

Review of the Literature

Musculoskeletal Medicine

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Lumbar spine

Sylvian, Grenier and McGill (2007) Quantification of lumbar stability by using 2 different abdominal activation strategies. Archives of physical medicine and rehabilitation 88 (1) p54-62 PMID 17207676

The objective of this study was to determine whether abdominal hollowing is more effective for lumbar spine stabilization than a full abdominal muscle co-contraction.

This report includes a summary of the evidence to date around the role of transverse abdominus training in the management of chronic back pain and the theories behind why many exercise programs to improve stability concentrate on this muscle.

- Transversus abdominus is recruited later, in some subjects with low back pain.
- Delay of transversus abdominus activation has been demonstrated during rapid arm movements in some low back pain sufferers and the magnitude of the arm movement has an effect.
- Delayed onset of trunk muscles during quick torso movements have also been described in addition to quads inhibition, altered gluteal activation during walking and an inability to breathe deeply whilst maintaining spine stability.
- Strategies to recruit the transversus abdominus through abdominal hollowing technique have been proposed as a means of increasing stability.
- Subjects when tested are not able to activate only the transversus abdominus during abdominal hollowing exercises.
- As the demand of exercise progression increases the abdominal muscles converge all muscles being activated to the same degree at higher exercise levels.

The authors conclude there is no quantitative evidence but there is some indirect and qualitative evidence supporting transversus abdominus as an important stabiliser and that it is not possible to make legitimate claims as to the stabilizing role of any specific muscles, but that a general approach is effective.

In this study the effect of combining loading with either a hollow or brace on the dependent variables of lumbar stability and compression was examined in eight healthy men aged between 20 and 33. While supporting either a bilateral or asymmetric weight in the hands electromyographic and spine kinematic recordings were made during an abdominal brace and a hollow.

Spine stability index and lumbar compression were calculated and the article points interested readers to descriptions of the mathematical principles used in the calculation of these measures. A clear description of experimental procedure data collection and analysis is given.

Stability was defined in this study as the ability of the spinal column to survive an applied perturbation referred to as Euler column stability. Equilibrium will not be regained if the work done (input energy or disturbance) is greater than the potential energy of the column (energy stored in disks, ligaments, muscles, tendons). A combination of 3 space tracker and emg readings were used to calculate stability and

references are given for those interested in understanding further the mechanical model used to quantify stability in this study.

Bracing stability was always greater than hollowing stability, and asymmetric loads always produced greater stability than symmetric loads. Performing hollowing using just the transversus abdominus greatly reduced stability when compared to all abdominal muscles being active.

Subjects in this study had difficulty activating just the transversus abdominus demonstrated by electromyographic activity in all other abdominals. Therefore attempts at hollowing did result in some degree of bracing.

The authors advise that despite bracing appearing to be more effective at stabilizing than hollowing, this should not be interpreted as evidence to stop abdominal hollowing as a means of training recruitment of transversus abdominus because the muscle does form a component of the abdominal girdle.

However they suggest instruction to “draw in” the abdomen in an effort to increase stability may be misdirected and quote 2 further studies that have recently concluded general activity and non-specific exercise is more beneficial to reduce pain and increase function.

Study limitations are acknowledged. The small sample consisted of young healthy males with no LBP. This was a mechanical analysis of the role of the transversus abdominus and other abdominal muscles and demonstrated bracing of the abdominal muscles to be more effective than hollowing at achieving spinal stability. The authors point out the role transversus abdominus isolation training has in rehabilitation may not be mechanical and single strategies may not provide optimal training for functional tasks where great diversity in load and velocity are required.

Moreside, Vera-Carcia, McGill (2007) Trunk muscle activation patterns, lumbar compressive forces and spine stability when using the body blade. Physical therapy 87 (2) p 153-63 PMID 17244696

This study analysed trunk muscle activation patterns, spine kinematics, and lumbar compression in 14 healthy male university students when using the Body blade.

Data was collected from video analysis and surface electromyography of trunk and shoulder muscles. L4-5 compressive forces and spine stability was calculated using data from 3-dimensional lumbar spine position sensors.

The Body blade is a core power training tool consisting of 122-cm-long, 0.68-kg flexible foil with a natural frequency of 15 Hz. When the blade oscillates at 4.5 times per second, minimal additional energy is required to maintain this oscillation. The posture of the user, the position and orientation of the blade and the amplitude of the oscillations determine which specific muscle groups are being targeted and their level of activation.

The authors describe lumbar stability as the potential energy derived from the stiffness of the muscles, passive structures, and anatomical position of the spine. This needs to be greater than the destabilizing work performed in order for the system to be stable. If the potential energy is reduced due to a loss of stiffness in one of these elements to less than the applied work, the system is at risk of buckling and subsequent injury.

Increasing values of the calculated stability index associated with use of the Body blade demonstrated enhanced spine stability

Using the blade in a vertical orientation and oscillating in a medial-lateral direction trunk muscle activation levels were similar or greater than those in other spine stabilization exercises. Vertical use achieved relatively high activation levels of the obliques and moderate levels in erector spinae and latissimus dorsi muscles.

Horizontal use was found to be the easiest for most participants to master. When used in this way the focus of muscle activation was upper back and rectus abdominus muscles.

Diagonal use resulted in moderate amounts of co-contraction and the authors suggest this could be useful for training stabilization for specific work or sporting activities.

The L4-5 compressive loads associated with Body blade use were within an acceptable range, but increased with amplitude of oscillation and/or poor technique. It is possible compressive forces may become high enough to cause injury at large amplitudes. Using the Body blade in a coordinated manner poses minimal risk to spine stability. The authors therefore advise large amplitude oscillations be used with caution until good technique is achieved, particularly in those with compression-intolerant lumbar spine pathology.

All subjects were male, relatively fit, and from a university population and the authors acknowledge this as a limitation of the study. Values of compression and stability may be different for female, unfit male or older subjects. In addition crosstalk affecting EMG signals was also highlighted as a possible source of error.

The article concludes it is important to choose spine stabilization exercises that require co-activation of numerous trunk muscles, while conserving the spine with tolerable loads as no single muscle is dominant in ensuring the overall stability of the lumbar spine. They recommend good technique should promote symmetrical stiffness and coordinated muscle activation patterns, with minimal hand and torso motion.

Jalloh, Minhas (2007) Delays in the treatment of cauda equina syndrome due to its variable clinical features in patients presenting to the emergency department. Emergency medicine journal 24 (1) p 33-4 PMID 17183040

A previous meta-analysis showed that in patients with cauda equina syndrome (CES) considerable improvements in sensory, motor and sphincter deficits are more likely to be achieved if surgery is performed within 48 hours.

Many patients presenting with CES do not receive an urgent referral to a specialist and difficulties in diagnosis arise due to variation in presenting clinical features.

This short report summarises reasons for delayed treatment compiled from a retrospective review of case notes where diagnosis of CES was confirmed on magnetic resonance imaging.

Only 19% of patients presented with the characteristic combination of bilateral sciatica, lower limb weakness, saddle anaesthesia and sphincter disturbance. The strongest presenting features of CES were lower back pain, sacral sensory loss and urinary symptoms. This article highlights sacral sensory loss as a sensitive and relatively specific sign that can be quickly recognised in patients with CES.

Patients did not clearly manifest all the characteristic features of CES and delays in the treatment were most often due to delayed diagnosis, which was more likely to be the case with fewer presenting features. Diagnosis could be further complicated by sphincter disturbance, constipation and urinary retention associated with pain and opioid analgesia.

Cervical spine

Falla, Farina, Dahl, Graven-Nielson (2007) muscle pain induces task- dependent changes in cervical agonist/antagonist activity. Journal of applied physiology 102 (2) p 601-9 PMID 17038492

This study examined the effect of experimental neck muscle pain on the EMG-force relationship between agonist and antagonist muscles during cervical flexion and extension

Complex biomechanical systems such as the cervical spine have numerous degrees of freedom of movement which may be produced by several combinations of muscle actions. At any one time only a small number of these combinations will be active.

Nociceptive afferents can effect patterns of excitation and muscle coordination. For example decreased muscle activity due to pain may be compensated by decreased antagonist or increased synergic contribution.

Hypothesis: If force maintenance is mainly due to reorganization among painful and nonpainful muscles, there will be a differential effect on the antagonist muscles depending on the force direction and thus the ability to recruit synergic muscles.

Experimental muscle pain was induced by injection of saline into the sternal head of the sternocleidomastoid and the splenius capitis muscle.

Participants were asked to verbally rate their level of perceived pain on an 11-point numerical rating scale (NRS) anchored with "no pain" and "the worst possible pain imaginable." Pain intensity ratings were obtained immediately following the injection and every 30 s until pain was no longer reported. Participants documented the area of pain on a body chart. This demonstrated splenius and sternomastoid muscle pain is frequently referred in the distribution of both cervical and trigeminal innervated areas and may mimic the clinical representation of headache.

Other studies have also identified a relationship between headache intensity and occurrence of referred pain and suggest the ophthalmic division of the trigeminal nerve is predominantly involved in the mechanism of cervicogenic headache. This has been attributed to the convergence of cervical afferents and the trigeminal nerve.

EMG signals were detected from sternomastoid, splenius capitis and upper trapezius muscles bilaterally. Experimentally induced neck muscle pain changed cervical agonist/antagonist activity without modification in muscle fiber membrane properties. EMG activity was consistently reduced in the painful agonist muscle, whereas modulation of antagonist activity depended on the direction of movement.

Decreased muscle activation likely reflects decreased motoneuron discharge rate due to reflex inhibition mediated by small-diameter muscle afferents or changes in the descending drive from higher centers to the motoneuron pool. The activity of muscles other than the painful muscle was also affected, indicating a redistribution of load in the muscle group contributing to the task in order to maintain constant force.

This study concludes local excitation of nociceptive afferents has an inhibitory effect on the painful muscle that is counteracted by a complex reorganization of the motor strategy of the muscle group involved in the task so that the motor output is maintained .

Haavik-Taylor and Murphy (2007) Cervical spine manipulation alters sensorimotor integration: a somatosensory evoked potential study. Clinical neurophysiology 118 (2) p391-402 PMID 17137836

This study investigated the immediate sensorimotor neurophysiological effects of cervical spine manipulation using somatosensory evoked potentials (SEPs).

Twelve subjects with a history of recurrent neck stiffness and/or neck pain, but no acute symptoms at the time were studied. This was in order to assess the effects of joint manipulation delivered to dysfunctional joints alone without the presence of acute pain, which is known to have an effect on SEPs.

For the purpose of this study spinal dysfunction was defined as the presence of restricted intersegmental range of motion and tenderness to palpation in at least one cervical spine segment.

The spinal manipulations carried out in this study were high velocity, low amplitude thrusts to the spine held in lateral flexion, with slight rotation and slight extension. Previous research has shown that reflex EMG activation observed following manipulation only occurs following high-velocity low amplitude manipulations when compared to lower velocity mobilizations and is more likely to alter afferent input to the CNS and lead to measurable SEP

In addition twelve subjects participated in a passive head movement control experiment where no spinal manipulation was performed. This was not intended to act as a sham manipulation but as a physiological control for possible changes occurring due to cutaneous, muscular or vestibular input involved with the type of passive head movement occurring during preparation for cervical manipulation.

All subjects were screened for evidence of vertebral artery ischemia using head position of extension, lateral flexion and rotation. Subjects were also screened for other contraindications to cervical manipulation, such as recent history of trauma, inflammatory or infectious arthropathies, or bone malignancies.

By recording SEPs and monitoring the peripheral nerve afferent activity, it is possible to determine where in the somatosensory pathway changes induced by spinal manipulation may be occurring. This was done before and for 30 min after a single session of cervical spine manipulation, or passive head movement.

There was a significant decrease in the amplitude of parietal and frontal SEP components following a single session of cervical spine manipulation compared to pre-manipulation baseline values. Changes lasted on average 20 min following the manipulation intervention. No changes were observed in the passive head movement control group.

The authors suggest following spinal manipulation there may be a decrease of activity in cortical and subcortical loops linking the basal ganglia, thalamus, pre-motor areas and primary motor cortex resulting from peripheral nerve stimulation and this may be due to altered afferent input.

Episodes of acute pain may initially induce plastic changes in the sensorimotor system. Pain has been shown to increase SEP peak amplitudes and somatosensory evoked magnetic fields. Sensorimotor disturbances that persist beyond an episode of acute pain play a role in chronicity.

The reduced cortical SEP peak amplitudes observed in the current study following spinal manipulation may reflect a normalization of such injury/pain-induced central plastic changes. This may be one mechanism for the improvement of functional ability reported following spinal manipulation.

The major finding in this study was that a single session of spinal manipulation to dysfunctional joints resulted in attenuated cortical evoked responses for up to 30 minutes post-manipulation before returning to baseline levels.

The observations in the present study suggest spinal manipulation of dysfunctional joints may modify transmission in neuronal circuitries at cortical level and possibly deeper brain structures such as the basal ganglia as well as at spinal level which has been indicated by previous research. The authors conclude spinal manipulation of dysfunctional cervical joints can lead to transient cortical plastic changes which may help to explain the mechanisms responsible for the pain relief and restoration of function following spinal manipulation treatment.

Cleland, Childs, Fritz, Whitman, Eberhart (2007). Development of a clinical predication rule for guiding treatment of a subgroup of patients with neck pain: use of thoracic spine manipulation, exercise and patient education. Physical therapy 87 (1) p9-23 PMID 17142640

The aim of this study was to develop a clinical prediction rule (CPR) to identify patients with neck pain who are likely to improve from treatment with thoracic spine thrust manipulation. Classification systems based on signs and symptoms that match treatments to subgroups of patients who are most likely to benefit can be helpful for physical therapists.

The background to this study is that premanipulative screening has not been demonstrated as a reliable means of identifying patients at risk of serious complications associated with cervical manipulation. In addition there is limited evidence to suggest thoracic spine thrust manipulation may be useful in the management of patients with neck pain. The suggestion is that a biomechanical link exists between the cervical and thoracic spines. As risk of complication is lower with thoracic spine thrust techniques they might be a suitable, safer alternative to cervical thrust manipulation.

78 subjects between the ages of 18 and 60, with a primary complaint of mechanical neck pain with or without unilateral upper-extremity symptoms and no evidence of nerve root compression or history of whiplash injury within the last 6 weeks participated in this study.

Manipulation techniques used were a seated distraction manipulation, a supine upper thoracic spine manipulation, and a middle thoracic spine manipulation and are fully described in the article. Each subject received 6 manipulations per treatment session, were instructed in cervical-range-of-motion exercise and advised to maintain usual activity within the limits of pain.

The global rating of change (GROC) was used to establish a successful outcome. It is a 15-point scale ranging from 'a very great deal worse' to 'about the same' to 'a very great deal better'. Subjects rating their perceived recovery as a very great deal better, a great deal better, or quite a bit better were categorized as having a successful outcome. Perceived level of recovery measured in this way has been shown to be sensitive to clinically important changes with physical therapy management of patients with neck pain

This study used a high threshold on the GROC for determining a successful outcome increasing the likelihood any symptom improvement was clinically significant rather than due to the passage of time.

42 patients were classified to have a successful outcome based on their perceived recovery. From this data a CPR with 6 variables was identified. If 3 of the 6 variables were present, the chance of experiencing a successful outcome improved

- Symptom duration of <30 days,
- No symptoms distal to the shoulder.
- Subject reports that looking up does not aggravate symptoms
- FABQPA (fear avoidance belief questionnaire physical ability sub scale) score of < 12,
- Diminished upper thoracic spine kyphosis (T3-T5)
- Cervical extension of <30 degrees

Reliability analysis of the identified potential predictor variables was carried out. The authors point out it is important to determine predictor variables are reproducible if they are to be of use in a CPR.

Future studies will be necessary to validate this rule as only 4 physiotherapists took part in the study.

Stewart, Maher, Refshauge, Herbert, Bogduk, Nicholas (2007). Randomized controlled trial of exercise for chronic whiplash-associated disorders. Pain 128 (1-2) p59-68 PMID 17029788

Background: current literature suggests that at three months, approximately one-third of subjects with whiplash injury will have high levels of persisting pain and disability.

Treatments that have been shown to work for other forms of chronic spinal pain have been adopted for the treatment of chronic whiplash associated disorder. However evidence for the lumbar spine cannot be necessarily be extrapolated to the cervical spine after a traumatic injury.

This study compared exercise and advice with advice alone for people with persisting pain and disability following a whiplash injury. Patient characteristics that moderated the effect of exercise treatment were also investigated.

Participants were randomly allocated to exercise and advice or advice alone. Subjects in the advice group received standardised education, reassurance and encouragement to resume light activity given in one consultation and two follow-up phone contacts. Favourable prognosis of whiplash was emphasised common inaccurate beliefs about whiplash were addressed. Subjects were reassured that physical activity is unlikely to further damage the neck and back, and that inactivity may cause muscle weakness and hamper recovery. Patient understanding of whiplash, attitudes, beliefs and fears that may impose barriers to recovery were also explored.

The six-week graded exercise program consisted of 3 sessions in the first and second weeks, 2 sessions in the third and fourth weeks and 1 session in the fifth and sixth weeks carried out under physiotherapy supervision, each session lasting 1 hour.

Exercise programs were individualized, progressive and submaximal aimed at improving ability to complete functional activities specified by the participant as being difficult due to symptoms. Programs carried included aerobic exercise, stretches, functional activities, activities to build speed, endurance and coordination, and trunk and limb strengthening exercises.

Cognitive behavioural therapy principles were used including setting goals of progressively increasing difficulty, shaping, encouraging self-monitoring of progress and self-reinforcement. Participants were also given an individualized home exercise program.

Outcomes were pain intensity, pain bothersomeness and functional ability, disability, global perceived effect, health-related quality of life and work status at 6 weeks and 12 months

Fifteen subjects (23%) in the advice group and, 10 subjects (15%) in the advice plus exercise group reported seeking additional treatment during the first 6 weeks. Thirty-five subjects (56%) in the advice group and eighteen subjects (29%) in the exercise group sought additional treatment in the 12 month follow up period.

Subjects in the exercise group thought the treatment they received was more credible and logical than did patients in the advice group and subjects in the advice group were more likely to seek other treatment during the treatment period and the subsequent 12 months. The authors suggest this may be because they did not feel they were receiving sufficient treatment.

All groups improved on average from baseline to 6 weeks. Compared with advice alone, exercise produced small reductions in pain intensity and bothersomeness, and small improvements in function, disability, quality of life and global perceived effect for people with mildly disabling chronic whiplash at 6-weeks follow-up. These effects were not apparent at 12 months.

Individuals with high initial levels of pain and disability improved to a greater extent with exercise than those with low levels. This is a valuable finding given that chronic whiplash patients with high levels of pain and disability have been shown to have a worse prognosis than those with lower levels of pain.

A critical issue is whether the magnitude of the effects of exercise is clinically worthwhile. The effect of exercise in this study equated to a change from "minimally improved" to "much improved" likely to be considered worthwhile by patients with chronic whiplash,

Further research to investigate how to adjust the exercise program in order to increase the size and durability of the treatment effect would be of benefit. The authors suggest this could be done by changing the intensity and/or duration of the initial exercise program or adding follow-up reminder phone calls and/or face-to-face consultations.

Duration of whiplash symptoms was not a predictor of response to exercise treatment in this study. However subjects were selected for this study if they had symptoms longer than 3 months and less than 12 months. Therefore subjects who have had symptoms for longer than 12 months may not respond to exercise treatment in the same way.

The authors conclude that exercise and advice produces better outcomes than advice alone for people who have sustained a whiplash injury and have ongoing pain and disability that persist beyond three months. The effect of exercise is greater in people with high levels of pain and disability than those with low levels. The superior results with exercise and advice compared to advice alone are however small and only apparent in the short term

Lower Limb

Robinson, Keenan and Conaghan (2007). Clinical effectiveness and dose response of image-guided intra-articular corticosteroid injection for hip osteoarthritis. Rheumatology (Oxford) 46 (2) p285-91 PMID 16873380

The background to this article suggests there have been relatively few studies of intrarticular steroid (IAST) in hip osteoarthritis (OA). One possible reason is that radiology input is usually required to perform hip injection under image guidance to ensure appropriate intra-articular placement. This makes studies more complex to conduct than for example a study of intra-articular knee injections that can be carried out easily in an out patient clinic setting.

This study assessed symptomatic change, dose response and predictors of response after IAST injection at 2 doses in hip OA.

Baseline measures were Western Ontario and McMaster Universities OA index (WOMAC) scores, body mass index (BMI), radiographic grading and ultrasound measures (capsular thickness and osteophyte assessment).

WOMAC scores incorporate assessment of the functional impact of treatment as well as the effect on pain and have been recommended for use in OA trials.

75 patients were injected with 40 mg methylprednisolone and 45 patients were injected with 80 mg. Injections were fluoroscopically guided using an anterior approach and a 22-gauge spinal needle with the patient in a supine position. Each steroid dose was mixed with 3–4 cc 0.5% bupivacaine.

Change in WOMAC scores from baseline to weeks 6 and 12 were calculated for each dose and dose comparisons were made. Clinical responders were defined as having a greater than 15% reduction in baseline pain score and were used to establish predictors of response.

Both the 40 mg and 80 mg IAST doses had a beneficial effect at week 6 and the 80 mg dose maintained this improvement at week 12. Comparison of the two dose groups provided some evidence of a dose response.

For the 40 mg dose, there was a statistically significant improvement in pain and stiffness but not disability at week 6, and only the improvement in stiffness at week 12 was maintained.

For the 80 mg dose, there was significant improvement in pain, stiffness and disability at week 6, which was maintained at week 12.

The 80 mg dose demonstrated a significant improvement compared with the 40 mg for stiffness at week 12 and disability at both weeks 6 and 12.

Patients lost to follow-up were recorded but not included in the statistical analysis. The authors recommend future studies should profile such patients.

Limitations of this study are discussed in the article. Patients were not randomized to treatment and the clinician was not blinded to the treatment dose. Sample size was determined by availability of patients in the given time frame, a power calculation was not carried out. There was no placebo group as placebo fluoroscopic exposure and injection was not considered to be ethical.

This study has shown a positive effect for IAST injection in OA of the hip which was dose related 80 mg methylprednisolone being superior to 40 mg dose. Ultrasound or radiographic features did not predict response.

Effect of attention focus on acquisition and retention of postural control following ankle sprain. Laufer, Rotem-Lehrer, Ronen, Khayutin, Rozenberg Archives of physical medicine and rehabilitation 2007 jan 88 (1) p105-8 PMID 17207684

Forty volunteers aged between 19 and 33 with grade 1 or 2 ankle sprain within last 4 months were randomly allocated to 1 of 2 groups receiving differing training instructions when using the Biodex Stability System for postural control. The training instructions directed the participants to use either an internal or an external focus of attention.

Instructions related to body movements are described as using an internal focus of attention (IFA). Instructions to focus on the effect of a movement rather than on the movement itself are described as using an external focus of attention (EFA).

In this study the EFA group were instructed to focus on stabilizing the platform, whilst the IFA group were instructed to focus on stabilizing their body. Increases in overall and AP stability were observed in both groups. Improvement was greater in the external-focus group.

The study clearly defines inclusion, exclusion criteria and the experimental procedure which was tested for reliability.

The authors claim the results are consistent with other studies showing EFA may be more effective in promoting motor skill learning. A suggested explanation is that focusing on body movement may interfere with the automatic control processes, while focusing on the outcome of the movement may allow unconscious processes to take over and control movement.

Limitations to this study were acknowledged by the authors. A significant difference in sex distribution between the 2 groups occurred and only short term effects of training were investigated. It was not possible to conclude whether differences between the groups were clinically significant or resulted in any functional difference.

Man, Morrissey, Cywinski (2007) Effect of neuromuscular electrical stimulation on ankle swelling in the early period after ankle sprain. Physical therapy 87 (1) p 53 PMID 17179442

This study evaluated the effectiveness of neuromuscular electrical stimulation (NMES) in the treatment of swelling associated with acute ankle sprain. 34 subjects were randomly assigned to NMES treatment, a control group receiving submotor electrical stimulation (ES), and a sham treatment group.

A summary is given of the mechanisms by which NMES is thought to have an effect on oedema. Muscle contractions have a mechanical effect that compresses venous and lymphatic vessels increasing venous return and lymphatic flow. In addition there may be an effect on the interstitial hydrostatic pressure components of fluid exchange affecting oedema formation and resolution.

Outcome measures were ankle-foot volume, ankle girth, and self-assessed ankle function tested on 3 occasions within 5 days of injury.

No statistically significant differences among the groups for ankle-foot volume and self-assessed ankle function were found. Ankle girth measurements were shown to be statistically significant for the NMES group but not for the other 2 groups. However this may not be clinically significant as baseline ankle girth values were significantly different between groups.

The treatment parameters for NMES used in this study are fully described and the results indicate that NMES is not effective in reducing ankle-foot volume or increasing self-assessed ankle function in this study. However the authors acknowledge that many different parameters are used in clinical practice and the results of this study are therefore only applicable to NMES as applied in this study.

The small sample size could have further contributed to the negative findings of this study. Power calculations demonstrate the study to be of low power and the authors point out this needs taking into consideration when interpreting the results to be non significant.

The authors recommend areas for further research including NMES with different treatment parameters and the use of submotor electrical stimulation. Some animal studies suggest swelling due to increased capillary permeability, as is the case with injury may respond better to submotor ES which is thought to reduce micro vessel permeability reducing the amount of fluid accumulating the interstitial spaces. Another theory suggested is an electrophoretic phenomenon where negatively charged current repels negatively charged serum proteins, causing a fluid shift and reducing Oedema

Lempainen, Sarimo, Mattila, Heikkila, Orava, Puddu (2007) Distal tears of the hamstring muscles: review of the literature and our results of surgical treatment. British journal of sports medicine 41 (2) p80-3

This is an evaluation of surgical treatment for distal hamstring tears in 18 athletes aged between 18 and 40. Diagnosis was based on the history, clinical examination and imaging findings. Subjects complained of weak knee flexion, pain, stiffness, muscle cramps and spasms in the posterior aspect of distal thigh. Those patients with a complete distal hamstring tear also reported a feeling of instability at the knee.

Clinical examination revealed weakness of knee flexion and pain and tenderness of the distal thigh. Patients with an acute injury had localised swelling and haematoma of the distal posterior thigh. A proximally retracted muscle belly and a palpable defect were present in five patients with a complete

rupture. The preoperative diagnosis was confirmed by either magnetic resonance imaging (MRI) or ultrasound.

Injuries ranged from 5 days to 6 years old and patients were followed up for between 12–78 months following surgery. In 15 cases the tear was located at the musculotendinous junction. In 2 cases there was an avulsion of the biceps femoris tendon and in one case a longitudinal tear was present at the tendinous part of the biceps femoris muscle.

Severity of distal hamstring injury can be difficult to assess by clinical examination alone and diagnostic imaging was used in addition to clinical examination in this study. The authors recommend MRI should be used to aide decision making regarding treatment.

Following surgery 14 of the athletes were able to return to the pre-injury level of sports.

The authors suggest surgical treatment is beneficial in selected cases of distal hamstring tears. However no studies have been done comparing surgical with conservative treatment.

Chouliaras, Ristansi, Moraiti, Stergiou, Georgoulis (2007). Effectiveness of reconstruction of the anterior cruciate ligament with quadrupled hamstrings and bone-patellar tendon bone autografts: an in vivo study comparing tibial internal-external rotation. American journal of sports medicine 35 (2) p189-96

This study used an optoelectronic motion capture system with markers placed on selected bony landmarks of the lower limbs and the pelvis to assess the amount of tibial roatation occurring in acl reconstructed knees when ascending-descending and pivoting on a stairwell consisting of 3 consecutive steps.

The aim was to establish whether there was any difference between hamstring tendon and patellar tendon graft in the amount of tibial rotation occurring during demanding activities

Both groups had significantly increased tibial rotation when compared with the controls and the authors conclude that neither of the 2 most frequently used grafts for ACL reconstruction restore tibial rotation to normal levels.

Upper limb

Tonks, Pai, Murali (2007) Steroid Injection Therapy is the Best Conservative Treatment for Lateral Epicondylitis: A Prospective Randomised Controlled Trial. Int J Clin Pract. 61(2) p240-246.

<http://www.medscape.com/viewarticle/552229>

This is an RCT comparing a watch and wait policy, physiotherapy alone, steroid injection alone, and physiotherapy plus steroid injection combined, for the treatment of tennis elbow.

48 patients were randomised to one of four treatment groups

- Group 1: no treatment/observation only.
- Group 2: injection therapy only.
- Group 3: physiotherapy.
- Group 4: injection plus physiotherapy

Injection consisted of a single injection of 10 mg of triamcinolone acetonide and 2% lignocaine hydrochloride made up to a volume of 1 ml into the symptomatically tender region of the common extensor origin.

Physiotherapy consisted of progressive slow, repetitive wrist and forearm stretching and muscle conditioning exercises.

Outcome measures were pain free grip strength (PFGS), extensor weight strength (measured with the patient's forearm supported on a table taking the wrist from full flexion into full extension) and the Patient Related Forearm Evaluation Questionnaire (PRFEQ).

The PRFEQ is a validated tennis elbow disability questionnaire. However the authors state this has now been superseded by the Patient Related Tennis Elbow Evaluation (PRTEE). References for both of these measurement tools are given in the article.

Outcome measures utilised in this study have been demonstrated to be reliable and sensitive to change.

Patients receiving steroid injection were statistically significantly better for all outcome measures at the 7-week follow up suggesting that steroid injections are the best option in the short term for patients with tennis elbow.

This study found no interaction between injection and physiotherapy, no additional benefit being derived from combining steroid injection and physiotherapy.

The authors acknowledge that the small sample size, high drop out rate of patients who had physiotherapy treatment and short follow up period are a potential weakness of this study.

Other studies of tennis elbow have not been able to demonstrate statistically significant treatment effects between groups at 12-month follow up, suggesting patients with tennis elbow improve at 12 months whether or not they have had treatment, reflecting the underlying natural history of this condition.

This study also highlights that corticosteroid can be transferred iontophoretically into all tissue layers down to and including tendinous structures. This involves local tissue concentrations of corticosteroid lower than those achieved with injection. This therapy is non-invasive, safe, effective and painless which may be more acceptable to patients.