

## 2. LBP

### Proprioceptive mechanism CLBP

Pain. 2019 Dec;160(12):2866-2876. doi: 10.1097/j.pain.0000000000001679.

#### **Recurrent low back pain patients demonstrate facilitated pronociceptive mechanisms when in pain, and impaired antinociceptive mechanisms with and without pain.**

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Abstract

Low back pain (LBP) has been inconsistently associated with enhanced pronociceptive and impaired antinociceptive mechanisms. It remains unknown whether alterations are causal, consequential, or coincidental to pain presence.

This study investigated pronociceptive and antinociceptive mechanisms in recurrent LBP (RLBP) patients across painful and pain-free periods, compared with age/sex-matched asymptomatic controls. During a painful episode (day 0) and when pain-free (day 28), 30 RLBP patients were assessed and compared with 30 controls over the same timeframe. Pressure pain thresholds were recorded bilaterally on the arm, back, and leg. Cuff algometry was used to assess cuff pressure pain detection threshold and cuff pain tolerance threshold on the lower legs, as well as temporal summation of pain (10 repeated painful cuff test stimuli on the dominant leg scored on a visual analogue scale) and conditioned pain modulation ([CPM]: cuff pain detection/tolerance threshold on dominant leg, before vs during painful cuff conditioning on the contralateral leg).

Recurrent LBP patients displayed reduced pressure pain thresholds at the arm and back on day 0 compared with day 28 ( $P < 0.047$ ) and with controls on day 0 ( $P < 0.049$ ). Cuff pain detection threshold was reduced, and ratings of suprathreshold test stimuli were increased in RLBP patients on day 0 compared with day 28 ( $P < 0.02$ ).

Temporal summation of pain magnitude (increase in visual analogue scale scores) was enhanced in RLBP participants on day 0 compared with day 28 ( $P = 0.027$ ) and with controls on day 0 ( $P = 0.039$ ). Conditioned pain modulation magnitude (increased threshold during conditioning) was lower overall in RLBP participants than in controls ( $P = 0.021$ ). Enhanced pronociceptive mechanisms were observed in RLBP patients. When pain-free, measures returned to similar levels as controls, except for CPM, which remained impaired.

**Central pain processing**

Pain. 2019 Dec;160(12):2829-2840. doi: 10.1097/j.pain.0000000000001674.

**Whole-brain functional network disruption in chronic pain with disk herniation.**

Huang S<sup>1,2</sup>, Wakaizumi K<sup>3,4</sup>, Wu B<sup>1,5</sup>, Shen B<sup>1,5</sup>, Wu B<sup>1,6</sup>, Fan L<sup>1</sup>, Baliki MN<sup>3,4</sup>, Zhan G<sup>5</sup>, Apkarian AV<sup>1,7,8</sup>, Huang L<sup>1,7</sup>.

Brain functional network properties are globally disrupted in multiple musculoskeletal chronic pain conditions. Back pain with lumbar disk herniation (LDH) is highly prevalent and a major route for progression to chronic back pain. However, brain functional network properties remain unknown in such patients.

Here, we examined resting-state functional magnetic resonance imaging-based functional connectivity networks in chronic back pain patients with clear evidence for LDH (LDH-chronic pain n = 146), in comparison to healthy controls (HCs, n = 165). The study was conducted in China, thus providing the opportunity to also examine the influence of culture on brain functional reorganization with chronic pain. The data were equally subdivided into discovery and validation subgroups (n = 68 LDH-chronic pain and n = 68 HC, for each subgroup), and contrasted to an off-site data set (n = 272, NITRC 1000). Graph disruption indices derived from 3 network topological measurements, degree, clustering coefficient, and efficiency, which respectively represent network hubness, segregation, and integration, were significantly decreased compared with HC, across all predefined link densities, in both discovery and validation groups. However, global mean clustering coefficient and betweenness centrality were decreased in the discovery group and showed trend in the validation group.

The relationship between pain and graph disruption indices was limited to males with high education. These results deviate somewhat from recent similar analysis for other musculoskeletal chronic pain conditions, yet we cannot determine whether the differences are due to types of pain or also to cultural differences between patients studied in China and the United States.

**Central sensitization personality types**

Pain Pract. 2019 Nov;19(8):800-810. doi: 10.1111/papr.12809. Epub 2019 Jul 10.

**Trait Sensitivity, Anxiety, and Personality Are Predictive of Central Sensitization Symptoms in Patients with Chronic Low Back Pain.**

Clark JR<sup>1,2,3</sup>, Nijs J<sup>2,3</sup>, Yeowell G<sup>1</sup>, Holmes P<sup>4</sup>, Goodwin PC<sup>1</sup>.

**BACKGROUND:**

Sensitivity-related trait characteristics involving physical and emotional sensitivities and high trait anxiety personality types have been observed in individuals with nonspecific chronic low back pain (NSCLBP). High trait sensitivity to sensory stimulation combined with interpretation biases based on personality type may contribute to the development of central sensitization (CS) symptoms. To date, there is limited research that has considered both sensitivity levels and personality type in NSCLBP with CS. The purpose of this study was to investigate (1) relationships between trait sensory profiles, trait anxiety, and CS symptoms, and (2) the predictive capacity of sensory profiles, trait anxiety, and personality types on CS symptoms in people with NSCLBP.

**METHODS:**

This was a cross-sectional observational study using 4 self-report measures on adults (N = 165, mean age = 45 ± 12 [standard deviation] years) from physiotherapy clinics in England, Ireland, and New Zealand. Inclusion: NSCLBP > 6 months, age 18 to 64 years, predominant CS pain presentation, no other pathology. Parametric and nonparametric correlation statistics and regression analyses were used.

**RESULTS:**

Positive correlations were found between central sensitization inventory (CSI) scores and sensory hypersensitivity profiles and trait anxiety. CSI score increases could be predicted by sensory-sensitive, low-registration profiles; trait anxiety scores; and extreme defensive high anxious personality type.

**CONCLUSIONS:**

Trait sensory hyper- and/or hyposensitivity and high trait anxiety-related personality type characteristics predict the extent of CS symptoms in people with NSCLBP. Further investigation is required to establish causality between these characteristics and CS symptoms.

**Most elderly LBP unresolved**

J Am Board Fam Med. 2019 Nov-Dec;32(6):781-789. doi: 10.3122/jabfm.2019.06.190041.

**Natural History of Back Pain in Older Adults over Five Years.**

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**INTRODUCTION:**

Back pain is a prevalent health problem. Research often focuses on adults. Evidence on the long-term course of back pain in older patients is limited. A prospective cohort study (BACE) was conducted in a primary care setting in the Netherlands. We aim to investigate the 5-year course and medical consumption of older adults (>55 years) presenting with back pain in general practice.

**METHODS:**

Patients aged >55 years, consulting their general practitioner with a new back pain episode, were included between 2009 to 2011. Follow-up questionnaires included, for example, pain severity, disability, quality of life, recovery, and medical consumption.

**RESULTS:**

A total of 675 patients (mean age  $\pm$  SD, 66.4  $\pm$  7.6 years) participated, showing a mean ( $\pm$  SD) back pain reduction from 5.2 ( $\pm$  2.7) to 3.6 ( $\pm$  2.8) (numeric rating scale, 0 to 10) at 3 months follow-up; disability decreased from 9.8 ( $\pm$  5.8) to 7.8 ( $\pm$  6.2) (Roland-Morris Disability Questionnaire, 0 to 24). After 6 months, this remained practically constant over time. Medical consumption was highest in the first months; medication was used by 72% at baseline and approximately one-third (25% to 39%) during follow-up. At 5-year follow-up (response rate 58%; n = 392), 43% had recovered; a majority reported persistent or recurrent back pain.

**CONCLUSION:**

Clinically relevant improvements in back pain intensity and disability were seen in the first 3 to 6 months of follow-up. A majority of patients does not become pain free within 3 months; this does not improve over 5 years. However, most patients stop consulting health care professionals during follow-up. Current medical strategies may not be sufficient in older back pain patients, where back pain becomes a recurrent or chronic condition in the majority of patients.

**Exercise and education in LBP**

Br J Sports Med. 2019 Oct 31. pii: bjsports-2018-100035. doi: 10.1136/bjsports-2018-100035.

**Exercise alone and exercise combined with education both prevent episodes of low back pain and related absenteeism: systematic review and network meta-analysis of randomised controlled trials (RCTs) aimed at preventing back pain.**

Huang R<sup>1,2</sup>, Ning J<sup>1</sup>, Chuter VH<sup>3</sup>, Taylor JB<sup>4,5</sup>, Christophe D<sup>6</sup>, Meng Z<sup>7</sup>, Xu Y<sup>8</sup>, Jiang L<sup>9</sup>.

**OBJECTIVES:**

We aimed to investigate which prevention strategies for low back pain (LBP) are most effective.

**DESIGN:**

We completed a Bayesian network meta-analysis to summarise the comparative effectiveness of LBP prevention strategies. The primary outcomes were an episode of LBP and LBP-associated work absenteeism represented as ORs with associated 95% credibility intervals (CrIs). We ranked all prevention strategies with surface under the cumulative ranking curve (SUCRA) analysis.

**DATA SOURCES:**

PubMed, EMBASE and CENTRAL databases were searched along with manual searches of retrieved articles. We only included randomised controlled trials (RCTs) that reported an episode of LBP and/or LBP-associated work absenteeism evaluating LBP prevention strategies were included.

**ELIGIBILITY CRITERIA FOR SELECTING STUDIES:**

Data were independently extracted by two investigators, and RCT quality was assessed using the Cochrane Risk of Bias tool.

**RESULTS AND SUMMARY:**

Forty RCTs were included. Exercise combined with education (OR: 0.59, CrI: 0.41 to 0.82) and exercise alone (OR: 0.59, CrI: 0.36 to 0.92) both prevented LBP episodes; exercise combined with education and education alone both had large areas under the curve (SUCRA: 81.3 and 79.4, respectively). Additionally, exercise (OR: 0.04, CrI: 0.00 to 0.34) prevented LBP-associated work absenteeism, with exercise and the combination of exercise and education ranking highest (SUCRA: 99.0 and 60.2, respectively).

**CONCLUSIONS:**

Exercise alone and exercise combined with education can prevent episodes of LBP and LBP-related absenteeism.

**Cognitive functional therapy****Cognitive functional therapy compared with a group-based exercise and education intervention for chronic low back pain: a multicentre randomised controlled trial (RCT)**

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Kieran O'Sullivan

**Background** One-size-fits-all interventions reduce chronic low back pain (CLBP) a small amount. An individualised intervention called cognitive functional therapy (CFT) was superior for CLBP compared with manual therapy and exercise in one randomised controlled trial (RCT). However, systematic reviews show group interventions are as effective as one-to-one interventions for musculoskeletal pain. This RCT investigated whether a physiotherapist-delivered individualised intervention (CFT) was more effective than physiotherapist-delivered group-based exercise and education for individuals with CLBP.

**Methods** 206 adults with CLBP were randomised to either CFT (n=106) or group-based exercise and education (n=100). The length of the CFT intervention varied according to the clinical progression of participants (mean=5 treatments). The group intervention consisted of up to 6 classes (mean=4 classes) over 6–8 weeks. Primary outcomes were disability and pain intensity in the past week at 6 months and 12 months postrandomisation. Analysis was by intention-to-treat using linear mixed models.

**Results** CFT reduced disability more than the group intervention at 6 months (mean difference, 8.65; 95% CI 3.66 to 13.64; p=0.001), and at 12 months (mean difference, 7.02; 95% CI 2.24 to 11.80; p=0.004). There were no between-group differences observed in pain intensity at 6 months (mean difference, 0.76; 95% CI -0.02 to 1.54; p=0.056) or 12 months (mean difference, 0.65; 95% CI -0.20 to 1.50; p=0.134).

**Conclusion** CFT reduced disability, but not pain, at 6 and 12 months compared with the group-based exercise and education intervention. Future research should examine whether the greater reduction in disability achieved by CFT renders worthwhile differences for health systems and patients.

**Trial registration number** ClinicalTrials.gov registry (NCT02145728).

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## 7. PELVIC ORGANS/WOMAN'S HEALTH

### Vit D reduces risk of urinary tract infections

Eur J Obstet Gynecol Reprod Biol. 2019 Oct 21;243:51-56. doi: 10.1016/j.ejogrb.2019.10.015.

#### **Association of serum vitamin D levels and urinary tract infection in pregnant women: A case control study.**

Haghdoost S<sup>1</sup>, Pazandeh F<sup>2</sup>, Darvish S<sup>3</sup>, Khabazkhoob M<sup>4</sup>, Huss R<sup>5</sup>, Lak TB<sup>6</sup>.

##### *OBJECTIVE:*

Urinary tract infection (UTI) is common during pregnancy and can cause serious complications for the mother and fetus. Vitamin D, is known to have an effect on the urothelium, with immunomodulatory capacity against bacterial infection. This study explored the association between serum vitamin D levels and urinary tract infections in pregnant women.

##### *STUDY DESIGN:*

In this case control study, 187 participants including, 97 pregnant women diagnosed as a symptomatic UTI (case group) and 90 matched healthy pregnant women (control group) were consecutively enrolled from prenatal care clinic of Imam Reza Hospital in Urmia, North West of Iran. The two groups were matched for trimester and parity, and sexual intercourse. Blood samples were collected from both groups. Chemiluminescent immunoassay (CLIA) was used to evaluate the serum vitamin D levels. We used a binary multivariate unconditional logistic regression approach to evaluate the association between UTI and vitamin D and risk factor of the UTI.

##### *RESULTS:*

Vitamin D deficiency (less than 20 ng/mL) was diagnosed in 85.7% of case group and 52.2% of control group. The serum vitamin D levels were significantly lower in pregnant women in the case group compared to the control group ( $12.7 \pm 5.9$  ng/ml vs  $26.05 \pm 10.37$ ;  $p < 0.001$ ). Pregnant women in case group with acute pyelonephritis had significantly lower serum vitamin D levels than those with Cystitis ( $p < 0.05$ ). The serum vitamin D level of less than 20 ng/ml was the only factor associated with UTI after adjusting for all the confounders in multiple binary logistic regression modeling (AdjOR = 3.67; 95% of CI: 1.19-6.24;  $p < 0.001$ ).

##### *CONCLUSIONS:*

Women with vitamin D deficiencies are at increased risk of urinary tract infections during pregnancy. However, further studies are essential to confirm these observed results.

**10 A. CERVICAL SPINE****Cervical disc**

Musculoskelet Sci Pract. 2019 Jul 5;44:102038. doi: 10.1016/j.msksp.2019.07.002

**The acute response of the nucleus pulposus of the cervical intervertebral disc to three supine postures in an asymptomatic population.**

Elmaazi A<sup>1</sup>, Morse CI<sup>2</sup>, Lewis S<sup>1</sup>, Qureshi S<sup>3</sup>, McEwan I<sup>1</sup>.

**BACKGROUND:**

The dynamic disc model refers to the ability of a spinal disc's position to be manipulated by body postures and movements. Research on lumbar discs has indicated movement of the anterior and posterior disc that correlates with posture of the spine. The aim of this study was to assess whether, despite its structural differences, the cervical disc responds to flexed and extended postures in a similar fashion to the lumbar disc.

**METHOD:**

A repeated measures study. Twenty five asymptomatic participants (age:  $33.7 \pm 9.1$  years) volunteered. Scans were performed in supine using an Esaote 0.2T magnetic resonance imaging scanner. Participants lay with their cervical spine initially placed in neutral, followed by flexion and finally extension. The position of the posterior disc nucleus pulposus at C5-6 and C6-7 was measured against a vertical line connecting the posterior vertebral bodies above and below each disc.

**RESULTS:**

Changes in cervical spine position were associated with significant changes in posterior disc nucleus pulposus position at both C5-6 and C6-7 ( $p < 0.01$  for both). Post hoc testing showed a significant difference in posterior disc nucleus pulposus position at C5-6 between flexion and extension ( $p = 0.02$ ). There was similarly a significant change at C6-7 between neutral and flexion ( $p = 0.001$ ), and between flexion and extension ( $p = 0.02$ ).

**CONCLUSIONS:**

These results indicate that the cervical posterior nucleus pulposus is affected by spinal loading, consistent with the concept of the dynamic disc model.



## 12 A. WHIPLASH

### Investigating types of care

BMC Health Serv Res. 2019; 19: 806.doi: 10.1186/s12913-019-4623-y PMID: 31694622

#### Evidence-based care in high- and low-risk groups following whiplash injury: a multi-centre inception cohort study

Alexandra Griffin,<sup>1,2</sup> Jagnoor Jagnoor,<sup>2,5</sup> Mohit Arora,<sup>2</sup> Ian D. Cameron,<sup>2</sup> Annette Kifley,<sup>2</sup> Michele Sterling,<sup>3,4</sup> Justin Kenardy,<sup>4</sup> and Trudy Rebeck<sup>1,2</sup>

#### Background

Studies aimed at improving the provision of evidence-based care (EBC) for the management of acute whiplash injuries have been largely successful. However, whether EBC is broadly provided and whether delivery of EBC varies based on risk of non-recovery, is uncertain. Receiving EBC should improve recovery, though this relationship has yet to be established. Further, mitigating the effect of EBC is the relationship with the practitioner, a phenomenon poorly understood in WAD. This study aimed to determine the proportion of individuals with whiplash, at differing baseline risk levels, receiving EBC. This study also aimed to determine whether receiving EBC and the therapeutic relationship were associated with recovery at 3 months post injury.

#### Methods

Participants with acute whiplash were recruited from public hospital emergency departments, private physiotherapy practices, and State Insurance Regulatory Authority (SIRA) databases. Participants completed questionnaires at baseline (demographics, risk of non-recovery) and 3-months (treatment received, risk identification, therapeutic relationship) post injury. Primary health care providers (HCPs) treating these participants also completed questionnaires at 3-months. Recovery was defined as neck disability index  $\leq 4/50$  and global perceived effect of  $\geq 4/5$ .

#### Results

Two-hundred and twenty-eight people with acute whiplash, and 53 primary care practitioners were recruited. The majority of the cohort reported receiving EBC, with correct application of the Canadian C-spine rule (74%), and provision of active treatments (e.g. 89% receiving advice) high. Non-recommended (passive) treatments were also received by a large proportion of the cohort (e.g. 50% receiving massage). The therapeutic relationship was associated with higher odds of recovery, which was potentially clinically significant (OR 1.34, 95% CI 1.18–1.62). EBC was not significantly associated with recovery.

#### Conclusions

Guideline-based knowledge and practice has largely been retained from previous implementation strategies. However, recommendations for routine risk identification and tailored management, and reduction in the provision of passive treatment have not. The therapeutic relationship was identified as one of several important predictors of recovery, suggesting that clinicians must develop rapport and understanding with their patients to improve the likelihood of recovery.

**13 B. TMJ/ORAL****Kinesiophobia and TMD**

Musculoskelet Sci Pract. 2019 Aug 30;44:102054. doi: 10.1016/j.msksp.2019.102054.

**Multiple diagnoses, increased kinesiophobia? - Patients with high kinesiophobia levels showed a greater number of temporomandibular disorder diagnoses.**

Lira MR<sup>1</sup>, Lemes da Silva RR<sup>2</sup>, Bataglion C<sup>3</sup>, Aguiar ADS<sup>1</sup>, Greggi SM<sup>1</sup>, Chaves TC<sup>4</sup>.

**OBJECTIVES:**

The aim of this study was to empirically derive subgroups according to pain-related fear of movement beliefs using cluster analysis within a sample of TMD patients and asymptomatic volunteers.

**METHODS:**

129 volunteers participated in this cross-sectional study (34.78, standard deviation [SD]: 12.49 years; 92 TMD patients and 37 symptom-free volunteers). Mechanical pain sensitivity through pressure pain threshold (PPT) on orofacial and remote sites, kinesiophobia, pain catastrophizing, anxiety and depression were assessed. A cluster analysis was used to derive subgroups according to kinesiophobia scores (TSK/TMD).

**RESULTS:**

Three subgroups were derived: cluster 1 (high kinesiophobia [n = 53], TSK score: 33, SD[standard deviation] = 2.9), cluster 2 (moderate kinesiophobia [n = 50], TSK score: 26.2, SD = 2.14) and cluster 3 (no/low kinesiophobia [n = 26], TSK score 12.12, SD = 2.08) which included patients with higher overall PPT and lower scores on psychosocial variables. The group with high kinesiophobia showed high levels of pain catastrophizing, anxiety, and orofacial pain-related disability compared to the other subgroups and mechanical pain hyperalgesia in remote site compared to the low-kinesiophobia group. Also, we found a greater prevalence of triple diagnosis for the high-kinesiophobia subgroup compared to the moderate kinesiophobia group - odds ratio: 12.6 (95% confidence interval [CI]: 3.31-43.52, p < 0.01).

**CONCLUSION:**

These results suggested that patients with TMD and higher levels of kinesiophobia beliefs may show a more complex clinical feature, with high psychosocial distress, widespread mechanical pain sensitivity, and a more complex TMD disorder. In this way, we suggest a relationship between the number of TMD diagnoses and kinesiophobia severity.

## 15. VESTIBULAR

### Should we abandon positional tests

#### Should we abandon positional testing for vertebrobasilar insufficiency?

Lucy Thomas\* Julia Treleaven

DOI: <https://doi.org/10.1016/j.msksp.2019.102095>

#### Highlights

- Positional testing has an important role for screening and differential diagnosis.
- Positive tests via symptom reproduction determine inadequate collateral flow.
- Correct use and interpretation is vital as tests do not assess arterial integrity.
- Tests should not be abandoned but further research is needed.

#### Abstract

Positional testing for vertebrobasilar insufficiency (VBI) is used by physiotherapists as part of pre-manipulative screening protocols. Recently, the validity of the tests have been questioned because a negative test does not infer safety with cervical manipulative therapy but the reasoning surrounding this opinion may be questioned. While the positional tests were developed to test vertebral artery flow contralateral to the direction of head movement and the subsequent effect on cerebral blood supply, as inferred by symptom reproduction, ultrasound studies have shown that vertebral artery flow is inherently variable. Rather, the tests should be considered as testing for adequacy of collateral flow in particular head positions rather than decreased blood flow in a particular artery, with more attention to characteristics of symptom reproduction. We contend that positional testing for VBI remains valuable for testing adequacy of collateral flow, and also has an important place as part of the differential diagnosis of individuals with dizziness or imbalance.

The physiotherapist's ability to differentially diagnose dizziness and recognise the presence or not of VBI is not only critical for prompt medical investigation and management because it is a risk factor for transient ischaemic events and stroke, but has important influences over management decisions regarding cervical musculoskeletal treatment including exercise interventions.

Importantly, the positional tests should not be considered as tests of arterial integrity and used to assess the risk of damage to the vertebral or internal carotid artery or presence of cervical arterial dissection. Urgent research is needed before we abandon positional testing prematurely.

### 40. ANKLE SPRAINS AND INSTABILITY

#### Foot intrinsic exercise helps ankle instability

J Exerc Rehabil. 2019 Oct 28;15(5):709-714. doi: 10.12965/jer.1938488.244. eCollection 2019 Oct.

#### **Effects of a 6-week intrinsic foot muscle exercise program on the functions of intrinsic foot muscle and dynamic balance in patients with chronic ankle instability.**

Lee DR<sup>1</sup>, Choi YE<sup>2</sup>.

We aimed to evaluate the effects of a 6-week intrinsic foot muscle exercise program on the activation of intrinsic foot muscle movement and dynamic balance in adults with chronic ankle stability. A total of 30 adults with chronic ankle instability were recruited. The participants were randomly assigned to a group performing intrinsic foot muscle exercises and a control group doing no exercises. We measured the activation rate and dynamic balance of the abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, and quadratus plantae before and after the intervention.

We found that the activation rate and dynamic balance significantly increased in all intrinsic foot muscles in the experimental group.

These results suggest that intrinsic foot muscle exercise for patients with chronic ankle stability is an effective treatment for improving the functions and balance ability of the intrinsic foot muscles.

**Test for**

Clin J Sport Med. 2019 Nov;29(6):509-522. doi: 10.1097/JSM.0000000000000535.

**Ability of Functional Performance Tests to Identify Individuals With Chronic Ankle Instability: A Systematic Review With Meta-Analysis.**

Rosen AB<sup>1</sup>, Needle AR<sup>2</sup>, Ko J<sup>3</sup>.

**OBJECTIVE:**

The purpose of this systematic review with meta-analysis was to determine the effectiveness of functional performance tests (FPTs) in differentiating between individuals with chronic ankle instability (CAI) and healthy controls.

**DATA SOURCES:**

The National Library of Medicine Catalog (PubMed), the Cumulative Index for Nursing and Allied Health Literature (CINAHL), and the SPORTDiscus, from inception to June 2017 were searched. Search terms consisted of: "Functional Performance Test\*" OR "Dynamic Balance Test\*" OR "Postural Stability Test\*" OR "Star Excursion Balance Test\*" OR "Hop Test\*" AND "Ankle Instability" OR "Ankle Sprain." Included articles assessed differences in FPTs in patients with CAI compared with a control group.

**MAIN RESULTS:**

Included studies were assessed for methodological quality and level of evidence. Individual and mean effect sizes were also calculated for FPTs from the included articles. Twenty-nine studies met the criteria and were analyzed. The most common FPTs were timed-hop tests, side-hop, multiple-hop test, single-hop for distance, foot-lift test, and the Star Excursion Balance Tests (SEBTs). The side-hop ( $g = -1.056$ ,  $P = 0.009$ ,  $n = 7$ ), timed-hop tests ( $g = -0.958$ ,  $P = 0.002$ ,  $n = 9$ ), multiple-hop test ( $g = 1.399$ ,  $P < 0.001$ ,  $n = 3$ ), and foot-lift tests ( $g = -0.761$ ,  $P = 0.020$ ,  $n = 3$ ) demonstrated the best utility with large mean effect sizes, whereas the SEBT anteromedial ( $g = 0.326$ ,  $P = 0.022$ ,  $n = 7$ ), medial ( $g = 0.369$ ,  $P = 0.006$ ,  $n = 7$ ), and posteromedial ( $g = 0.374$ ,  $P < 0.001$ ,  $n = 13$ ) directions had moderate effects.

**CONCLUSIONS:**

The side-hop, timed-hopping, multiple-hop, and foot-lift seem the best FPTs to evaluate individuals with CAI. There was a large degree of heterogeneity and inconsistent reporting, potentially limiting the clinical implementation of these FPTs. These tests are cheap, effective, alternatives compared with instrumented measures.

**45 B. MANUAL THERAPY CERVICAL****TMJ and tinnitus helped**

Pain Med. 2019 Oct 29. pii: pnz278. doi: 10.1093/pm/pnz278.

**Effects of Cervico-Mandibular Manual Therapy in Patients with Temporomandibular Pain Disorders and Associated Somatic Tinnitus: A Randomized Clinical Trial.**

Delgado de la Serna P<sup>1</sup>, Plaza-Manzano G<sup>2,3</sup>, Cleland J<sup>4,5,6</sup>, Fernández-de-Las-Peñas C<sup>7,8</sup>, Martín-Casas P<sup>2</sup>, Díaz-Arribas MJ<sup>2</sup>.

**OBJECTIVE:**

This randomized clinical trial investigated the effects of adding cervico-mandibular manual therapies into an exercise and educational program on clinical outcomes in individuals with tinnitus associated with temporomandibular disorders (TMDs).

**METHODS:**

Sixty-one patients with tinnitus attributed to TMD were randomized into the physiotherapy and manual therapy group or physiotherapy alone group. All patients received six sessions of physiotherapy treatment including craniocervical and temporomandibular joint (TMJ) exercises, self-massage, and patient education for a period of one month. Patients allocated to the manual therapy group also received cervico-mandibular manual therapies targeting the TMJ and cervical and masticatory muscles. Primary outcomes included TMD pain intensity and tinnitus severity. Secondary outcomes included tinnitus-related handicap (Tinnitus Handicap Inventory [THI]), TMD-related disability (Craniofacial Pain and Disability Inventory [CF-PDI]), self-rated quality of life (12-item Short Form Health Survey [SF-12]), depressive symptoms (Beck Depression Inventory [BDI-II]), pressure pain thresholds (PPTs), and mandibular range of motion. Patients were assessed at baseline, one week, three months, and six months after intervention by a blinded assessor.

**RESULTS:**

The adjusted analyses showed better outcomes (all,  $P < 0.001$ ) in the exercise/education plus manual therapy group (large effect sizes) for TMD pain ( $\eta^2 P = 0.153$ ), tinnitus severity ( $\eta^2 P = 0.233$ ), THI ( $\eta^2 P = 0.501$ ), CF-PDI ( $\eta^2 P = 0.395$ ), BDI-II ( $\eta^2 P = 0.194$ ), PPTs ( $0.363 < \eta^2 P < 0.415$ ), and range of motion ( $\eta^2 P = 0.350$ ), but similar changes for the SF-12 ( $P = 0.622$ ,  $\eta^2 P = 0.01$ ) as the exercise/education alone group.

**CONCLUSIONS:**

This clinical trial found that application of cervico-mandibular manual therapies in combination with exercise and education resulted in better outcomes than application of exercise/education alone in individuals with tinnitus attributed to TMD.

## 45 C. MANUAL THERAPY THORACIC

### Manip and pain processing

Neuroimage Clin. 2019; 24: 102042. doi: 10.1016/j.nicl.2019.102042 PMID: 31670070

#### **Evidence for decreased Neurologic Pain Signature activation following thoracic spinal manipulation in healthy volunteers and participants with neck pain**

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**Background Context** Spinal manipulation (SM) is a common treatment for neck and back pain, theorized to mechanically affect the spine leading to therapeutic mechanical changes. The link between specific mechanical effects and clinical improvement is not well supported. SM's therapeutic action may instead be partially mediated within the central nervous system.

**Purpose** To introduce brain-based models of pain for spinal pain and manual therapy research, characterize the distributed central mechanisms of SM, and advance the preliminary validation of brain-based models as potential clinical biomarkers of pain.

**Study Design** Secondary analysis of two functional magnetic resonance imaging studies investigating the effect of thoracic SM on pain-related brain activity: A non-controlled, non-blinded study in healthy volunteers (Study 1,  $n = 10$ , 5 females, and mean age =  $31.2 \pm 10.0$  years) and a randomized controlled study in participants with acute to subacute neck pain (Study 2,  $n = 24$ , 16 females, mean age =  $38.0 \pm 15.1$  years).

**Methods** Functional magnetic resonance imaging was performed during noxious mechanical stimulation of the right index finger cuticle pre- and post-intervention. The effect of SM on pain-related activity was studied within brain regions defined by the Neurologic Pain Signature (NPS) that are predictive of physical pain.

### Results

In Study 1, evoked mechanical pain ( $p < 0.001$ ) and NPS activation ( $p = 0.010$ ) decreased following SM, and the changes in evoked pain and NPS activation were correlated ( $r_{RM}^2 = 0.418$ ,  $p = 0.016$ ). Activation within the NPS subregions of the dorsal anterior cingulate cortex (dACC,  $p = 0.012$ ) and right secondary somatosensory cortex/operculum (rS2\_Op,  $p = 0.045$ ) also decreased following SM, and evoked pain was correlated with dACC activity ( $r_{RM}^2 = 0.477$ ,  $p = 0.019$ ). In Study 2, neck pain ( $p = 0.046$ ) and NPS ( $p = 0.033$ ) activation decreased following verum but not sham SM. Associations between evoked pain, neck pain, and NPS activation, were not significant and less clear, possibly due to inadequate power, methodological limitations, or other confounding factors.

### Conclusions

The findings provide preliminary evidence that SM may alter the processing of pain-related brain activity within specific pain-related brain regions and support the use of brain-based models as clinical biomarkers of pain.

**45 D. MANUAL THERAPY EXTREMITIES****Mulligan helps knee OA**

BMC Musculoskelet Disord. 2019; 20: 452. doi: 10.1186/s12891-019-2841-4  
PMCID: PMC6800493 PMID: 31627723

**The effect of mobilization with movement on pain and function in patients with knee osteoarthritis: a randomized double-blind controlled trial**

Hani A. Alkhwajah<sup>1</sup> and Ali M. Alshami<sup>2</sup>

**Background**

Few studies have investigated the effects of mobilization with movement (MWM) in patients with knee osteoarthritis (OA) compared to other procedures. Sham procedures are generally more appropriate control than using no or usual treatments. Moreover, studies investigating the widespread hypoalgesic effects of MWM in patients with knee OA are lacking. The aim was to investigate the effect of MWM on function and pain in patients with knee OA compared to sham MWM.

**Methods**

This is a randomized double-blind (patients and assessor) controlled trial. Forty adult patients with knee OA of grade II and above were recruited to receive either MWM treatment or sham MWM for the knee. The outcome measures included the following: a visual analogue scale (VAS) for pain, the pressure pain threshold (PPT) test, the Western Ontario and McMaster Universities Osteoarthritis (WOMAC) Index, the timed up and go (TUG) test, knee strength and knee range of motion (ROM). The measurements were taken at baseline, immediately after intervention and 2 days later.

**Results**

Compared with sham MWM, MWM resulted in greater immediate improvement in pain [mean difference (95% CI): -2.2 (-2.8, -1.6)], PPT at both the knee [176 (97, 254)] and shoulder [212 (136, 288)], TUG time [-1.6 (-2.1, -1.1)], knee flexor strength [2.0 (1.3, 2.7)] and extensor strength [5.7 (4.1, 7.2)] and knee flexion ROM [12.8 (9.6, 15.9)] (all,  $p < 0.001$ ) but not knee extension ROM [-0.8 (-1.6, 0.1)] ( $p = 0.067$ ). After 2 days of intervention, patients who received MWM also demonstrated a greater improvement in pain [-1.0 (-1.8, -0.1)], PPT at the shoulder [107 (40, 175)], TUG time [-0.9 (-1.4, -0.4)], knee flexor strength [0.9 (0.2, 1.7)] and extensor strength [2.9 (2.1, 3.9)] and knee flexion ROM [8.3 (4.7, 11.9)] (all,  $p \leq 0.026$ ). However, WOMAC scores and knee extension ROM showed no evidence of change at any stage after intervention ( $p \geq 0.067$ ).

**Conclusions**

MWM provided superior benefits over sham MWM in terms of local and widespread pain, physical function (walking), knee flexion and extension muscle strength and knee flexion ROM for at least 2 days in patients with knee OA.



**46 A. UPPER LIMB NEUROMOBILIZATION****Neural mob helps CTS**

PeerJ. 2019 Nov 8;7:e8012. doi: 10.7717/peerj.8012. eCollection 2019.

**Long-term patient observation after conservative treatment of carpal tunnel syndrome: a summary of two randomised controlled trials.**

Wolny T<sup>1</sup>, Linek P<sup>1</sup>.

**BACKGROUND:**

Physiotherapy of carpal tunnel syndrome (CTS) involves manual therapy based on neurodynamic techniques. Until now, two randomized controlled trials have shown that immediately after therapy, CTS patients who received neurodynamic techniques had significant improvement in nerve conduction, pain, symptom severity (SSS), functional state (FSS), muscle strength (MS) and two-point discrimination (2PD). However, long-term effects seem to be more important, as they are the only ones that can significantly improve the patient's health and influence economic and social costs. Thus, the objective of this study was to evaluate the long-term (six months) effects of neurodynamic techniques in the conservative treatment of CTS patients.

**METHODS:**

Carpal tunnel syndrome patients (107) from two previously published randomised clinical trials were observed for six months after the treatment based on neurodynamic techniques.

**RESULTS:**

The sensory conduction velocity, motor conduction velocity, and motor latency were not subject to statistically significant changes within six months after therapy ( $p > 0.05$ ). In both groups, there was further pain reduction ( $p < 0.05$ ). In Group B, the symptom severity improved significantly ( $p < 0.05$ ), while the functional status in both groups remained unchanged ( $p > 0.05$ ). In both groups, there was muscle strength improvement ( $p < 0.05$ ). Two-point discrimination remained unchanged six months after the therapy.

**CONCLUSION:**

The use of manual therapy based on neurodynamic techniques maintains the beneficial effects 6 months after therapy in CTS patients.

**46 B. LOWER LIMB NEUROMOILIZATION****Improvement in hamstring flexibility**

Phys Ther Sport. 2019 Nov;40:244-250. doi: 10.1016/j.ptsp.2019.10.005. Epub 2019 Oct 15.

**Effects of neurodynamic treatment on hamstrings flexibility: A systematic review and meta-analysis.**

López López L<sup>1</sup>, Torres JR<sup>1</sup>, Rubio AO<sup>1</sup>, Torres Sánchez I<sup>1</sup>, Cabrera Martos I<sup>1</sup>, Valenza MC<sup>2</sup>.

**OBJECTIVE:**

To provide detailed information on the effectiveness of neurodynamic treatment on hamstrings flexibility.

**METHODS:**

Systematic review in the following databases: PubMed, Google Scholar, and ScienceDirect. Articles were included if the intervention followed a neurodynamic treatment and the study was a randomized clinical trial including at least one measurement related to hamstrings flexibility. Articles were independently screened for inclusion and data were extracted by two researchers. It was registered in the PROSPERO database (CRD42015020707).

**RESULTS:**

Finally, 6 articles (n = 294 participants) were included. Neurodynamic treatment was compared with no treatment, placebo, and with other manual therapy techniques such as active and passive stretching, muscle inhibition and proprioceptive neuromuscular facilitation. Meta-analysis shows benefits of neurodynamic treatment for knee-extension range of motion (1 trials compared with no intervention, MD = -2.23, 95% CI = -3.02 to -1.44, and 4 trials compared to other techniques, MD = -0.40, 95% CI = -1.09 to 0.29, I<sup>2</sup> = 81.55%) and passive straight leg raise test measures (2 trials compared with no intervention, MD = 2.26, 95% CI = 1.78 to 2.74, I<sup>2</sup> = 0%, and 3 trials compared with other techniques MD = 2.26, 95% CI = 1.78 to 2.74, I<sup>2</sup> = 0%).

**CONCLUSIONS:**

This review and meta-analysis shows the effectiveness of neurodynamic treatment on hamstrings flexibility compared with no intervention and other techniques.

## 52. EXERCISE

### Exercise helps dentists with neck pain

Int Arch Occup Environ Health. 2019 Oct 25. doi: 10.1007/s00420-019-01480-x

#### **Effect of therapeutic exercise routine on pain, disability, posture, and health status in dentists with chronic neck pain: a randomized controlled trial.**

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##### *PURPOSE:*

To investigate the effect of therapeutic exercise (TE) on pain, disability, posture, and health status in female dentists suffering from chronic neck pain (NP).

##### *METHODS:*

48 female dentists (40-45 years) suffering from NP were randomly divided into two experimental (n = 24) and control (n = 24) groups. Experimental group received 8 weeks of TE aimed to improve (1) muscle coordination and proprioception, (2) muscular endurance, and (3) muscle strength. Control group received no specific exercises. The pain, disability, posture (forward head and protracted shoulder angles), and health status were assessed at baseline and after an 8-week TE by visual analogue scale (VAS), neck disability index (NDI), photogrammetry, and self-rated general health questionnaire, respectively. Wilcoxon and Mann-Whitney non-parametric tests were used for statistical analysis.

##### *RESULTS:*

There were significant between-group differences in neck pain [p = 0.003, 0.86 (0.09-1.65)], disability [p = 0.009, ES (95% CI) = 0.78 (0.020-1.37)], forward head angle [p = 0.039, ES (95% CI) = 0.61 (0.034-1.19)], protracted shoulder angle [p = 0.031, ES (95% CI) = 0.64 (0.062-1.22)], and health status [p = 0.022, ES (95% CI) = 0.68 (0.102-1.26)] favoring the corrective exercise group. There were significant within-group changes in pain, disability, posture, and health status in the experimental group. However, there were no within group changes in the control group.

##### *CONCLUSIONS:*

TEs successfully alleviated pain, disability, posture, and health status in female dentists suffering from chronic NP. Considering the extremely large effect size of TEs, this intervention was recommended to neck pain treatment in patients suffering from chronic NP, poor posture, and health problem.

## Comparing circuit trainings intensity

**High-Intensity Interval Circuit Training Versus Moderate-Intensity Continuous Training on Functional Ability and Body Mass Index in Middle-Aged and Older Women: A Randomized Controlled Trial**

*Int. J. Environ. Res. Public Health* **2019**, *16*(21), 4205; <https://doi.org/10.3390/ijerph16214205>  
The literature suggests that high-intensity interval training (HIIT) is more effective than moderate-intensity continuous training (MICT) to improve functional ability. However, there is no evidence on including HIIT in a circuit programme (HIICT).

Our objective was to determine what type of training (HIICT or MICT) induces greater adaptations in the functional ability and body mass index of middle-aged and older women. The study used a quasi-experimental randomized controlled trial with 54 participants (age =  $67.8 \pm 6.2$  years). Participants were randomly allocated to HIICT ( $n = 18$ ), MICT ( $n = 18$ ) or a non-exercise control group (CG;  $n = 18$ ).

The participants in the HIICT or MICT groups trained twice a week (1 h/session) for 18 weeks. Forty-one subjects were analysed (HIICT;  $n = 17$ , MICT;  $n = 12$ , CG;  $n = 12$ ). Five subjects presented adverse events during the study. Strength, gait, cardiorespiratory fitness, balance and body mass index were measured. A significant training  $\times$  group interaction was found in the arm curl test, where HIICT was statistically better than MICT and CG. Likewise, HIICT was statistically better than the CG in the BMI interaction. In lower limb strength, gait/dynamic balance and cardiorespiratory fitness, both HIICT and MICT were statistically better than the CG.

In conclusion, HIICT generated better adaptations in upper limb strength than MICT. Likewise, HIICT generated better adaptations in body mass index than CG. Finally, both HIICT and MICT had a similar influence on strength, cardiorespiratory fitness and gait/dynamic balance.

**56. ATHLETICS****Marathon training**

J Sci Med Sport. 2019 Oct 18. pii: S1440-2440(18)31310-0. doi: 10.1016/j.jsams.2019.09.013.

**An evaluation of the training determinants of marathon performance: A meta-analysis with meta-regression.**

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**OBJECTIVES:**

Marathoners rely on expert-opinion and the anecdotal advice of their peers when devising their training plans for an upcoming race. The accumulation of results from multiple scientific studies has the potential to clarify the precise training requirements for the marathon. The purpose of the present study was to perform a systematic review, meta-analysis and meta-regression of available literature to determine if a dose-response relationship exists between a series of training behaviours and marathon performance.

**DESIGN:**

Systematic review, meta-analysis and meta-regression.

**METHODS:**

A systematic search of multiple literature sources was undertaken to identify observational and interventional studies of elite and recreational marathon (42.2km) runners.

**RESULTS:**

Eighty-five studies which included 137 cohorts of runners (25% female) were included in the meta-regression, with average weekly running distance, number of weekly runs, maximum running distance completed in a single week, number of runs  $\geq 32$ km completed in the pre-marathon training block, average running pace during training, distance of the longest run and hours of running per week used as covariates. Separately conducted univariate random effects meta-regression models identified a negative statistical association between each of the above listed training behaviours and marathon performance ( $R^2$  0.38-0.81,  $p < 0.001$ ), whereby increases in a given training parameter coincided with faster marathon finish times. Meta-analysis revealed the rate of non-finishers in the marathon was 7.27% (95% CI 6.09%-8.65%).

**CONCLUSIONS:**

These data can be used by athletes and coaches to inform the development of marathon training regimes that are specific to a given target finish time.

## 61. FIBROMYALGIA

### Phenotypes

#### **Heritability of the fibromyalgia phenotype varies by age**

Diptavo Dutta Laura J. Scott

<https://doi.org/10.1002/art.41171>

#### **Objectives**

Many studies suggest a strong familial component to fibromyalgia (FM). However, these studies have nearly all been confined to individuals with “primary” FM, i.e. FM without any other accompanying disorder. The current 2011-16 criteria for diagnosing FM construct a score using a combination of the number of painful body sites and the severity of somatic symptoms (FM-score). We estimated the genetic heritability of FM-score across sex and age groups to identify subgroups of individuals with greater heritability, which may help in the design of future genetic studies.

#### **Methods**

We collected data on 26,749 individuals of European ancestry undergoing elective surgery at the University of Michigan (Michigan Genomics Initiative study, MGI). We estimated the SNP-based heritability of FM-score by age and sex categories using genome-wide association study (GWAS) data and a linear mixed model.

#### **Results**

Overall, FM-score had an estimated heritability of 13.9% (SE=2.9%). Estimated FM-score heritability was highest in individuals  $\leq 50$  years of age (23.5%; SE=7.9%) and lowest in individuals  $>60$  years (7.3%; SE=8.1%). These patterns remained the same when we analyzed FM as a case-control phenotype. Even though women had approximately 30% higher average FM-score than males across age categories, FM-score heritability did not differ significantly by sex.

#### **Conclusion**

Younger individuals appear to have a much stronger genetic component to the FM-score than older individuals. Older individuals may be more likely to have what previously had been called “secondary FM.” Regardless of the cause, these results have implications for future genetic studies of FM and associated conditions.

## TENS

Arthritis Rheumatol. 2019 Nov 18. doi: 10.1002/art.41170.

**A Randomized Controlled Trial of TENS for Movement-Evoked Pain in Women with Fibromyalgia.**

Dailey DL<sup>1,2</sup>, Vance CG<sup>1</sup>, Rakel BA<sup>1,3</sup>, Zimmerman MB<sup>4</sup>, Embree J<sup>1,3</sup>, Merriwether EN<sup>5</sup>, Geasland KM<sup>1</sup>, Chimenti R<sup>1</sup>, Williams JM<sup>6</sup>, Golchha M<sup>6</sup>, Crofford LJ<sup>6</sup>, Sluka KA<sup>1,3</sup>.

**OBJECTIVE:**

Fibromyalgia (FM) is characterized by pain and fatigue, particularly during physical activity. Transcutaneous electrical nerve stimulation (TENS) activates endogenous pain inhibitory mechanisms. We evaluated if using TENS during activity would improve movement-evoked pain and other patient-reported outcomes in women with FM.

**METHODS:**

Participants were randomly assigned to receive active-TENS (n=103), placebo-TENS (n=99) or no-TENS (n=99) and instructed to use it at home 2h/day during activity for 4- weeks. TENS was applied to the lumbar and cervicothoracic regions using a modulated frequency (2-125Hz) at the highest tolerable intensity. Participants rated movement-evoked pain (primary outcome) and fatigue on an 11-point scale before and during application of TENS. Primary and secondary patient-reported outcomes were assessed at randomization and 4weeks.

**RESULTS:**

After 4-weeks, the active-TENS group reported a greater reduction in movement-evoked pain and fatigue than placebo-TENS (Pain, Group mean difference(95% CI): -1.0(-1.8, -0.2), p=0.008; Fatigue: -1.4(-2.4, -0.4), p=0.001) and no-TENS groups (Pain: -1.8(-2.6, -1.0), p<0.0001; Fatigue: -1.9(-2.9, -0.9), p=<0.0001). A greater percentage of the active-TENS group reported improvement on the global impression of change when compared to placebo-TENS (70% vs. 31%, p<0.0001) and no-TENS (9%, p<0.0001). There were no TENS-related serious adverse events and less than 5% of participants experienced minor adverse events from TENS.

**CONCLUSION:**

Among women with FM and stable medication, 4-weeks of active-TENS use compared with placebo-TENS or no-TENS resulted in a significant improvement in movement-evoked pain and other clinical outcomes. Further research is needed to examine effectiveness in a real world, pragmatic setting to establish clinical importance of these findings