

Collected Scientific Research Relating to the Use of Osteopathy with Sporting injuries and recovery

Important:

1) Osteopathy involves helping people's own self-healing abilities to work better, rather than focussing primarily on particular conditions.

2) Each person is different, and osteopathy treats them differently.

Therefore people respond to osteopathic treatment in different ways. Treatments that work for one person cannot be guaranteed to work for another person in the same way. The fact that there is scientific research supporting a treatment in a group of people does not mean that it will always work in the same way (which is probably true of all research).

A number of things make research into osteopathy challenging. These include the two aspects of osteopathy mentioned above, and also the lack of major commercial interests to provide funding in expectation of financial returns. At the same time, there is an emerging body of research demonstrating the usefulness of osteopathic treatment.

Please note: there is room for debate about the classifications used for these studies. Please let John Smartt know if you believe that any of these classifications are incorrect.

These studies are from peer-reviewed journals

Number of studies: 31

Clinically and statistically significant results

Number of studies: 28

Systematic reviews

Number of studies: 2

Majewski-Schrage T, Snyder K 2016 **The Effectiveness of Manual Lymphatic Drainage in Patients With Orthopedic Injuries.** J Sport Rehabil Feb;25(1):91-7 <http://www.ncbi.nlm.nih.gov/pubmed/26458244>

"CLINICAL SCENARIO: Managing edema after trauma or injury is a primary concern for health care professionals, as it is theorized that delaying the removal of edema will increase secondary injury and result in a longer recovery period. The inflammatory process generates a series of events, starting with bleeding and ultimately leading to fluid accumulation in intercellular spaces and the formation of edema. Once edema is formed, the lymphatic system plays a tremendous role in removing excess interstitial fluid and returning the fluid to the circulatory system.

Therefore, rehabilitation specialists ought to use therapies that enhance the uptake of edema via the lymphatic system to manage edema; however, the modalities commonly used are ice, compression, and elevation. Modalities such as these may be effective at preventing swelling but present limited evidence to suggest that the function of the lymphatic system is enhanced. Manual lymphatic drainage (MLD) is a manual therapy technique that assists the lymphatic system function by promoting variations in interstitial pressures by applying light pressure using different hand movements."

"The literature was searched for level 2 evidence or higher that investigated the effects of MLD techniques on patients with orthopedic injuries.

- A systematic review was published in 2009 that examined the evidence to support MLD techniques in sports medicine. The review included 2 level 1 studies and 1 level 2 study⁸⁻¹⁰ that compared outcomes after MLD treatments with a control treatment. The findings revealed significant decreases in edema and pain,⁸ volume,⁹ and aspartate aminotransferase and lactate dehydrogenase¹⁰ in patients who received MLD treatment compared with those who received the control treatment.

- The literature search revealed 4 possible studies related to the clinical question that were not included in the systematic review published in 2009. One study was excluded because it was rated as level 4 evidence, using 5 participants in a single-subject A-B design. Therefore, 3 met the inclusion criteria¹²⁻¹⁴ and were included."

"There is moderate evidence to support the use of MLD techniques for improving patient- and disease-oriented outcomes, including edema, range of motion, and activities of daily living in patients with orthopedic injuries. Patients who received MLD treatment experienced significant improvements in at least 1 outcome in all 3 studies. Those who did not receive MLD also experienced significant improvements in other measured outcomes. Due to the lack of homogeneity between studies, we cannot conclude that MLD is superior over no treatment; however, it may help decrease edema and increase range of motion and activities of living. Strength of Recommendation: Level 2 evidence⁶ supports the use of MLD for improving both patient- and disease-oriented outcomes for orthopedic conditions."

Vairo GL, Miller SJ, McBrier NM, Buckley WE. 2009 **Systematic review of efficacy for manual**

lymphatic drainage techniques in sports medicine and rehabilitation: an evidence-based practice approach. J Man Manip Ther 17(3):e80-9. <http://www.ncbi.nlm.nih.gov/pubmed/20046617>

"When combined with concomitant musculoskeletal therapy, pilot and case studies demonstrate MLDT [manual lymphatic drainage technique]'s effectiveness. The best evidence suggests that efficacy of MLDT in sports medicine and rehabilitation is specific to resolution of enzyme serum levels associated with acute skeletal muscle cell damage as well as reduction of edema following acute ankle joint sprain and radial wrist fracture. "

Other reviews

Number of studies: 1

Bolin DJ 2010 **The application of osteopathic treatments to pediatric sports injuries.** *Pediatr Clin North Am* Jun;57(3):775-94 <https://www.ncbi.nlm.nih.gov/pubmed/20538156>

"The application of manual techniques to pediatric athletic injuries has been considered alternative medicine. There are many injuries that are associated with loss of normal motion. Altered biomechanics can be readily identified and treated using manual methods. These include articular or thrust techniques, muscle energy, strain-counterstrain, and myofascial treatments, among others. Although there are few high-quality studies available, most available literature reports effectiveness of manual techniques in combination with therapeutic exercise for common pediatric motion restrictions."

Randomised controlled trials

Number of studies: 14

Bakar Y, Coknaz H, Karlı Ü, Semsek Ö, Serin E, Pala ÖO 2015 **Effect of manual lymph drainage on removal of blood lactate after submaximal exercise.** *J Phys Ther Sci* Nov;27(11):3387-91 <http://www.ncbi.nlm.nih.gov/pubmed/26696704>

"[Purpose] It has been well-established that exercise-induced muscle damage occurs following intense exercise. Massage is commonly used to manage muscle damage resulting from exercise. However the effect of massage after exercise is still not clear. The purpose of this study was to examine the effect of manual lymph drainage on muscle damage and on the removal of blood lactate following submaximal exercise (SE), as part of a solution to the challenging problem in sports medicine of muscular recovery after exercise. [Subjects and Methods] Eighteen healthy male students, with moderate exercise training, were randomly assigned to either receive manual lymph drainage (MLD) or serve as controls. Both groups were subjected to a graded exercise test, performed on a treadmill ergometer, to determine each subject's individual anaerobic threshold (IAT). Seven days later, all subjects were made to run for 30 minutes on the same treadmill ergometer, at a running speed equivalent to the IAT. One group received MLD treatment, while the control subjects received no treatment. [Results] Following an increase immediately after exercise, lactic acid (LA) and lactate dehydrogenase (LDH) serum levels dropped rapidly and significantly at the end of MLD application and two hours after SE in the subjects receiving MLD. The course of creatine kinase (CK) and myoglobin levels was comparable, and with myoglobin showing a significant difference at 2 h after SE, and CK at 24 h after SE. [Conclusion] Manual lymph drainage after SE correlated with a more rapid fall in LA and of the muscular enzymes of LDH, CK and myoglobin, and may have resulted in an improvement in the regenerative processes elicited by structural damage to the muscle cells"

Ajimsha MS, Binsu D, Chithra S 2014 **Effectiveness of myofascial release in the management of plantar heel pain: a randomized controlled trial.** *Foot (Edinb)* Jun;24(2):66-71 <http://www.ncbi.nlm.nih.gov/pubmed/24703512>

"Previous studies have reported that stretching of the calf musculature and the plantar fascia

are effective management strategies for plantar heel pain (PHP). However, it is unclear whether myofascial release (MFR) can improve the outcomes in this population.

OBJECTIVE:

To investigate whether myofascial release (MFR) reduces the pain and functional disability associated with plantar heel pain (PHP) in comparison with a control group receiving sham ultrasound therapy (SUST).

DESIGN:

Randomized, controlled, double blinded trial.

SETTING:

Nonprofit research foundation clinic in India.

METHOD:

Sixty-six patients, 17 men and 49 women with a clinical diagnosis of PHP were randomly assigned into MFR or a control group and given 12 sessions of treatment per client over 4 weeks. The Foot Function Index (FFI) scale was used to assess pain severity and functional disability. The primary outcome measure was the difference in FFI scale scores between week 1 (pretest score), week 4 (posttest score), and follow-up at week 12 after randomization.

Additionally, pressure pain thresholds (PPT) were assessed over the affected gastrocnemii and soleus muscles, and over the calcaneus, by an assessor blinded to the treatment allocation.

RESULTS:

The simple main effects analysis showed that the MFR group performed better than the control group in weeks 4 and 12 ($P < 0.001$). Patients in the MFR and control groups reported a 72.4% and 7.4% reduction, respectively, in their pain and functional disability in week 4 compared with that in week 1, which persisted as 60.6% in the follow-up at week 12 in the MFR group compared to the baseline. The mixed ANOVA also revealed significant group-by-time interactions for changes in PPT over the gastrocnemii and soleus muscles, and the calcaneus ($P < 0.05$).

CONCLUSIONS:

This study provides evidence that MFR is more effective than a control intervention for PHP"

Saban B, Deutscher D, Ziv T 2014 **Deep massage to posterior calf muscles in combination with neural mobilization exercises as a treatment for heel pain: a pilot randomized clinical trial.** *Manual Therapy* Apr;19(2):102-8 <http://www.ncbi.nlm.nih.gov/pubmed/24090993>

"Plantar heel pain syndrome (PHPS) is a common foot disorder; however, there is limited clinical evidence on which to base treatment. Repeated clinical observations indicating heel pain during heel rise and mini squat on the affected leg, involving activation of posterior calf muscles, formed the basis of this study.

OBJECTIVE:

To compare deep massage therapy to posterior calf muscles and neural mobilization with a self-stretch exercise program (DMS) to a common treatment protocol of ultrasound therapy to the painful heel area with the same self-stretch exercises (USS).

METHODS:

Patients with PHPS were assigned to a program of 8 treatments over a period of 4-6 weeks in a single-blind randomized clinical trial. Functional status (FS) at admission and discharge from therapy as measured by the Foot & Ankle Computerized Adaptive Test was the main outcome measure.

RESULTS:

Sixty-nine patients were included in the trial (mean age 53, standard deviation (SD) 13, range 25-86, 57% women), 36 received DMS treatment and 33 with USS. The overall group-by-time interaction for the mixed-model analysis of variance (ANOVA) was found statistically significant ($p = 0.034$), with a change of (mean (confidence interval, CI)) 15 (9-21) and 6 (1-11) FS points for the DMS and USS groups, respectively.

CONCLUSIONS:

Data indicated that both treatment protocols resulted in an overall short-term improvement, however, DMS treatment was significantly more effective in treating PHPS than USS treatment."

Ebert JR, Joss B, Jardine B, Wood DJ. 2013 **Randomized trial investigating the efficacy of manual lymphatic drainage to improve early outcome after total knee arthroplasty.** *Arch Phys Med Rehabil* Nov;94(11):2103-11 <http://www.ncbi.nlm.nih.gov/pubmed/23810354>

"To investigate the efficacy of manual lymphatic drainage (MLD) in the early postoperative period after total knee arthroplasty (TKA) to reduce edema and pain and improve knee range of motion."

"Prospective randomized controlled trial."

"A significant group effect was observed for active knee flexion, with post hoc tests demonstrating a significantly greater active knee flexion in the MLD group when compared with the control (no MLD) group at the final measure prior to hospital discharge (day 4 postsurgery) and at 6 weeks postsurgery. There were no further group effects observed for the remaining patient-reported and functional outcomes."

"MLD in the early postoperative stages after TKA appears to improve active knee flexion up to 6 weeks postsurgery, in addition to conventional care."

Knygsand-Roehoej K, Maribo T. 2011 **A randomized clinical controlled study comparing the effect of modified manual edema mobilization treatment with traditional edema technique in patients with a fracture of the distal radius.** J Hand Ther Jul-Sep;24(3):184-93; quiz 194 <http://www.ncbi.nlm.nih.gov/pubmed/21193287>

"A statistically significant improvement was observed in ADL [activities of daily living] after three weeks after inclusion ($p=0.03$) in the modified MEM [manual edema mobilisation] group compared with the control group. Furthermore, fewer edema treatment sessions were needed ($p=0.03$) in the modified MEM group. At six weeks, we observed a difference between the two groups' needs for further edema treatment ($p=0.04$)."

Moore SD, Laudner KG, McLoda TA, Shaffer MA 2011 **The immediate effects of muscle energy technique on posterior shoulder tightness: a randomized controlled trial.** J Orthop Sports Phys Ther Jun;41(6):400-7 <http://www.ncbi.nlm.nih.gov/pubmed/21471651>

"Randomized controlled trial.

OBJECTIVES:

To compare a muscle energy technique (MET) for the glenohumeral joint (GHJ) horizontal abductors and an MET for the GHJ external rotators to improve GHJ range of motion (ROM) in baseball players.

BACKGROUND:

Overhead athletes often exhibit loss of GHJ ROM in internal rotation, which has been associated with shoulder pathology. Current stretching protocols aimed at improving flexibility of the posterior shoulder have resulted in inconsistent outcomes. Although utilization of MET has been hypothesized to lengthen tissue, there are limited empirical data describing the effectiveness of such stretches for treating posterior shoulder tightness.

METHODS:

Sixty-one Division I baseball players were randomly assigned to 1 of 3 groups: MET for the GHJ horizontal abductors ($n = 19$), MET for the GHJ external rotators ($n = 22$), and control ($n = 20$). We measured preintervention and postintervention GHJ horizontal adduction and internal rotation ROM, and conducted analyses of covariance, followed by Tukey honestly significant difference post hoc analysis for significant group-by-time interactions ($P < .05$).

RESULTS:

The group treated with the MET for the horizontal abductors had a significantly greater increase in GHJ horizontal adduction ROM postintervention (mean \pm SD, $6.8^\circ \pm 10.5^\circ$) compared to the control group ($-1.1^\circ \pm 6.8^\circ$) ($P = .011$) and a greater increase in internal rotation ROM postintervention ($4.2^\circ \pm 5.3^\circ$) compared to the group treated with the MET for the external rotators ($0.2^\circ \pm 6.3^\circ$) ($P = .020$) and the control group ($-0.2^\circ \pm 4.0^\circ$) ($P = .029$). No significant differences among groups were found for any other variables ($P > .05$).

CONCLUSION:

A single application of an MET for the GHJ horizontal abductors provides immediate improvements in both GHJ horizontal adduction and internal rotation ROM in asymptomatic collegiate baseball players. Application of MET for the horizontal abductors may be useful to gain ROM in overhead athletes."

Arienti C, Daccò S, Piccolo I, Redaelli T 2011 **Osteopathic manipulative treatment is effective on pain control associated to spinal cord injury**. Spinal Cord Apr;49(4):515-9 <http://www.ncbi.nlm.nih.gov/pubmed/21135862>

"We enrolled 47 patients with SCI [spinal cord injury], 26 with pain of both nociceptive and neuropathic origin, and 21 with pure neuropathic pain. In all, 33 patients had a complete spinal cord lesion (ASIA level A) and 14 had incomplete lesion (ASIA level B, C and D). The patients were subdivided in a pharmacological group (Ph), a pharmacological osteopathic (PhO) group and a osteopathic (Os) group. The verbal numeric scale (VNS) was used at various time intervals to evaluate treatment outcomes."

"Ph patients reached a 24% improvement in their pain perception, assessed by the VNS scale after 3 weeks of treatment, whereas Os patients reached a 16% improvement in their pain perception for the same weeks. Both treatments per se failed to induce further improvements at later time points. In contrast, the combination of the two approaches yielded a significantly better pain relief both in patients with nociceptive or pure neuropathic pain in the PhO group."

"Our results suggest the OMT is a feasible approach in patients in whom available drugs cannot be used. Moreover, a benefit can be expected by the association of OMT in patients treated according to existing pharmacological protocols."

Picelli A, Ledro G, Turrina A, Stecco C, Santilli V, Smania N. 2011 **Effects of myofascial technique in patients with subacute whiplash associated disorders: a pilot study**. Eur J Phys Rehabil Med Dec;47(4):561-8 <http://www.ncbi.nlm.nih.gov/pubmed/21796089>

"The Fascial Manipulation© technique may be a promising method to improve cervical range of motion in patients with subacute whiplash associated disorders.

CLINICAL REHABILITATION IMPACT: Myofascial techniques may be useful for improving treatment of subacute whiplash associated disorders also reducing their economic burden."

Arroyo-Morales M, Olea N, Martinez M, Moreno-Lorenzo C, Díaz-Rodríguez L, Hidalgo-Lozano A 2008 **Effects of myofascial release after high-intensity exercise: a randomized clinical trial**. J Manipulative Physiol Ther Mar;31(3):217-23 [https://www.jmptonline.org/article/S0161-4754\(08\)00032-8/fulltext](https://www.jmptonline.org/article/S0161-4754(08)00032-8/fulltext)

"Objective

The usefulness of massage as a recovery method after high-intensity exercise has yet to be established. We aimed to investigate the effects of whole-body massage on heart rate variability (HRV) and blood pressure (BP) after repeated high-intensity cycling exercise under controlled and standardized pretest conditions.

Methods

The study included 62 healthy active individuals. After baseline measurements, the subjects performed standardized warm-up exercises followed by three 30-second Wingate tests. After completing the exercise protocol, the subjects were randomly assigned to a massage (myofascial release) or placebo (sham treatment with disconnected ultrasound and magnetotherapy equipment) group for a 40-minute recovery period. Holter recording and BP measurements were taken after exercise protocol and after the intervention.

Results

After the exercise protocol, both groups showed a significant decrease in normal-to-normal interval, HRV index, diastolic BP ($P > .001$), and low-frequency domain values ($P = .006$). After the recovery period, HRV index ($P = .42$) and high-frequency (HF) ($P = .94$) values were similar to baseline levels in the massage group, whereas the HRV index tended ($P = .05$) to be lower and the HF was significantly ($P < .01$) lower vs baseline values in the placebo group, which also showed a tendency ($P = .06$) for HF to be lower than after the exercise. Likewise, diastolic BP returned to baseline levels in the massage group ($P = .45$) but remained lower in the placebo group ($P = .02$).

Conclusion

Myofascial release massage favors the recovery of HRV and diastolic BP after high-intensity exercise (3 Wingate tests) to preexercise levels."

Schillinger A, Koenig D, Haefele C, Vogt S, Heinrich L, Aust A, Birnesser H, Schmid A 2006 **Effect of manual lymph drainage on the course of serum levels of muscle enzymes after treadmill exercise.** Am J Phys Med Rehabil Jun;85(6):516-20 <http://www.ncbi.nlm.nih.gov/pubmed/16715021>

"OBJECTIVE:

Improving muscular recovery after exercise is an important topic in sports medicine. The aim of the present study was to evaluate the effect of manual lymph drainage on the course of serum levels of muscle enzymes after an extended treadmill exercise.

DESIGN:

Fourteen recreational athletes (seven women, seven men) were included in the study. The participants underwent a graded exercise test on a treadmill ergometer to determine the individual anaerobic threshold (IAT). Seven days after the graded exercise test, all subjects performed 30 mins of treadmill exercise at an intensity equivalent to IAT. The subjects were randomized into two groups of seven persons. One group was treated with manual lymph drainage (ML), whereas the control group (CG) received no treatment after the endurance exercise at IAT level.

RESULTS:

After an increase immediately after exercise, a fast decrease in lactate dehydrogenase (LDH) and in aspartate aminotransferase (AST) concentration was observed, with significantly lower values for LDH after 48 hrs in the subjects having received lymph drainage treatment. The course of creatine kinase (CK) levels was comparable, but did not reach significance."

van den Dolder PA, Roberts DL 2006 **Six sessions of manual therapy increase knee flexion and improve activity in people with anterior knee pain: a randomised controlled trial.** Aust J Physiother 52(4):261-4 <http://www.ncbi.nlm.nih.gov/pubmed/17132120>

"Randomised controlled trial"

"Pain was measured using the Patellofemoral Pain Severity Questionnaire. Active knee flexion and extension was measured from photographs. Activity was measured by having the participants step up and down a 15 cm step, leading with the painful leg as many times as they could in a 60 second period. Measurements were taken before and after intervention by a blinded assessor."

"The experimental group decreased their pain by -8 mm (95% CI to 1 p = 0.08) and pain on stairs by -10, (95% CI -22 to 2 p = 0.10) compared with the control group. They increased their active knee flexion by 10 deg (95% CI TO 16, p = 0.004) and the number of steps in 60 seconds by 5 (95% CI 2 TO 8, p = 0.001) compared with the control group.

CONCLUSION:

Manual therapy is effective improving knee flexion and stair climbing i patients with anterior knee pain. There is a trend towards a small improvement in pain."

Eisenhart AW, Gaeta TJ, Yens DP. 2003 **Osteopathic manipulative treatment in the emergency department for patients with acute ankle injuries.** J Am Osteopath Assoc Sep;103(9):417-21 <http://www.ncbi.nlm.nih.gov/pubmed/14527076>

"The purpose of this study was to evaluate the efficacy of osteopathic manipulative treatment (OMT) as administered in the emergency department (ED) for the treatment of patients with acute ankle injuries."

"Patients aged 18 years and older with unilateral ankle sprains were randomly assigned either to an OMT study group or a control group. Independent outcome variables included edema, range of motion (ROM), and pain. Both groups received the current standard of care for ankle sprains and were instructed to return for a follow-up examination. Patients in the OMT study group also received one session of OMT from an osteopathic physician."

"Patients in the OMT study group had a statistically significant (F = 5.92, P = .02) improvement in edema and pain and a trend toward increased ROM immediately following intervention with OMT. Although at follow-up both study groups demonstrated significant improvement, patients in the OMT study group had a statistically significant improvement in ROM when compared with patients in the control group."

"Data clearly demonstrate that a single session of OMT in the ED can have a significant effect in the management of acute ankle injuries."

Härén K, Backman C, Wiberg M 2000 **Effect of manual lymph drainage as described by Vodder on oedema of the hand after fracture of the distal radius: a prospective clinical study.** *Scand J Plast Reconstr Surg Hand Surg* Dec;34(4):367-72 <http://www.ncbi.nlm.nih.gov/pubmed>

"The aim of this study was to evaluate the efficacy of manual lymph drainage, as described by Vodder, in reducing oedema in the hand after a traumatic injury. During a period of 10 months in 1996-7, a total of 26 consecutive patients with a fracture of the distal radius that was treated by external fixation were included in the study. Patients were randomised into an experimental (n = 12) and a control group (n = 14). Treatment started 11 days after application of the external fixator. All patients had the same conventional treatment with exercises, movement, oedema control, and education. The experimental group was given 10 treatments of manual lymph drainage in addition. Oedema was measured four times with the volumeter, and the injured hand was always compared with the uninjured one. The first measurement was made three days after removal of the external fixation. The difference in hand volume showed that the experimental group had significantly less oedema in the injured hand. This result indicates that manual lymph drainage is a useful method for reducing post-traumatic oedema in the hand."

Yeo HK, Wright A 2011 **Hypoalgesic effect of a passive accessory mobilisation technique in patients with lateral ankle pain.** *Manual Therapy* Aug;16(4):373-7 <https://www.ncbi.nlm.nih.gov/pubmed/21285003>

"A randomised, double blind, repeated measures study was conducted to investigate the initial effects of an accessory mobilisation technique applied to the ankle joint in 13 patients with a unilateral sub-acute ankle supination injury. Ankle dorsiflexion range of motion, pressure pain threshold, visual analogue scale rating of pain during functional activity and ankle functional scores were assessed before and after application of treatment, manual contact control and no contact control conditions. There were significant improvements in ankle dorsiflexion range of motion (p = 0.000) and pressure pain threshold (p = 0.000) during the treatment condition. However no significant effects were observed for the other measures. These findings demonstrate that mobilisation of the ankle joint can produce an initial hypoalgesic effect and an improvement in ankle dorsiflexion range of motion."

Other controlled clinical trials

Number of studies: 4

Vieira TM, Readi NG, Schwarcke L, Botter A 2015 **The effect of lymph drainage on the myoelectric manifestation of vastus lateralis fatigue: Preliminary results.** *Conf Proc IEEE Eng Med Biol Soc* Aug;2015:6671-4 <http://www.ncbi.nlm.nih.gov/pubmed/26737823>

"Variations in surface electromyograms (EMGs) collected from the vastus lateralis muscle during isometric fatiguing contractions were investigated pre-post lymphatic drainage (intervention group, N=3) and pre-post rest (control group, N=3). The slope of conduction velocity and of EMG amplitude and spectral descriptors was computed from the start to the failure time; the instant after which subjects could not endure contractions. When compared to subjects in the control group, those in the intervention group endured longer. Similarly, muscle fatigue affected to a lesser extent EMGs following lymphatic drainage than following rest. These preliminary results suggest the lymphatic drainage may potentially delay muscle fatigue."

Schwerla F, Kaiser AK, Gietz R, Kastner R. 2013 **Osteopathic treatment of patients with long-term sequelae of whiplash injury: effect on neck pain disability and quality of life.** *The Journal of Alternative and Complementary Medicine* Jun;19(6):543-9 <http://www.ncbi.nlm.nih.gov/pubmed/23273259>

This was a time-series study, where there may not have been adequate control for the effects of natural recovery over time.

"The clinical sequelae and manifestation resulting from whiplash injury are defined as late whiplash syndrome (LWS). The objective of this study was to investigate whether a series of osteopathic treatments of patients with LWS may improve their symptoms."

"The study was designed as a two-phase (pre-post) clinical intervention study. In phase one, the patients received no treatment for 6 weeks; in phase two, they received five test-dependent osteopathic treatments."

"A direct comparison between the untreated period and the treatment period revealed clinically relevant and statistically significant improvements in the osteopathic treatment period for the NPAD. In the intervention phase, the NPAD dropped from 41.5 to 26.0 points, which corresponds to an improvement of 37% (95% confidence interval=11.1-19.8; $p < 0.0005$). For the SF-36, both the physical and the mental component summary showed a significant and substantial improvement during treatment phase ($p = 0.009$ versus $p = 0.02$). Prior to treatment, 17 patients (43.6%) were diagnosed with a positive PTSD; this number fell to only 6 (15.4%) during observation."

"Five (5) osteopathic treatments had a beneficial effect on the physical as well as the mental aspects of LWS and lives up to its claim of being a complementary modality in the treatment regimen of this condition. Based on these preliminary findings, rigorous randomized controlled studies are warranted."

Kessler T, de Bruin E, Brunner F, Vienne P, Kissling R. 2003 **Effect of manual lymph drainage after hindfoot operations**. *Physiother Res Int* 8(2):101-10 <http://klosetraining.com/wp-content/uploads/2013/10/Effect-of-MLD-after-Hindfoot-Operations-Physiotherapy-Research-InternationalKessler-et-al-2003.pdf>

"BACKGROUND AND PURPOSE: Manual lymph drainage therapy is often prescribed following hindfoot operations. However, the relative efficacy of this treatment component has not yet been determined.

METHOD: A two-group pre-test-post-test study design was used in this preliminary randomized clinical trial of 23 subjects who underwent hindfoot surgery. Patients were randomly assigned into two groups: an intervention group of 11 patients who received standard physiotherapy plus manual lymph drainage; and a control group of 12 patients who received standard physiotherapy but no lymph drainage. The main outcome measure was the percentage reduction in excess limb volume, measured by the water displacement method at the second post-operative day (t1) and at the day of discharge (t2).

RESULTS: Compared to the control group, a significant reduction in post-operative swelling was measured in the intervention group only ($p = 0.011$).

CONCLUSIONS: Application of lymph drainage techniques after hindfoot operations, in combination with standard physiotherapy exercises, achieves greater limb volume reduction than exercise alone. The present study offers an insight into a treatment that may shorten rehabilitation and thereby control the cost of caring for post-operative treatment complicated by post-operative swelling."

Yu IY, Jung IG, Kang MH, Lee DK, Oh JS 2015 **Immediate effects of an end-range mobilization technique on shoulder range of motion and skin temperature in individuals with posterior shoulder tightness**. *J Phys Ther Sci Jun*;27(6):1723-5 <https://www.ncbi.nlm.nih.gov/pubmed/26180306>

"This study investigated the effects of an end-range mobilization technique on the range of motion of the glenohumeral internal rotation and the skin temperature of the shoulder in individuals with posterior shoulder tightness. [Subjects] Thirteen subjects with posterior shoulder tightness who had glenohumeral internal rotation deficit $\geq 15^\circ$ participated. [Methods] All subjects underwent glenohumeral joint end-range mobilization intervention. The internal rotation range of motion of the glenohumeral joint was measured by a goniometer and the shoulder skin temperature was measured by a digital infrared thermographic imaging device before and immediately after the intervention. Paired t-tests were used to analyze the differences in these

parameter pre and post-intervention. [Results] The glenohumeral internal rotation range of motion and skin temperature of the posterolateral shoulder increased significantly post-intervention. [Conclusion] The end-range mobilization technique is effective for increasing the glenohumeral internal rotation range of motion and skin temperature of the shoulder in individuals with posterior shoulder tightness."

Cohort studies

Number of studies: 2

Chiarotto A, Fortunato S, Falla D 2015 **Predictors of outcome following a short multimodal rehabilitation program for patients with whiplash associated disorders.** Eur J Phys Rehabil Med Apr;51(2):133-41 <http://www.ncbi.nlm.nih.gov/pubmed/24896143>

"Patients with whiplash associated disorders (WAD) may present with physical and psychological symptoms which persist long after the initial onset of pain. Several studies have shown that therapeutic exercise for motor and sensorimotor control combined with manual therapy in a multimodal rehabilitation (MMR) program is effective at improving pain and disability in patients with neck disorders. To date, no studies have investigated which self-reported physical or psychological symptoms are predictive of response to this MMR program." "After treatment, patients exhibited significant improvements in all evaluated outcomes (all $P < 0.01$). Regression models accounting for 35% and 36% of the variance in pain intensity outcomes included average pain intensity over the previous week and pain catastrophizing as significant predictors. Disability and pain catastrophizing were predictors of changes in disability following the MMR program explaining 49% of the variance in the model. Furthermore, higher PTSS at baseline was a significant predictor of PTSS after treatment, explaining 55% of the variance in the model. CONCLUSION: Improved outcomes on pain intensity, disability and PTSS following a MMR program could be partially predicted based on the patient's initial presentation."

Cashman GE, Mortenson WB, Gilbert MK. 2014 **Myofascial treatment for patients with acetabular labral tears: a single-subject research design study.** J Orthop Sports Phys Ther Aug;44(8):604-14 <http://www.ncbi.nlm.nih.gov/pubmed/25029918>

"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."

Case series

Number of studies: 1

Hidalgo-Lozano A, Fernández-de-las-Peñas C, Díaz-Rodríguez L, González-Iglesias J, Palacios-Ceña D, Arroyo-Morales M 2011 **Changes in pain and pressure pain sensitivity after manual treatment of active trigger points in patients with unilateral shoulder impingement: a case series.** Journal of Bodywork and Movement Therapies Oct;15(4):399-404 http://www.researchgate.net/publication/51670726_Changes_in_pain_and_pressure_pain_sensitivity_after_manual_treatment_of_active_trigger_points_in_patients_with_unilateral_shoulders_impingement_A_case_series

"The aim of this case series was to investigate changes in pain and pressure pain sensitivity after manual treatment of active trigger points (TrPs) in the shoulder muscles in individuals with unilateral shoulder impingement. Twelve patients (7 men, 5 women, age: 25 ± 9 years) diagnosed with unilateral shoulder impingement attended 4 sessions for 2 weeks (2 sessions/week). They received TrP pressure release and neuromuscular interventions over each active TrP that was found. The outcome measures were pain during arm elevation (visual analogue scale, VAS) and pressure pain thresholds (PPT) over levator scapulae, supraspinatus, infraspinatus, pectoralis major, and tibialis anterior muscles. Pain was captured pre-intervention and at a 1-month follow-up, whereas PPT were assessed pre- and post-treatment, and at a 1-month follow-up. Patients experienced a significant ($P < 0.001$) reduction in pain after treatment (mean \pm SD: 1.3 ± 0.5) with a large effect size ($d > 1$). In addition, patients also experienced a significant increase in PPT immediate after the treatment ($P < 0.05$) and one month after discharge ($P < 0.01$), with effect sizes ranging from moderate ($d = 0.4$) to large ($d > 1$). A significant negative association ($r(s) = -0.525$; $P = 0.049$) between the increase in PPT over the supraspinatus muscle and the decrease in pain was found: the greater the decrease in pain, the greater the increase in PPT. This case series has shown that manual treatment of active muscle TrPs can help to reduce shoulder pain and pressure sensitivity in shoulder impingement. Current findings suggest that active TrPs in the shoulder musculature may contribute directly to shoulder complaint and sensitization in patients with shoulder impingement syndrome, although future randomized controlled trials are required."

LeBeau RT, Nho SJ 2014 **The use of manual therapy post-hip arthroscopy when an exercise-based therapy approach has failed: a case report.** *J Orthop Sports Phys Ther* Sep;44(9):712-21 <http://www.ncbi.nlm.nih.gov/pubmed/25098193>

"BACKGROUND: Although there is a growing body of literature on both surgical intervention and postsurgical rehabilitation of acetabular labral repairs and femoroacetabular impingement, there is a paucity of information on how to manage individuals who show a lack of progress postsurgery.

CASE DESCRIPTION: A 30-year-old woman underwent surgical labral repair with femoroacetabular impingement osteochondroplasty. Postsurgery, she was initially treated with an exercise-based approach, but experienced an increase in hip pain and further decline in function. Her primary functional deficits were difficulty standing and pain (6/10) with ambulation. A combination of soft tissue mobilization and trigger point dry needling was used to address perceived muscle dysfunction, and nonthrust manipulation was used to address perceived hip joint hypomobility.

OUTCOMES: Following 12 therapy sessions over 120 days, the patient returned to her demanding occupation with minimal residual symptoms. By the end of the period of care, the patient's Harris hip score had improved from 56 to 96 and her Lower Extremity Functional Scale score had improved from 26 to 70. DISCUSSION: This case describes a multimodal manual therapy approach and the health outcomes of a patient following labral repair with femoroacetabular impingement decompression who did not respond to an initial exercise-based postsurgical rehabilitation approach. Level of Evidence Therapy, level 4."

Batt J, Neeki MM 2013 **Osteopathic manipulative treatment in tarsal somatic dysfunction: a case study.** *J Am Osteopath Assoc* Nov;113(11):857-61 <http://www.ncbi.nlm.nih.gov/pubmed/24174508>

"The authors present a case of a 24-year-old woman with left foot pain that began after an inversion injury obtained while running. The pain minimally improved with nonsteroidal anti-inflammatory medications. Clinical examination revealed a relatively normal foot with palpable changes in the bony structures at the midfoot consistent with a tarsal subluxation. Cuboid reduction was performed using high-velocity, low-amplitude manipulation, after which the patient reported immediate and near-complete pain relief. The authors also review mechanisms of injury, clinical findings, and treatment modalities for patients with tarsal subluxation."

Genese JS 2013 **Osteopathic manipulative treatment for facial numbness and pain after whiplash injury.** *J Am Osteopath Assoc* Jul;113(7):564-7 <http://www.ncbi.nlm.nih.gov/pubmed/23843380>

"Whiplash injury is often caused by rear-end motor vehicle collisions. Symptoms such as neck pain and stiffness or arm pain or numbness are common with whiplash injury. The author reports a case of right facial numbness and right cheek pain after a whiplash injury. Osteopathic manipulative treatment techniques applied at the level of the cervical spine, suboccipital region, and cranial region alleviated the patient's facial symptoms by treating the right-sided strain of the trigeminal nerve. The strain on the trigeminal nerve likely occurred at the upper cervical spine, at the nerve's cauda, and at the brainstem, the nerve's point of origin. The temporal portion of the cranium played a major role in the strain on the maxillary."

Case controlled studies

Number of studies: 1

Howell JN, Cabell KS, Chila AG, Eland DC 2006 **Stretch reflex and Hoffmann reflex responses to osteopathic manipulative treatment in subjects with Achilles tendinitis.** J Am Osteopath Assoc Sep;106(9):537-45 <http://www.ncbi.nlm.nih.gov/pubmed/17079523>

"The use of OMT [osteopathic manipulative therapy] produced a 23.1% decrease in the amplitude of the stretch reflex of the soleus ($P < .05$) in subjects with Achilles tendinitis. Similarly significant responses were measured in the lateral and medial heads of the gastrocnemius in OMT subjects. The H-reflex was not significantly affected by OMT. In control subjects, neither reflex was significantly affected by sham manipulative treatment. By using a rating scale on questionnaires before treatment and daily for 7 days posttreatment, OMT subjects indicated significant clinical improvement in soreness, stiffness, and swelling."

Mixed results (significant for some outcomes, not others)

Number of studies: 3

Randomised controlled trials

Number of studies: 2

Pichonnaz C, Bassin JP, Léclureux E, Christe G, Currat D, Aminian K, Jolles BM. 2016 **Effect of Manual Lymphatic Drainage After Total Knee Arthroplasty: A Randomized Controlled Trial.** Arch Phys Med Rehabil May;97(5):674-82 <https://www.ncbi.nlm.nih.gov/pubmed/26829760>

"To evaluate the effects of manual lymphatic drainage (MLD) on knee swelling and the assumed consequences of swelling after total knee arthroplasty (TKA).

DESIGN: Randomized controlled trial.

SETTING: Primary care hospital.

PARTICIPANTS: Two groups of 30 patients were randomized before TKA surgery (N=60; 65% women [39]; mean age, 70.7±8.8y; weight, 77.8±11.3kg; size, 1.64±0.08m; body mass index, 29.9±4.1kg/m²).

INTERVENTIONS: Participants received either 5 MLD treatments or a placebo, added to rehabilitation, in between the second day and the seventh day after surgery.

MAIN OUTCOME MEASURES: Swelling was measured by blinded evaluators before surgery and at second day, seventh day, and 3 months using bioimpedance spectroscopy and volume measurement. Secondary outcomes were active and passive range of motion, pain, knee function, and gait parameters.

RESULTS: At seventh day and 3 months, no outcome was significantly different between groups, except for the knee passive flexion contracture at 3 months, which was lower and less frequent in the MLD group (-2.6°; 95% confidence interval, -5.0° to -0.21°; $P = .04$; absolute risk reduction, 26.6%; 95% confidence interval, 0.9%-52.3%; number needed to treat, 4). The mean pain level decreased between 5.8 and 8.2mm on the visual analog scale immediately after MLD, which was significant after 4 of 5 MLD treatments.

CONCLUSIONS: MLD treatments applied immediately after TKA surgery did not reduce swelling. It reduced pain immediately after the treatment. Further studies should investigate whether the positive effect of MLD on knee extension is replicable"

Collins CK, Masaracchio M, Cleland JA 2014 **The effectiveness of strain counterstrain in the treatment of patients with chronic ankle instability: A randomized clinical trial.** J Man Manip Ther Aug;22(3):119-28 http://www.researchgate.net/publication/264832772_The_effectiveness_of_strain_counterstrain_in_the_treatment_of_patients_with_chronic_ankle_instability_A_randomized_clinical_trial

"Study Design:Randomized clinical trial.Objective:To determine the effect of strain counterstrain (SCS) on dynamic balance and subjective sense of instability in individuals with chronic ankle instability (CAI).Although many studies have been published on CAI, the cause for this common clinical dysfunction remains inconclusive. No studies have assessed the effectiveness of SCS on CAI.Methods:At baseline all participants completed a demographic questionnaire, the star excursion balance test (SEBT), and the foot and ankle ability measure (FAAM). Following the baseline evaluation, participants were randomized into the SCS experimental group (EG) (n513) or the sham SCS group (SG) (n514). All participants received the assigned treatment once a week for 4 weeks and participated in a prescribed exercise program. At week 4, all participants repeated the outcome measures and completed a global rating of change (GROC) form. The primary aim was examined with a two-way analysis of variance (ANOVA).Results:A significant group-by-time interaction was found for seven directions in the SEBT (P,0.031). For subjective measures, no significant group-by-time interaction was found for the FAAM (P.0.548), but the GROC revealed a significant difference (P50.014) in the mean score for the EG (3.92±1.66) when compared to the SG (2.43±1.66).Discussion:Although SCS may not have an effect on subjective ankle function in individuals with CAI, preliminary evidence suggests that SCS may lead to an improvement in dynamic ankle stability and the subjective sense of ankle instability"

Cohort studies

Number of studies: 1

Brumm LF, Janiski C, Balawender JL, Feinstein A. 2013 **Preventive osteopathic manipulative treatment and stress fracture incidence among collegiate cross-country athletes.** J Am Osteopath Assoc Dec;113(12):882-90 <http://www.ncbi.nlm.nih.gov/pubmed/24285030>

"There was a statistically significant decrease in the cumulative annual incidence of stress fractures in male, but not female, cross-country athletes after receiving OMT.[osteopathic manipulative treatment]"