures in the sagittal plane has been associated with predisposition to spinal disorders. The objective was to evaluate and compare the changes produced on the sagittal thoracic and lumbar spinal curvatures, and pelvic tilt from standing posture on the floor to upper, middle, lower and aerodynamic handlebars postures adopted on their own road bicycles.

**MATERIAL AND METHOD:** A total of twenty-eight male professional cyclists ( $179.92 \pm 5.78$  cm;  $67.18 \pm 5.74$  kg) participated in the study. Cyclists had an experience of  $17.22 \pm 6.16$  years in cycling, and spent  $6.52 \pm 0.51$  days per week and  $3.78 \pm 0.61$  hours per day training on their bicycles. Sagittal spinal curvatures (thoracic and lumbar) and pelvic tilt were measured in the standing position on the floor and while sitting on a bicycle with different handlebar-hand positions (high, middle, low and aerodynamic) using a Spinal Mouse system.

##### **RESULTS:**

The thoracic spine showed significantly greater angular values while in a standing posture than on the bicycle in all handlebar-hands postures evaluated. The lumbar curvature changed from lordosis (negative values - anterior convexity) in standing posture to kyphosis (positive values - posterior convexity) in all handlebar-hands positions on the bicycle. The aerodynamic handlebar positions showed the greatest lumbar flexion (lumbar kyphosis) and anterior pelvic tilt.

**CONCLUSIONS:** Professional cyclists passively maintain their thoracic spine straighter on the bicycle due to handlebar-hands support than in standing posture. However, the lumbar spine is flexed on the bicycle in all handlebar-hands evaluated. The pelvis is modified to greater anterior pelvic tilt when the handlebar-hands position is farther and lower regarding the saddle of the bicycle.

**KEYWORDS:** Thoracic; bike-fitting; cycling; lumbar; pelvis; posture

PMID: 25061036

## Cycling

**Journal of Bodywork and Movement Therapies v DOI: <http://dx.doi.org/10.1016/j.jbmt.2014.05.003>**

**The effects of acute bout of cycling on auditory & visual reaction times.**

Zinat Ashnagar, PT, Azadeh Shadmehr, PhD , Shohreh Jalaei, PhD

### Summary

#### Aim

The purpose of this study was to investigate the effects of an acute bout of cycling exercise on auditory choice reaction time, visual choice reaction time, auditory complex choice reaction time and visual complex choice reaction time.

#### Methods

29 subjects were randomly divided into experimental and control groups. The subjects of the experimental group carried out a single bout of submaximal cycling exercise. The auditory choice reaction time, visual choice reaction time, auditory complex choice reaction time and visual complex choice reaction times were measured before and after the exercise session. The reaction time tests were taken from the subjects by using Speed Anticipation and Reaction Tester (SART) software. In the control group, the reaction time tests were performed by the subjects with an interval of 30 min.

#### Results

In the experimental group, the percentage changes of mean auditory choice and complex choice reaction time values were significantly decreased in comparison with the control group ( $P < 0.05$ ). Although the visual choice and complex choice reaction times were decreased after the exercise, the changes were not significant ( $P > 0.05$ ).

#### Conclusion

An acute bout of cycling exercise improved the speed of auditory and visual reaction times in healthy young females. However, these positive changes were significantly observed only in the auditory reaction time tests in comparison with the control group.

**Keywords:** Auditory reaction time, Visual reaction time, Cycling exercise

## PAIN

### Chronic stress and pain

Phys Ther. 2014 Jul 17.

#### **Chronic Stress, Cortisol Dysfunction, and Pain: A Psychoneuroendocrine Rationale for Stress Management in Pain Rehabilitation.**

Hannibal KE1, Bishop MD2.

##### **Abstract**

**Purpose:** Pain is a primary symptom driving patients to seek physical therapy and its attenuation commonly defines a successful outcome.

**Analysis:** A large body of evidence is dedicated to elucidating the relationship between chronic stress and pain. A physiologic stress response may be evoked by fear or perceived threat to safety, status, or well-being, and elicits the secretion of sympathetic catecholamines (epinephrine and norepinephrine) and neuroendocrine hormones (cortisol) to promote survival and motivate success. Cortisol is a potent anti-inflammatory that functions to mobilize glucose reserves for energy and modulate inflammation. Cortisol may also facilitate the consolidation of fear-based memories for future survival and avoidance of danger.

**Findings:** While short-term stress may be adaptive, maladaptive responses (such as magnification, rumination, or helplessness) to pain or non-pain-related stressors may intensify cortisol secretion and condition a sensitized physiologic stress response that is readily recruited. Ultimately, a prolonged or exaggerated stress response may perpetuate cortisol dysfunction, widespread inflammation, and pain. While stress may be unavoidable in life and challenges are inherent to success, humans have the capability to modify what they perceive as stressful and how they respond to it. Exaggerated psychological responses (eg: catastrophizing) following maladaptive cognitive appraisals of potential stressors as threatening may exacerbate cortisol secretion by facilitating fear-based activation of the amygdala. Coping, cognitive re-appraisal, or confrontation of stressors may minimize cortisol secretion and prevent chronic, recurrent pain.

**Conclusions:** Given the parallel mechanisms underlying the physiologic effects of a maladaptive response to pain and non-pain-related stressors, physical therapists should consider screening for non-pain-related stress to facilitate treatment, prevent chronic disability, and improve quality of life.

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PMID: 25035267

## Clinical predictors

Spine J. 2013 Dec 12. pii: S1529-9430(13)01982-7. doi: 10.1016/j.spinee.2013.07.487.

### Clinical predictors of psychological distress in patients presenting for evaluation of a spinal disorder.

Daubs MD1, Hung M2, Adams JR2, Patel AA2, Lawrence BD2, Neese AM2, Brodke DS2.

#### Abstract

##### **BACKGROUND CONTEXT:**

Psychological distress has been shown to adversely affect the treatment outcomes of many spinal disorders. Most physicians do not routinely use psychological screening questionnaires. Additionally, physicians have not performed well when assessing patients for psychological distress while using clinical impression alone.

##### **PURPOSE:**

The purpose of our study was to evaluate the clinical factors that most accurately predict the presence of psychological distress in patients presenting for the evaluation of a spinal disorder.

##### **STUDY DESIGN:**

This is a retrospective study.

##### **PATIENT SAMPLE:**

Three hundred eighty-eight consecutive patients presented for an initial evaluation of a spinal disorder at a tertiary spine clinic.

##### **OUTCOME MEASURES:**

Oswestry disability index (ODI), visual analog scale (VAS), and distress risk assessment method (DRAM).

##### **METHODS:**

Three hundred eighty-eight consecutive patients presenting for the evaluation of a spinal disorder with a completed DRAM, ODI, and VAS were evaluated. The DRAM was used to classify the patients' level of psychological distress. Clinical variables such as history of depression, use of antidepressants, use of other psychotropic medications, history of surgery, and history of chronic pain syndromes along with ODI and VAS scores were used to develop a model to predict a patient's level of psychological distress.

##### **RESULTS:**

Our model was highly accurate (92%), sensitive (92%), and specific (95%) in predicting a patient's level of psychological distress. If patients' VAS is 4 or 5, their ODI is less than 45, and they are not on any psychotropic medications, they likely will fall into the normal group. Patients with a VAS greater than 7, currently taking antidepressants or other psychotropic medications, an ODI greater than 58, and a history of surgery are likely to fall into the higher distressed categories of distressed depressive or distressed somatic.

##### **CONCLUSIONS:**

A patient's clinical history, ODI, and VAS scores can predict their level of psychological distress. In general, patients with higher VAS pain scores, higher ODI scores (>58), and those taking an antidepressant or another psychotropic medication were likely to have high levels of psychological distress. The predictive clinical factors noted in this study are readily available to most physicians treating spinal disorders and may be helpful in improving their ability to detect patients with psychological distress, counseling them on realistic outcomes, and possibly improve their treatment outcomes.

##### **KEYWORDS:**

Anxiety; Clinical predictors; Depression; Distress Risk Assessment Method; Oswestry Disability Index; Outcomes measurements; Psychological distress; Spinal disorders; Visual analog scale

PMID: 24333833

## Tissue changes in pain

Clin J Pain. 2014 May;30(5):409-20. doi: 10.1097/AJP.0b013e31829e9d2a.

### **Chronic widespread pain: increased glutamate and lactate concentrations in the trapezius muscle and plasma.**

Gerdle B1, Larsson B, Forsberg F, Ghafouri N, Karlsson L, Stensson N, Ghafouri B.

#### **Abstract**

##### **BACKGROUND:**

Chronic widespread pain (CWP), including fibromyalgia syndrome (FM), is associated with prominent negative consequences. CWP has been associated with alterations in the central processing of nociception. Whereas some researchers consider CWP/FM as a central hyperexcitability pain condition, others suggest that the central alterations are maintained by peripheral nociceptive input. Microdialysis can be used in vivo to study muscle alterations in chronic myalgia.

##### **AIM:**

The aim of the study was to investigate the plasma and interstitial concentrations of metabolites and algesics in the trapezius muscle of women with CWP and in pain-free women (CON).

##### **MATERIALS AND METHODS:**

Seventeen women with CWP and 24 CON went through a clinical examination and completed a questionnaire; the pressure pain thresholds in the upper and lower extremities were registered. Microdialysis was conducted in the trapezius muscle, and a blood sample was drawn. Muscle blood flow, interstitial muscle concentrations, and plasma concentrations of lactate, pyruvate, glutamate, glucose, and glycerol (not in the plasma) were determined.

##### **RESULTS:**

CWP patients had significantly increased interstitial muscle ( $P=0.02$  to  $0.001$ ) and plasma ( $P=0.026$  to  $0.017$ ) concentrations of lactate and glutamate. No significant differences existed in blood flow between CWP and CON. The interstitial concentrations-but not the plasma levels-of glutamate and lactate correlated significantly with aspects of pain such as pressure pain thresholds of the trapezius ( $R=0.22$ ) and tibialis anterior ( $R=0.18$ ) and the mean pain intensity ( $R=0.10$ ) in CWP but not in CON.

##### **CONCLUSIONS:**

The present study supports the suggestion that aspects of pain and central alterations in CWP/FM are influenced by peripheral tissue alterations.

PMID: 23887335

## Virtual body

Eur J Pain. 2014 Aug;18(7):1040-8. doi: 10.1002/j.1532-2149.2014.00451.x. Epub 2014 Jan 21.

### **Modulation of pain threshold by virtual body ownership.**

Martini M1, Perez-Marcos D, Sanchez-Vives MV.

#### **Abstract**

##### **BACKGROUND:**

Appropriate sensorimotor correlations can result in the illusion of ownership of exogenous body parts. Nevertheless, whether and how the illusion of owning a new body part affects human perception, and in particular pain detection, is still poorly investigated. Recent findings have shown that seeing one's own body is analgesic, but it is not known whether this effect is transferable to newly embodied, but exogenous, body parts. In recent years, results from our laboratory have demonstrated that a virtual body can be felt as one's own, provided realistic multisensory correlations.

##### **METHODS:**

The current work aimed at investigating the impact of virtual body ownership on pain threshold. An immersive virtual environment allowed a first-person perspective of a virtual body that replaced the own. Passive movement of the index finger congruent with the movement of the virtual index finger was used in the 'synchronous' condition to induce ownership of the virtual arm. The pain threshold was tested by thermal stimulation under four conditions: (1) synchronous movements of the real and virtual fingers; (2) asynchronous movements; (3) seeing a virtual object instead of an arm; and (4) not seeing any limb in real world.

##### **RESULTS:**

Our results show that, independently of attentional and stimulus adaptation processes, the ownership of a virtual arm per se can significantly increase the thermal pain threshold.

##### **CONCLUSIONS:**

This finding may be relevant for the development and improvement of digital solutions for rehabilitation and pain treatment.

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PMID: 24449513

## Pain assessment mechanisms value

### Minimum Important Differences for the Patient-Specific Functional Scale, 4 Region-Specific Outcome Measures, and the Numeric Pain Rating Scale

**Authors:** J. Haxby Abbott, DPT, PhD, FNZCP1, John Schmitt, PT, PhD2

#### Study Design

Multicenter, prospective, longitudinal cohort study.

#### Objectives

To investigate the minimum important difference (MID) of the Patient-Specific Functional Scale (PSFS), 4 region-specific outcome measures, and the numeric pain rating scale (NPRS) across 3 levels of patient-perceived global rating of change in a clinical setting.

#### Background

The MID varies depending on the external anchor defining patient-perceived “importance.” The MID for the PSFS has not been established across all body regions.

#### Methods

One thousand seven hundred eight consecutive patients with musculoskeletal disorders were recruited from 5 physical therapy clinics. The PSFS, NPRS, and 4 region-specific outcome measures—the Oswestry Disability Index, Neck Disability Index, Upper Extremity Functional Index, and Lower Extremity Functional Scale—were assessed at the initial and final physical therapy visits. Global rating of change was assessed at the final visit. MID was calculated for the PSFS and NPRS (overall and for each body region), and for each region-specific outcome measure, across 3 levels of change defined by the global rating of change (small, medium, large change) using receiver operating characteristic curve methodology.

#### Results

The MID for the PSFS (on a scale from 0 to 10) ranged from 1.3 (small change) to 2.3 (medium change) to 2.7 (large change), and was relatively stable across body regions. MIDs for the NPRS (−1.5 to −3.5), Oswestry Disability Index (−12), Neck Disability Index (−14), Upper Extremity Functional Index (6 to 11), and Lower Extremity Functional Scale (9 to 16) are also reported.

#### Conclusion

We reported the MID for small, medium, and large patient-perceived change on the PSFS, NPRS, Oswestry Disability Index, Neck Disability Index, Upper Extremity Functional Index, and Lower Extremity Functional Scale for use in clinical practice and research. *J Orthop Sports Phys Ther* 2014;44(8):560–564. Epub 14 May 2014. doi:10.2519/jospt.2014.5248

**Keyword:** clinimetrics, functional outcome measure, outcome assessment

Read More: <http://www.jospt.org/doi/abs/10.2519/jospt.2014.5248#.U9v7z1bOhhM>

## Emotions and chronic pain

Scandinavian Journal of Pain DOI: <http://dx.doi.org/10.1016/j.sjpain.2014.05.008> Volume 5, Issue 3, Pages 151–158, July 2014

### A hybrid emotion-focused exposure treatment for chronic pain: A feasibility study

Steven J. Linton , Alan E. Fruzzetti

#### Abstract

**Background and aims:** Exposure in vivo for patients with fear-related chronic pain has a strong theoretical base as well as empirical support. However, the treatment does not work for every patient and overall the effect size is only moderate, underscoring the need for improved treatments. One possible way forward might be to integrate an emotion regulation approach since emotions are potent during exposure and because distressing emotions may both interfere with exposure procedures and patient motivation to engage in exposure. To this end, we proposed to incorporate an emotion-regulation focus into the standard exposure in vivo procedure, and delivered in the framework of achieving relevant personal goals. The aim of this study then was to test the feasibility of the method as well as to describe its effects.

**Method:** We tested a hybrid treatment combining an emotion-regulation approach informed by Dialectical Behaviour Therapy (DBT) with a traditional exposure protocol in a controlled, single-subject design where each of the six participants served as its own control. In this design participants first make ratings to establish a baseline from which results during treatment and the five month follow-up may then be compared. To achieve comparisons, participants completed diary booklets containing a variety of standardized measures including pain catastrophizing, pain intensity, acceptance, and function.

**Results:** Compared to baseline, all subjects improved on key variables, including catastrophizing, acceptance, and negative affect, at both post treatment and follow up. For 5 of the 6 subjects considerable gains were also made for pain intensity and physical function. Criteria were established for each measure to help determine whether the improvements were clinically significant. Five of the six participants had consistent results showing clinically significant improvements across all the measures. The sixth participant had mixed results demonstrating improvements on several variables, but not on pain intensity or function.

**Conclusions:** This emotion-regulation hybrid exposure intervention resulted in considerable improvements for the participants. The results of this study underscore the potential utility of addressing emotions in the treatment of chronic pain. Further, they support the idea that targeting emotional stimuli and using emotion regulation skills in conjunction with usual exposure may be important for obtaining the best results. Finally, we found that this treatment is feasible to provide and may be an important addition to usual exposure. However, since we did not directly compare this hybrid treatment with other treatments, additional research is needed before firm conclusions can be made.

**Implications:** Addressing emotional distress in the treatment of patients suffering chronic pain appears to be quite relevant. Emotion regulation skills, employed together with exposure in vivo, hold the promise of being useful tools for achieving better results for patients suffering fear-related and emotionally distressing chronic pain.

**Keywords:** Chronic pain, Fear-avoidance, Exposure, Emotional distress, Emotion-focused treatment, Catastrophizing, Acceptance

## Trauma and chronic pain in older adults

Journal of Bodywork and Movement Therapies DOI: <http://dx.doi.org/10.1016/j.jbmt.2014.04.011>

### Prevalence and correlates of pain interference in older adults: Why treating the whole body and mind is necessary

Peter Przekop, D.O., PhD. , [Mark G. Haviland, PhD.](#), [Keiji Oda, M.P.H.](#), [Kelly R. Morton, PhD.](#)

#### Summary

**Purpose:** Our study presents pain-related interference rates in a sample of community-dwelling, older adults and determines factors associated with these restrictions.

**Study population:** Participants were 9506 respondents to the Biopsychosocial Religion and Health Study (66.8% female and 33.2% male; average age = 62.3 years).

**Results:** In this sample, 48.2% reported no pain-related interference, whereas 37.7% reported moderate and 14.1% reported severe interference.

**Findings:** As hypothesized, older age, female gender, lower education, financial strain, traumatic experiences, worse health, increased body mass index, poor sleep, and depressive symptoms all were associated with higher pain interference ratings (ordered logistic regression/three-level pain criterion; odds ratios  $p < 0.05$ ).

**Conclusions:** Our findings are similar to those from younger adults, and they suggest enduring effects of trauma on health and reveal the complexity of chronic pain in community-dwelling, older adults.

**Keywords:** [Pain interference](#), [Chronic pain](#), [Older adults](#), [Trauma](#), [Depression](#)

## Insomnia and pain

Spine J. 2013 Dec 10. pii: S1529-9430(13)01967-0. doi: 10.1016/j.spinee.2013.11.052.

### **Insomnia in a chronic musculoskeletal pain with disability population is independent of pain and depression.**

Asih S1, Neblett R1, Mayer TG2, Brede E1, Gatchel RJ3.

#### **Abstract**

**BACKGROUND CONTEXT:** Insomnia is frequently experienced by patients suffering from chronic musculoskeletal disorders but is often seen as simply a symptom of pain or depression and not as an independent disorder. Compared with those who experience only chronic pain, patients with both chronic pain and insomnia report higher pain intensity, more depressive symptoms, and greater distress. However, insomnia has not yet been systematically studied in a chronic musculoskeletal pain with disability population.

**PURPOSES:** This study assessed the prevalence and severity of patient-reported insomnia, as well as the relationship among insomnia, pain intensity, and depressive symptoms, in a chronic musculoskeletal pain with disability population.

**STUDY DESIGN/SETTING:** This was a retrospective study of prospectively captured data.

**PATIENT SAMPLE:** A consecutive cohort of 326 chronic musculoskeletal pain with disability patients (85% with spinal injuries) entered a functional restoration treatment program. All patients signed a consent form to participate in this protocol.

**OUTCOME MEASURES:** Insomnia was assessed with the Insomnia Severity Index, a validated patient-report measure of insomnia symptoms. Four patient groups were formed: no clinically significant insomnia (score, 0-7); subthreshold insomnia (score, 8-14); moderate clinical insomnia (score, 15-21); and severe clinical insomnia (score, 22-28). Three patterns of sleep disturbance were also evaluated: early, middle, and late insomnia. Additional validated psychosocial patient-reported data were collected, including the Pain Visual Analog Scale, the Beck Depression Inventory, the Oswestry Disability Index, and the Pain Disability Questionnaire.

**METHODS:** Patients completed a standard psychosocial assessment battery on admission to the functional restoration program. The program included a quantitatively directed exercise process in conjunction with a multimodal disability management approach. The four insomnia groups were compared on demographic and psychosocial variables. The shared variances among insomnia, depression, and pain were determined by partial correlational analyses.

**RESULTS:** The presence of no clinically significant insomnia, subthreshold insomnia, moderate clinical insomnia, and severe clinical insomnia was found in 5.5%, 21.2%, 39.6%, and 33.7% of the cohort, respectively. More than 70% of patients reported moderate to severe insomnia symptoms, which is a considerably higher prevalence than that found in most patient cohorts studied previously. A stepwise pattern was found, in which severe clinical insomnia patients reported the highest pain, the most severe depressive symptoms, and the greatest disability. The severe clinical insomnia patients also reported a higher number of sleep disturbance types (early, middle, and late insomnia) than the other three groups. In fact, 62.9% of them reported all three disturbance types. Although correlations were found between insomnia and depressive symptoms and between insomnia and pain, the shared variances were small (12.9% and 3.6%, respectively), indicating that depression and pain are separate constructs from insomnia.

**CONCLUSION:** This research indicates that insomnia is a significant and pervasive problem in a chronic musculoskeletal pain with disability population. Most importantly, although insomnia has traditionally been assumed to be simply a symptom of pain or depression, the findings of the present study reveal that it is a construct relatively independent from both pain and depression. Specific insomnia assessment and treatment is therefore recommended for this chronic musculoskeletal pain with disability population.

PMID: 24333458

## **Brain mechanisms and pain**

Pain. 2014 Jul 15. pii: S0304-3959(14)00327-3. doi: 10.1016/j.pain.2014.07.008.

### **Distinct Brain Mechanisms Support Spatial vs. Temporal Filtering of Nociceptive Information.**

Nahman-Averbuch H1, Martucci KT2, Granovsky Y3, Weissman-Fogel I4, Yarnitsky D3, Coghil RC5.

#### **Abstract**

**Purpose:** The role of endogenous analgesic mechanisms has largely been viewed in the context of gain modulation during nociceptive processing. However, these analgesic mechanisms may play critical roles in the extraction and subsequent utilization of information related to spatial and temporal features of nociceptive input. To date, it remains unknown if spatial and temporal filtering of nociceptive information is supported by similar analgesic mechanisms.

**Methods:** To address this question, human volunteers were recruited to assess brain activation with functional MRI during conditioned pain modulation (CPM) and offset analgesia (OA). CPM provides one paradigm for assessing spatial filtering of nociceptive information while OA provides a paradigm for assessing temporal filtering of nociceptive information.

**Results:** CPM and OA both produced statistically significant reductions in pain intensity. However, the magnitude of pain reduction elicited by CPM was not correlated with that elicited by OA across different individuals. Different patterns of brain activation were consistent with the psychophysical findings. CPM elicited widespread reductions in regions engaged in nociceptive processing such as the thalamus, insula and SII. OA produced reduced activity in SI, but was associated with greater activation in the anterior insula, dorso-lateral prefrontal cortex, intra-parietal sulcus, and inferior parietal lobule relative to CPM.

**Conclusions:** In the brainstem, CPM consistently produced reductions in activity while OA produced increases in activity. Conjunction analysis confirmed that CPM related activity did not overlap with that of OA. Thus, dissociable mechanisms support inhibitory processes engaged during spatial vs. temporal filtering of nociceptive information.

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**KEYWORDS:** Conditioned Pain Modulation; Diffuse Noxious Inhibitory Controls; Offset Analgesia; fMRI  
PMID: 25047783

## Pain and quality of life

Scandinavian Journal of Pain

### Relationship between pain and Quality of Life—Findings from the Swedish National Study on Aging and Care—Blekinge study

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Published Online: June 25, 2014 DOI: <http://dx.doi.org/10.1016/j.sjpain.2014.05.029>

#### Highlights

- Pain has a strong relationship with low Quality of Life (QoL) among elderly women.
- Insomnia is associated with low QoL among men who suffer less from pain.
- A striking gender difference: elderly women suffer from pain, elderly men suffer from insomnia.

#### Abstract

**Background and aims:** The influence of pain as well as Quality of Life (QoL) varies in accordance with biological, social, psychological and existential factors. This study investigates the influence of such factors on the relationship between pain and QoL among older adults from a gender perspective.

**Methods:** The Swedish National Study on Aging and Care (SNAC-Blekinge) baseline sample comprised 1402 individuals aged 60–96 years, of whom 769 (55%) reported pain. The participants were invited by a letter to take part in the study, which was carried out by research staff in two sessions of three hour each. Participants gave informed consent and completed a questionnaire between the two sessions. The reason for non-participation was registered among subjects who declined the invitation. Pain and insomnia were self-reported. Data on age, gender and if living alone or not were collected from the questionnaire. Co-morbidity was obtained from electronic patients records for a period of up to two years prior to participating in the SNAC study. SoC was measured by a translated short form from the original twenty-nine question instrument. QoL, was estimated using the HRQL Medical Outcome Study-Short Form (SF 12). In a model, pain, age, sex, insomnia, co-morbidity, living alone, sense of coherence (SOC), household economy, education and QoL were calculated through multivariate logistic regression.

**Results:** Among women, pain was found to have the highest OR (odds ratio) for low QoL [OR 2.27 (CI 1.36–3.78)], followed by low economic status [OR 1.75 (CI 1.08–2.84)], co-morbidity [OR 1.24 (CI 1.05–1.46)], low SOC [OR 1.08 (CI 1.06–1.10)] and lower age [OR 1.05 (CI 1.02–1.08)]. In men, insomnia was found to be the main contributor to low QoL [OR 1.86 (CI 1.04–3.33)], followed by low SOC [OR 1.08 (CI 1.05–1.11)] and lower age [OR 1.04 (CI 1.01–1.07)].

**Conclusions:** Pain has a strong relationship with low QoL among elderly women. Insomnia is associated with low QoL among men who suffer less from pain. Thus the main result is a striking gender difference: Elderly women suffer from pain, elderly men suffer from insomnia.

**Implications:** It is important to take account of sex, age, sleep problems, co-morbidity, SOC and economic status in order to understand the relationship between pain and QoL among older adults.

**Keywords:** Pain, Insomnia, QoL, Older adults, Gender

## Education level and pain experience

Spine (Phila Pa 1976). 2014 May 1;39(10):E637-44. doi: 10.1097/BRS.0000000000000267.

### **Influence of educational attainment on pain intensity and disability in patients with lumbar spinal stenosis: mediation effect of pain catastrophizing.**

Kim HJ1, Kim SC, Kang KT, Chang BS, Lee CK, Yeom JS.

#### **Abstract**

##### **STUDY DESIGN:**

Level IV, prospective case series.

##### **OBJECTIVE:**

To investigate the influence of educational attainment on the level of pain intensity and disability in patients with lumbar spinal stenosis (LSS) and determine how coping behavior, such as catastrophizing, may mediate the association between educational attainment and clinical impairments.

##### **SUMMARY OF BACKGROUND DATA:**

Educational attainment has been thought to influence disability caused by chronic painful disease, mediated by pain behavior or a coping strategy such as catastrophizing. Nevertheless, little is known about the role of educational attainment on pain intensity or disability related with LSS.

##### **METHODS:**

A total of 155 patients who were diagnosed as degenerative LSS participated in the study. Data on detailed medical history, physical examination, and series of questionnaires were collected, including pain catastrophizing scale, Oswestry Disability Index, and visual analogue pain scale for back and leg pain. For measures of socioeconomic status, educational attainment and occupation were assessed. Radiological analysis was performed using magnetic resonance images and computed tomographic scans. After adjustment of covariates, multivariate regression analysis was used to assess each component of the proposed mediation models among visual analogue pain scale for back/leg pain, Oswestry Disability Index, the level of education, occupation and pain catastrophizing scale. Mediation was also assessed by the bootstrapping technique.

##### **RESULTS:**

Educational attainment was negatively correlated with pain intensity, disability, and catastrophizing. Pain catastrophizing were also significantly correlated with disability and pain intensity for back/leg pain in the patients with LSS. In the relationship among variables, the mediation analysis with bootstrapping clearly showed the role of catastrophizing in the mediation between visual analogue pain scale for back pain/leg pain, Oswestry Disability Index, and the level of education.

##### **CONCLUSION:**

This study demonstrated that lower educational attainment was associated with increased pain intensity and disability in patients with LSS, which was mediated by the coping mechanism, catastrophizing.

PMID: 24525994

## **Pain processing sessions**

Pain. 2014 Jul 15. pii: S0304-3959(14)00328-5. doi: 10.1016/j.pain.2014.07.009.

### **Differential structural and resting state connectivity between insular sub-divisions and other pain-related brain regions.**

Wiech K1, Jbabdi S2, Lin CS3, Andersson J2, Tracey I3.

#### **Abstract**

**Purpose:** Functional neuroimaging studies suggest that the anterior, mid, and posterior division of the insula subserve different functions in the perception of pain. The anterior insula (AI) has predominantly been associated with cognitive-affective aspects of pain while the mid (MI) and posterior divisions (PI) have been implicated in sensory-discriminative processing. Here we examine whether this functional segregation is paralleled by differences in (i) structural and (ii) resting state connectivity and (iii) in correlations with pain-relevant psychological traits.

**Methods:** Analyses were restricted to the three insular subdivisions and other pain-related brain regions.

**Results:** Both type of analyses revealed largely overlapping results. The AI division was predominantly connected to the ventrolateral prefrontal (VLPFC; structural and resting state connectivity) and orbitofrontal cortex (OFC; structural connectivity). In contrast, PI showed strong anatomical connections to the primary (SI; structural connectivity) and secondary somatosensory cortex (SII; structural and resting state connectivity). MI displayed a "hybrid" connectivity pattern with strong connections with the VLPFC, SII (structural and resting state connectivity) and SI (structural connectivity). Moreover, resting state connectivity revealed strong connectivity of all three subdivisions with the thalamus.

**Findings:** On the behavioural level, AI structural connectivity was related to the individual degree of pain vigilance and awareness that showed a positive correlation with AI-amygdala connectivity and a negative correlation with AI-rACC connectivity.

**Conclusions:** In sum, our findings show a differential structural and resting state connectivity for the anterior, mid and posterior insula with other pain-relevant brain regions, which might at least partly explain their different functional profiles in pain processing.

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#### **KEYWORDS:**

Connectivity; Insula; Pain; Resting state; Structural

PMID: 25047781

## Adolescents and personality disorders

Eur Child Adolesc Psychiatry. 2014 Jul 23.

### **Pain perception in female adolescents with borderline personality disorder.**

Ludäscher P1, von Kalckreuth C, Parzer P, Kaess M, Resch F, Bohus M, Schmahl C, Brunner R.

#### **Abstract**

**Purpose:** Borderline personality disorder (BPD) is a severe and often debilitating psychiatric disorder that begins during adolescence. Core features of BPD are affective dysregulation, dysfunctional self-concepts, and difficulties in social interactive domains. A widely accepted marker for severe emotion dysregulation in adult BPD is decreased pain sensitivity. Until now it is unclear whether this characteristic feature of BPD is already present during adolescence. Thus, this study aims to investigate pain sensitivity in adolescent patients meeting DSM-IV criteria for BPD.

**Method:** 20 female adolescent patients with BPD (mean age 16.4 years) and 20 healthy age-matched control participants were investigated. Detection and pain thresholds for thermal stimuli were assessed on both hands. Furthermore, self-rating instruments were used to assess overall psychopathology, dissociation, and depression.

**Findings:** We found significantly higher pain thresholds in patients with BPD than in healthy controls. Patients with BPD had higher intensities of depression, overall psychopathology, and dissociative symptoms, but there was no correlation between pain sensitivity and any of these measures of psychopathology.

**Conclusions:** These findings are in line with previous findings in adult BPD patients concerning lower pain sensitivity as compared to healthy controls. This provides support for the idea that disturbed pain processing is not only a consequence of chronic BPD but is already present in early stages of BPD.

PMID: 25053123

## Complex regional Pain

### Emotions and CRP compared to LBP

Clin J Pain. 2014 Aug;30(8):647-53. doi: 10.1097/AJP.0000000000000007.

#### **Relationships between psychological factors, pain, and disability in complex regional pain syndrome and low back pain.**

Bean DJ1, Johnson MH, Kydd RR.

#### **Abstract**

##### **OBJECTIVE:**

Cognitive and emotional factors are known to influence peoples' pain experiences in many conditions, including low back pain. However, in complex regional pain syndrome (CRPS), their role is unclear. This study aimed to assess the relationships between psychological factors, pain, and disability in CRPS, compared with low back pain. This could help to identify target variables for psychological treatment.

##### **MATERIALS AND METHODS:**

A total of 88 CRPS patients and 88 low back pain patients completed measures of pain, disability, depression, anxiety, and fear of movement and reinjury (kinesiophobia). Mean scores between the 2 groups were compared, and correlations between psychological factors, pain, and disability were compared between the 2 groups. Predictors of pain and disability were assessed using multiple regression analyses.

##### **RESULTS:**

The 2 groups had remarkably similar scores on measures of pain, disability, depression, anxiety, and kinesiophobia. In both groups, those who were more depressed, anxious, and kinesiophobic were more disabled. For the CRPS group (but not the low back pain group), pain intensity significantly correlated with distress. Multivariate analyses showed that the unique predictors of disability for the 2 groups were pain and depression, and that depression had a stronger relationship with disability for the CRPS group. For both groups, pain intensity was predicted by kinesiophobia, and anxiety was a unique predictor in the CRPS group only.

##### **DISCUSSION:**

In CRPS, disability and pain severity were more strongly associated with psychological factors than they were in low back pain. Cause and effect relationships could not be established by this cross-sectional study.

PMID: 24135903

## Fibromyalgia

### Outlook

Scandinavian Journal of Pain Volume 5, Issue 3, Pages 161–166, July 2014

### A comparison of fibromyalgia symptoms in patients with Healthy versus Depressive, Low and Reactive affect balance styles

Loren L. Toussaint, Ann Vincent , Samantha J. McAllister, Terry H. Oh, Afton L. Hassett  
DOI: <http://dx.doi.org/10.1016/j.sjpain.2014.05.001>

#### Abstract

##### Background and aims

Affect balance reflects relative levels of negative affect (NA) and positive affect (PA) and includes four styles: Healthy (low NA/high PA), Depressive (high NA/low PA), Reactive (high NA/high PA) and Low (low NA/low PA). These affect balance styles may have important associations with clinical outcomes in patients with fibromyalgia. Herein, we evaluated the severity of core fibromyalgia symptom domains as described by the Outcomes Research in Rheumatology-Fibromyalgia working group in the context of the four affect balance styles.

##### Methods

Data from 735 patients with fibromyalgia who completed the Brief Pain Inventory, Multidimensional Fatigue Inventory, Profile of Mood States, Medical Outcomes Sleep Scale, Multiple Ability Self-Report Questionnaire, Fibromyalgia Impact Questionnaire-Revised, Medical Outcomes Study Short Form-36, and Positive and Negative Affect Schedule were included in this analysis.

##### Results

The majority (51.8%) of patients in our sample had a Depressive affect balance style; compared to patients with a Healthy affect balance style, they scored significantly worse in all fibromyalgia symptom domains including pain, fatigue, sleep disturbance, dyscognition, depression, anxiety, stiffness, and functional status ( $P = <.001$  to  $.004$ ). Overall, patients with a Healthy affect balance style had the lowest level of symptoms, while symptom levels of those with Reactive and Low affect balance styles were distributed in between those of the Depressive and Healthy groups.

##### Conclusions and implications

The results of our cross-sectional study suggest that having a Healthy affect balance style is associated with better physical and psychological symptom profiles in fibromyalgia. Futures studies evaluating these associations longitudinally could provide rationale for evaluating the effect of psychological interventions on affect balance and clinical outcomes in fibromyalgia.

**Keywords:** Affect balance, Fibromyalgia, OMERACT, Fibromyalgia symptoms, Affect