Clinical Practice Guideline: **Extra-Spinal Joint Manipulation/Mobilization for the Treatment of Upper Extremity Musculoskeletal Conditions**

Date of Implementation: **May 15, 2014**

Product: **Specialty**

Table of Contents

GUIDELINES

American Specialty Health - Specialty (ASH) considers upper extremity (UE) joint manipulation/mobilization medically necessary as part of a multimodal treatment plan for the treatment of UE Musculoskeletal Conditions if supported by documentation (Refer to Documentation Requirements to Substantiate Medical Necessity).

Extra-Spinal Manipulation/Mobilization and the Scapulothoracic Articulation

The scapula is not typically treated with grade V manipulation / high-velocity, low amplitude thrust (HVLA) joint manipulation. This articulation, however, can be treated with mobilization (Grades I - IV). Therefore, mobilization of the scapula is better described as manual therapy (CPT code 97140). Mobilizing the scapula stretches the attaching

muscles and connective tissues. The scapula does not directly attach to the ribs. The scapula lies on top of the ribs and is connected by muscles and connective tissues.

Documentation Requirements to Substantiate Medical Necessity

"Medically necessary" or "medical necessity" shall mean health care services that a healthcare practitioner/provider, exercising prudent clinical judgment, would provide to a patient for the purpose of evaluating, diagnosing, or treating an illness, injury, disease or its symptoms, and that are (a) in accordance with generally accepted standards of medical practice; (b) clinically appropriate in terms of type, frequency, extent, site, and duration; and considered effective for the patient's illness, injury, or disease; and (c) not primarily for the convenience of the patient or healthcare provider, and not more costly than an alternative service or sequence of services at least as likely to produce equivalent therapeutic or diagnostic results as to the diagnosis or treatment of that patient's illness, injury, or disease.

The patient's medical records should document the practitioner's clinical rationale to support UE joint manipulation/mobilization. Documentation should include the following in order to substantiate medical necessity:

- Absence of contraindications to UE joint manipulation/mobilization in the area of treatment, including but not limited to:
    1) Malignancy or infection
    2) Metabolic bone disease
    3) Fusion or ankylosis
    4) Acute fracture or ligament rupture
    5) Joint hypermobility/instability
- A subjective record of a UE complaint that correlates with physical exam findings to support UE joint manipulation/mobilization.
- Upon physical examination and as a best practice a hypomobile joint (e.g., restricted joint play of right glenohumeral joint) should be appropriately documented. At a minimum, abnormal joint mechanics or a range of motion abnormality MUST be appropriately documented and correlated with the subjective findings of a UE complaint and other pertinent exam findings in order to support UE joint manipulation/mobilization.
- A valid musculoskeletal diagnosis for a UE complaint for which UE joint manipulation/mobilization has been shown to be both safe and efficacious.
- Assessment of clinically significant change in patient condition, for continued care.

CPT® Codes and Descriptions

CPT® Code	CPT® Code Description
98943	Chiropractic manipulative treatment (CMT); extraspinal, 1 or more regions *, **
97140	Manual therapy techniques (e.g., mobilization/ manipulation, manual lymphatic drainage, manual traction), 1 or more regions, each 15 minutes

*In accordance with the current version of the CPT code manual, the five extraspinal regions are: 1) the head [includes the temporomandibular joint, excluding the atlanto-occipital] region; 2) the upper extremities; 3) the lower extremities; 4) the rib cage [excluding the costotransverse and costovertebral joints]; and 5) the abdomen.

**ASH considers Chiropractic Manipulation Treatment; extraspinal, 1 or more regions to be associated with HVLA thrust joint manipulation (or Grade V Mobilization) and Not joint mobilization (Grades I - IV).

DESCRIPTION/BACKGROUND

Much of the research on manipulation and the upper extremities is focused on the shoulder (as opposed to the elbow or wrist) and relates to rotator cuff injuries or disorders, shoulder complaints/dysfunction/disorder, and frozen shoulder (McHardy et al., 2008). Brantingham et al. (2011) included soft tissue disorders, and neurogenic shoulder pain. They noted that the definition of shoulder girdle was not standardized, and some studies would include the thoracic and cervical spine as well as the upper rib.

EVIDENCE REVIEW

Shoulder Rotator Cuff Disease/Disorder

Atkinson et al. (2008) looked at 60 volunteers (average age of 42 years) with a diagnosis of rotator cuff tendinopathy and randomized them into two groups (30 per group). Their outcome measures included the numerical pain rating scale (NRS-101), algometry, and goniometry. They compared an HVLA adjustment to a placebo (sham laser). The adjustment group had statistically significant decreases in the NRS and significantly increased global range of motion (ROM) in flexion, extension, abduction, adduction, external rotation, and horizontal abduction (all $p<0.05$). There were no serious adverse events. The shoulder manipulation appeared to provide short-term relief of rotator cuff tendinopathy vs. placebo ($p=0.05$). The sample size was not large enough to have full power.

Bennell et al. (2010) studied 120 patients (average age of 60 years) with rotator cuff disease with a history longer than 3 months. The active treatment consisted of manual therapy and a home exercise program. The manual therapy consisted of soft tissue massage, passive mobilization of the glenohumeral joint, scapular retraining and postural taping, spinal

mobilization and home exercises. The glenohumeral mobilization was a combination of anteroposterior and inferior joint glides in a supine position with the arm abducted at 45 and 90 degrees. This was performed for four repetitions at 30 seconds in each position. The placebo treatment consisted of inactive ultrasound therapy. Patients received 10 treatments over a 10-week period. The active group continued their exercise over the next 12 weeks. The control group received no treatment. Outcomes were pain and function measured by the shoulder pain and disability index, and participants' perceived global rating of overall change. At the end of 11 weeks, the active treatment generally produced similar improvements on shoulder pain and function, compared with a realistic placebo treatment that controlled for therapists' contact time. Significant differences favoring the active group for objective and subjective measures of muscle strength were seen at follow-up. Overall, significant differences in improvement were not seen in the active group until the 22-week follow-up.

In systematic reviews by Bronfort et al. (2010) and Brantingham et al. (2011), there was some support for manipulation for rotator cuff injury/disease. Bronfort et al. felt that the evidence was inconclusive, but favorable. Brantingham et al. (2011) concluded that there was fair evidence for using manipulation/mobilization for rotator cuff problems. Clar et al. (2014) concluded that mobilization and manipulation combined with exercise for rotator cuff disorders had moderate positive evidence to support effectiveness.

Wang et al. (2024) aimed to systematically map the type and dosage of joint mobilizations used in previous trials for managing patients with rotator cuff-related shoulder pain; and summarize the rationale for adopting a specific joint mobilization dosage. Authors included 32 studies. Most studies did not or partially report technique (67%) and within-session dosage (64%) of passive joint mobilization. Overall treatment was fully reported in 95% of studies. The dosage used for passive joint mobilization was heterogeneous (ranging from grade I to grade V). Most studies (85%) did not or partially report technique of mobilization with movement (MWM), whereas within-session and overall treatment dosages were fully reported in more than 85% of studies. Three sets of 10 repetitions were commonly used within-session dosage for MWM. Authors found very limited information on the rationale for selecting dosage of joint mobilization.

Celik et al. (2025) assessed the clinical effectiveness of MWM for shoulder pathologies compared with other treatment methods. Outcome data were analyzed for pain, function, and range of motion (ROM). Twenty-seven studies (1157 participants) were included. MWM demonstrated statistical superiority in function and shoulder flexion and abduction ROM compared with other mobilization techniques. There was a significant reduction in pain intensity, which was -1.55 cm, with high heterogeneity, favoring MWM in comparison with control group. MWM was significantly better for shoulder abduction ROM in comparison with physical therapy interventions with high heterogeneity and control group with high heterogeneity. However, clinical significance was not consistently

achieved. Authors concluded that although some statistical significance was found when comparing MWM with other treatment methods, it was observed that most of the statistically significant data did not reach clinical significance. Upon closer examination, outcome measures that showed clinical significance, either the interventions in the comparison group were inadequate, not evidence-based, or the improvements within the group were not logical.

Shoulder Impingement Syndrome

Bang and Deyle (2000) looked at 30 men and 22 women (average age 43 years old) diagnosed with shoulder impingement syndrome. The exercise group performed supervised flexibility and strengthening exercises. The manual therapy group performed the same program and received manual physical therapy treatment. Mobilizations of grade I-V were used. There was also mobilization of the thoracic and cervical spine, and the upper rib. Treatment was 6 sessions over a 3-week period. Strength was measured isometrically. Pain was a composite score of visual analog scale measures during resisted break tests, active abduction, and functional activities. Function was measured with a functional assessment questionnaire. The visual analog scale used to measure pain with functional activities and the functional assessment questionnaire were also measured 2 months after the initiation of treatment. Both groups experienced significant decreases in pain and increases in function, but there was significantly more improvement in the manual therapy group compared to the exercise group. Strength in the manual therapy group improved significantly while strength in the exercise group did not. Strength improvement initially may primarily be due to functional restoration.

Mundy et al. (2007) examined 30 patients (average age 23 years old) with shoulder impingement syndrome. They were divided into a treatment group that received shoulder adjustments and a control group that received sham ultrasound treatments. Manipulations were HVLA and directed at the GH joint, AC joint, and the upper ribs/scapula. Subjects were treated 8 times over 3 weeks and came back for a one-month follow-up. Outcome measures were Algometry (ALG), goniometric joint range of motion (GON), Visual Analogue Scale (VAS), and the Short-Form McGill Pain Questionnaire (SFMPQ). Data were collected at the 1st, 8th, and follow-up visits. Significant treatment effect was seen in the manipulation group at treatment 8 and the one–month follow-up. The sample size was too small to be definitive.

Surenkok and Aytar (2009) looked at the effect of scapular mobilization in shoulder dysfunction but included shoulder impingement syndrome, rotator cuff injury, and frozen shoulder patients. There were 30 subjects with an average age of 54.3 years. The three groups received either scapula mobilization, a sham treatment, or no treatment (control group). Scapula mobilization consisted of supero-inferior gliding, rotations, and distraction to the scapula. Sets of 10 mobilizations with 30 seconds in between were performed. Outcomes included pain severity, upward rotation of the scapula (measured by digital

inclinometer), and a Constant Shoulder Score (CSS). There were significant improvements for shoulder ROM, scapular upward rotation, and CSS between pretreatment and post-treatment compared with the sham and control groups. There did not seem to be any difference in patients with different shoulder diagnoses. Guimarães et al. (2016) compared the immediate effects of mobilization with movement (MWM) with sham technique on range of motion (ROM), muscle strength, and function in patients with shoulder impingement syndrome. Group 1 received the MWM technique in the first 4 sessions and the sham technique in the last 4 sessions and group 2 was treated with the opposite order of treatment conditions described for group 1. Shoulder ROM, isometric peak force assessed with a handheld dynamometer, and function as determined through the Disabilities of the Arm, Shoulder and Hand and Shoulder Pain and Disability Index (SPADI) questionnaires were collected at preintervention, interchange, and postintervention moments. Authors concluded that the MWM technique was no more effective than a sham intervention in improving shoulder ROM during external rotation and abduction, pain, and function in patients with shoulder impingement syndrome.

Riley et al. (2021) sought: (a) to determine if there was a difference in outcomes between immediate responders to glenohumeral mobilizations at the initial evaluation, 2-week, 4-week, and 6-month follow-up as compared to those that do not respond in participants with subacromial pain syndrome; (b) to see if there were statistically significant differences in outcomes within these groups between these time frames of interest, and (c) to see if symptom response at the initial evaluation was predictive of a favorable recovery. Data were collected for the subjective and objective variables of interest at the initial evaluation, 2-week, 4-week, and 6-month follow-up. Results demonstrated that there were no statistically significant between-group differences for the variables of interest except for the Global Rating of Change. The shoulder abduction AROM between-group difference exceeded the minimal detectable change at 4 weeks. The pair-wise comparison showed statistically significant differences for the outcomes of interest at each time point except for the GRoC between 4 weeks and 6 months. There was a statistically significant correlation between responders at the initial evaluation and shoulder abduction AROM at the 4-week follow-up. Authors concluded that individuals with subacromial pain syndrome may benefit from shoulder mobilization independent of their within-session response to shoulder mobilization at the initial evaluation. Eliason et al. (2021) evaluated the clinical outcome of guided exercises with or without joint mobilization, compared with controls who did not receive any treatment. A total of 120 patients, with clinically diagnosed subacromial pain syndrome, were randomized into guided exercise groups with and without additional joint mobilization, and a control group that did not receive any treatment. Data were analysed at baseline, 6 weeks, 12 weeks and 6 months. Shoulder function improved in all groups. At 12 weeks and 6 months the exercise groups improved significantly compared with the control group. Add-on joint mobilization resulted in decreased pain in active range of motion at 6 and 12 weeks compared with guided exercise or no treatment. Range of motion increased over time in all 3 groups. Authors concluded

that in patients with subacromial pain syndrome guided exercises improved shoulder function compared with no treatment. Add-on joint mobilization decreased pain in the short-term compared with exercise alone or no treatment.

Rosa et al. (2021) assessed the effects of two interventions on shoulder kinematics, Shoulder Pain and Disability Index (SPADI) scores, ROM, strength, and pressure pain threshold (PPT) in individuals with posterior capsule tightness (PCT) and shoulder impingement symptoms. In this prospectively registered randomized controlled trial, 59 individuals were randomized to either an Experimental Intervention Group (EIG, *n*=31) or a Control Intervention Group (CIG, *n*=28). The EIG received three targeted techniques on the involved shoulder: anterior-posterior directed glenohumeral mobilization, active resistance exercise for the shoulder external rotators, and posterior capsule stretching. The control group received sham ultrasound, active scapular retraction and upper trapezius stretching. Both groups received this physical therapist supervised intervention three times per week (approximately 20min each session) for 4 weeks. Authors concluded that the experimental intervention was more effective at improving PCT. No benefit of the specific approach over the non-specific intervention was noted for the remaining variables and both groups improved with no significant difference between the two interventions.

Gutiérrez-Espinoza et al. (2023) sought to determine the effects of scapular mobilization in addition to an exercise program in people with subacromial impingement syndrome (SIS). Seventy-two adults with SIS were randomly allocated to 1 of 2 groups. The control group (n=36) participated in a 6-week exercise program, and the intervention group (n = 36) participated in the same exercise program plus passive manual scapular mobilization. Both groups were assessed at baseline and 6 weeks (end of treatment). The primary outcome measure was upper limb function assessed using the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire. Secondary outcome measures were the Constant-Murley questionnaire, pain (visual analog scale [VAS]), and scapular upward rotation. All participants completed the trial. The between-group difference in DASH was -1.1 points, Constant-Murley 2.1 points, VAS rating of pain at rest -0.1 cm, and VAS rating of pain during movement -0.2 cm; scapular upward rotation at rest (arm by the side) was 0.6°, at 45° shoulder abduction was 0.8°, at 90° was 0.1°, and at 135° was 0.1°. Most differences were in favor of the intervention group; however, the effect sizes were weak and not statistically significant. Authors concluded that in the short-term, the addition of scapular mobilization did not provide significant clinical benefits in terms of function, pain or scapular motion in participants with SIS.

Shoulder Dysfunction and/or Pain (SCDP)

Bergman et al. (2004) looked at 150 patients with SCDP. One group received the usual medical care, and the other group received the usual medical care plus additional manipulative therapy. The manipulative group received up to 6 treatments over a 12-week period. Manipulation was performed on the shoulder girdle but there was no manipulation

to the glenohumeral joint. The shoulder girdle included the cervicothoracic spine and the adjacent ribs. Both HVLA manipulation and mobilization techniques were used. Outcomes included pain scales, shoulder disability, and general health. There was no significant difference between groups during treatment (6 weeks). After treatment (12 weeks), 43% of the intervention group and 21% of the control group reported full recovery. At 52-week follow-up, the same difference in recovery rate was seen. Improved outcomes favored the additional manipulative therapy, but the assessment of end points was subjective. One of the outcomes was the question "Are you cured?"

Chen et al. (2009) studied 90 people who had shoulder pain and stiffness for more than one month. All patients received advice and exercise. The experimental group also received passive mobilization of the shoulder joint. The mobilizations were directed at either the glenohumeral joint, acromioclavicular joint and/or the sternoclavicular joint. Only low velocity mobilizations were used either as a passive oscillatory movement or a sustained stretch. Outcome measures included the Shoulder Pain and Disability Index (SPADI) and ROM. Both groups improved but there was no statistical difference between groups.

Teys et al. (2008) investigated the effects of mobilization with movement (MWM) on ROM and pain pressure threshold (PPT). Eleven males and thirteen females (average age 46.1 years old) with an inability to elevate their arm greater than 100 degrees in the scapula plane, and pain greater than one month were included. The pain needed to be located over the anterior aspect of the shoulder. Outcome measures were ROM and algometry. The three groups were the experimental group, sham group, and control group. MWM was a posterior gliding force (Mulligan technique) applied to the humeral head during elevation in the scapula plane. Three sets of ten repetitions with a rest interval of 30 seconds between sets were performed. There was a significant improvement in the experimental group compared to the sham and control groups.

Knebl et al. (2002) examined 29 elderly patients (ages 65-85 years) with multiple types of shoulder dysfunction. One group received the manipulative therapy, and the other group received a placebo. The manipulative therapy was the Spencer technique, which is a combination of extension and circumduction movements. Treatment was once per week for 5 weeks. Outcome measures were ROM, a pain scale, and a functional assessment scale. Unlike most studies that reported no adverse effects, Knebl reported temporary soreness and stiffness that did resolve.

Brudvig et al. (2011) summarized the published research evidence examining if the combination of therapeutic exercise and joint mobilization is more beneficial than therapeutic exercise alone in patients with shoulder dysfunction. Seven studies that met the inclusion criteria were identified, with a total of 290 participants. Authors concluded that the current evidence is inconclusive with respect to the beneficial effects of the combination of therapeutic exercise and joint mobilization versus therapeutic exercise

alone for reducing pain, increasing ROM and function, and limiting disability in patients with shoulder dysfunction. Satpute et al. (2015) investigated the effects of hand-behind-back (HBB) Mulligan mobilization with movement (MWM) techniques on acute shoulder pain, impairment, and disability. This double-blind, randomized, controlled trial recruited 44 patients with acute shoulder pain and movement impairment allocated subjects to receive either MWM and exercise/hot pack (n = 22) or exercise/hot pack alone (n = 22). The average duration of symptoms was 4.1 and 4.7 weeks in the exercise and MWM groups, respectively. Paired t tests revealed that both groups demonstrated statistically significant improvements ($P < .001$) with large effect sizes for all variables. However, for all variables, the MWM-with-exercise group showed significantly greater improvements than the exercise group. Authors concluded that the outcomes of patients with acute shoulder pain and disability receiving shoulder HBB MWM with exercise improved greater than those receiving exercise/hot packs alone. In a systematic review by Clar et al. (2014), moderate favorable evidence was noted for mobilization and manipulation and mobilization with movement for shoulder girdle pain and dysfunction.

Adhesive Capsulitis

Nicholson (1985) compared two groups of 10 patients (average age 53 years old) with adhesive capsulitis. One group received standard clinic care and home exercises. The other group received the same treatment plus manual therapy. The manual therapy consisted of grade I-IV mobilizations applied to the glenohumeral joint. Mobilizations were received 2-3 times per week for 4 weeks. Outcomes were pain questionnaires and ROM. All ranges of movement in the experimental group increased significantly from baseline measures except for internal rotation. Passive abduction was significantly increased compared to the control group. Pain scores were lower in the mobilization group, but the difference was not significant.

Vermeulen et al. (2006) compared high-grade mobilization technique (HGMT) and low-grade mobilization techniques (LGMT) in 100 patients (average age 51.7 years old), who had adhesive capsulitis (median duration of 8 months). The HGMT were applied according to grades III and IV mobilizations. LGMT were grades I and II techniques. All mobilizations were directed at the glenohumeral joint only. Treatments were received 24 times in a 12-week period. Outcome measures were ROM, two shoulder questionnaires, pain visual analog scale, and the SF-36. Both groups improved significantly in all measures. The HGMT were significantly better for passive ABD and Ext. Rotation, active Ext. Rotation, and both shoulder questionnaires.

Buchbinder et al. (2007) looked at 144 patients (average age 55 years old) with adhesive capsulitis to determine if manual therapy and exercise had different outcomes when compared to a placebo (sham ultrasound). Shoulder symptoms had to be of duration greater than 3 months. Manual therapy included passive stretch, cervical and thoracic mobilization, glenohumeral joint glides, glenohumeral joint mobilization, and exercise. Treatments were

performed twice per week for 2 weeks, and then once per week for 4 weeks. All treatments followed arthrographic joint distension. Outcome measures included the Shoulder Pain and Disability Index (SPADI), overall pain, active shoulder ROM, and the SF-36. Outcomes were assessed at baseline, 6, 12, and 26 weeks. There was no additional benefit in pain, function, or quality of life with the manual therapy group, but there was a greater active ROM in the shoulder at 6-month follow-up. Perceived improvement was also greater at 6 months.

Yang et al. (2007) compared the use of three different mobilization techniques on 23 female patients (average age 55.7 years old) with adhesive capsulitis of greater than 3 months. Techniques used were end-range mobilization (ERM), mid-range mobilization (MRM), and mobilization with movement (MWM). Treatments were performed 2x per week for 12 weeks. Outcome measures were the Flexibility Scale of Shoulder Function (FLEX-SF), and shoulder kinematics as measured by the FASTRAK motion analysis. Data collection was done at the end of each 3-week interval. ERM and MWM were more effective than MRM in increasing mobility and functional ability. In a 2012 study, Yang et al. again examined the effectiveness of ERM/scapula mobilization on 23 patients with adhesive capsulitis, compared to a standard physical therapy approach. Treatments were received 2x per week for 8 weeks. Outcomes included ROM, disability scores, and shoulder complex kinematics. The mobilization group was significantly more effective than the standard physical therapy approach. Clar et al. (2014) noted in their systematic review that evidence for high grade mobilization was moderate and positive and inconclusive but favorable for mobilization with movement and Niel-Asher osteopathic techniques.

Page et al. (2014) evaluated manual therapy and exercise for adhesive capsulitis in a Cochrane Database Systematic Review. Authors included RCTs and quasi-randomized trials comparing any manual therapy or exercise intervention vs. placebo, no intervention, a different type of manual therapy or exercise or any other intervention for patients with adhesive capsulitis. Interventions included mobilization, manipulation and supervised or home exercise, delivered alone or in combination. Main outcomes of interest were participant-reported pain relief of 30% or greater, overall pain (mean or mean change), function, global assessment of treatment success, active shoulder abduction, quality of life and the number of participants experiencing adverse events. Thirty-three trials (1,836 participants) were included. The overall impression gained from these trials is that the few outcome differences between interventions that were clinically important were detected only up to seven weeks. Evidence of moderate quality shows that a combination of manual therapy and exercise for six weeks probably results in less improvement at seven weeks, but a similar number of adverse events compared with glucocorticoid injection. Forty-six percent (26/56) of participants reported treatment success with manual therapy and exercise compared with 77% (40/52) of participants receiving glucocorticoid injection. Group differences in improvement in overall pain and function at six months and 12 months were not clinically important. Authors concluded that the best available data show that a

combination of manual therapy and exercise may not be as effective as glucocorticoid injection in the short-term. It is unclear whether a combination of manual therapy, exercise and electrotherapy is an effective adjunct to glucocorticoid injection or oral NSAID. High-quality RCTs are needed to establish the benefits and harms of manual therapy and exercise interventions that reflect actual practice, compared with placebo, no intervention and active interventions with evidence of benefit (e.g., glucocorticoid injection).

Noten et al. (2016) systematically reviewed the literature for efficacy of isolated articular mobilization techniques in patients with primary adhesive capsulitis (AC) of the shoulder. Twelve randomized controlled trials involving 810 patients were included. The efficacy of 7 different types of mobilization techniques was evaluated. Authors concluded that overall, mobilization techniques have beneficial effects in patients with primary AC of the shoulder. Because of preliminary evidence for many mobilization techniques, the Maitland technique and combined mobilizations seem recommended at the moment. Hando et al. (2017) completed a study with the purpose to: (a) report clinical outcomes following translational manipulation under anesthesia (tMUA), (b) describe relevant health care costs and utilization following tMUA, and (c) summarize findings from two cases receiving joint arthroscopy following tMUA. Thirteen patients completed the six-week follow-up. Mean change scores for ROM and SPADI values were flexion; +38.5°, abduction; +71.1°, external rotation (shoulder abducted); +49.8°, internal rotation (shoulder abducted); +26.6°, SPADI scores; +44.4. 13 patient records were analyzed for health care utilization. Ten of the 13 patients utilized no additional shoulder-related health care. Surgical evaluation revealed no evidence of iatrogenic injury. Authors concluded that clinical outcomes were similar to previous studies. Utilization data indicated that for the majority of patients, little shoulder-related health care was utilized.

Woods and Loganathan (2017) analyzed a prospectively collected, single-surgeon, consecutive series of patients who underwent MUA for frozen shoulder between January 1999 and December 2015. The Oxford Shoulder Scores (OSS) and range of movement were the outcome measures. A total of 730 patients (792 shoulders) underwent MUA during the study period. A further MUA was undertaken in 141 shoulders (17.8%), for which they had complete data for 126. The mean improvement in OSS for all patients undergoing MUA was 16, and the mean post-operative OSS in those requiring a further MUA was 14 showing no significant difference. Improvement was seen after a further MUA, regardless both of the outcome of the initial MUA, and of the time of recurrence. Authors concluded that patients with a poor outcome or recurrent symptoms of a frozen shoulder after a MUA should be offered a further MUA with the expectation of a good outcome and a low complication rate.

Duzgun et al. (2019) aimed to compare the superiority of scapular mobilization, manual capsule stretching, and the combination of these two techniques in the treatment of frozen shoulder patients to evaluate the acute effects of these techniques on shoulder movements.

Group 1 (*n*=27) received scapular mobilization, and Group 2 (*n*=27) received manual posterior capsule stretching. After the patients were assessed, the interventions were re-applied with a crossover design to obtain results for the combined application (*n*=54). The range of motion, active total elevation, active internal rotation, and posterior capsule tensions of the shoulder joint were recorded before and immediately after mobilization. Statistical analysis showed an increase in all range of motion values, except for shoulder internal rotation, without significant difference among the groups ($p>0.05$). Authors concluded that scapular mobilization and manual posterior capsule interventions were effective in improving the acute joint range of motion in frozen shoulder patients.

Rangan et al. (2020) compared MUA and arthroscopic capsular release with early structured physiotherapy plus steroid injection. Participants were randomly assigned (2:2:1) to receive manipulation under anesthesia, arthroscopic capsular release, or early structured physiotherapy. In manipulation under anesthesia, the surgeon manipulated the affected shoulder to stretch and tear the tight capsule while the participant was under general anesthesia, supplemented by a steroid injection. Arthroscopic capsular release, also done under general anesthesia, involved surgically dividing the contracted anterior capsule in the rotator interval, followed by manipulation, with optional steroid injection. Both forms of surgery were followed by postprocedural physiotherapy. Early structured physiotherapy involved mobilization techniques and a graduated home exercise program supplemented by a steroid injection. Both early structured physiotherapy and postprocedural physiotherapy involved 12 sessions during up to 12 weeks. The primary outcome was the Oxford Shoulder Score (OSS; 0-48) at 12 months after randomization. All mean differences on the assessment of shoulder pain and function (OSS) at the primary endpoint of 12 months were less than the target differences. Therefore, none of the three interventions were clinically superior. Arthroscopic capsular release carried higher risks, and manipulation under anesthesia was the most cost-effective.

Rahbar et al. (2022) compared the efficacy of acromioclavicular joint mobilization and standard physical-therapy versus physical-therapy alone in the treatment of the frozen shoulder. Participants were randomly allocated into mobilization + physical-therapy (*n* = 28), and physical-therapy alone (*n* = 28) groups for one month. The primary outcomes were the shoulder pain and disability index and the shoulder range of motion. The secondary outcome was the visual analogue scale. Measures were performed at the baseline, immediately and one month after the beginning of the treatment. Visual analogue scale and the shoulder pain and disability index improved more significantly in the mobilization group compared to the physical-therapy group immediately and one month after the beginning of the treatment. Active abduction range of motion was also improved more significantly immediately after the treatment in the mobilization group compared to the physical-therapy group, however there were no significant differences between two groups concerning other measured range of motions. Authors concluded that adding acromioclavicular mobilization to standard physical-therapy was more efficient in

decreasing pain and disability and improving active abduction range of motion compared to standard physical-therapy in frozen shoulder patients.

Costantino et al. (2022) sought to define the state of the art and guide specialists in choosing effective treatments for adhesive capsulitis. For this study, 1089 subjects were taken into consideration and 19 out of the 20 studies compared multimodal therapies: 6 directly assessed the effectiveness of physical therapies (3 US; 1 WBC; 1 HILT and 1 rESWT), 3 studies evaluated the efficacy of manual glenohumeral mobilizations, 4 compared manual and mechanical stretching techniques, and 7 evaluated the effectiveness of different supervised group or home therapeutic exercises in multimodal rehabilitation programs. The characteristics of the selected studies were very heterogeneous, and sample were not uniform as regards stage of disease, level of ROM reduction and mean duration of complaints). Ultrasound therapy did not prove effective on the pathology, unlike radial shockwaves and cryotherapy. The joint mobilizations, techniques adopting posterior glenohumeral approaches and high-end mobilizations would appear to be effective both manual and instrumental techniques. In general stretching is a mandatory implementation in rehabilitation programs. From the data in the literature, it does not emerge the possibility of identifying treatment guidelines except for individual or group exercises, that are possibly oriented to the performance of daily activities.

Olguín-Huerta et al. (2023) sought to determine the effectiveness of scapular mobilization on range of motion, shoulder disability, and pain intensity in patients with primary adhesive capsulitis (AC). Six randomized clinical trials met the eligibility criteria. For scapular mobilization versus other therapeutic interventions, there was no significant difference in the effect sizes between groups for external rotation, for flexion, for shoulder disability, and for pain intensity. Authors concluded that scapular mobilization with or without other therapeutic interventions does not provide a significant clinical benefit regarding active shoulder range of motion, disability, or pain intensity in patients with primary AC, compared with other manual therapy techniques or other treatments; the quality of evidence was very low to moderate according to the grading of recommendation, assessment, development and evaluation approach.

Zhao et al. (2024) compared the efficacy and safety of arthroscopic capsular release (ACR) and manipulation under anesthesia (MUA) for refractory frozen shoulder (FS). A total of eight comparative studies with 768 patients were included. Compared with MUA, ACR had statistically better Δ VAS at over 12-month follow-up, which did not reach the minimal clinically important difference (MCID). Other outcomes regarding pain relief, function, and range of motion (ROM) improvements were not statistically different between the two groups at different follow-up timepoints. Compared with the MUA group, the ACR group had a significantly higher rate of severe complications, but comparable rates of mild complications and additional intervention. Authors concluded that in treating refractory FS, ACR demonstrated comparable pain relief, functional and ROM improvements, rates

of mild complications and additional intervention but a higher risk of severe complications to MUA during short-term follow-up periods. Notably, ACR exhibited statistically superior improvement in the long-term pain relief compared to the MUA group, although it did not reach the MCID.

Kubuk et al. (2024) compared the effects of end-range manual therapy versus other conservative intervention on pain intensity, shoulder range of movement (ROM), and physical function in adhesive capsulitis (AC). Ten randomized controlled trials were reviewed, involving 424 AC patients aged 20-70 years. Methodological quality of studies ranged from high to low. The end-range mobilization showed improvements in pain intensity, shoulder abduction, internal rotation, and external rotation, and physical function compared to other conservative interventions in the short-and medium-terms. Certainty of the evidence was downgraded to very low. Authors concluded that very low certainty evidence suggests that end-range mobilization techniques improve pain intensity, shoulder ROM, and physical function in the short-and medium-term in AC.

Epicondylitis/Epicondylalgia of the Elbow

There has been very little research on manipulation of the elbow in relation to elbow conditions. What little research that has been conducted invariably involves epicondylitis or the cubital tunnel. Most of this research is case reports. Hoogvliet et al. (2013) did a systematic review looking at the effectiveness of exercise therapy and mobilization techniques for epicondylitis. They found one review and 12 randomized controlled trials (RCTs) that studied lateral epicondylitis. A best evidence synthesis was used for the results, and they found limited, conflicting, or no evidence for the use of manual therapy to the extremity.

Stasinopoulos & Johnson (2004) looked at the effects of Cyriax physiotherapy on lateral epicondylitis. This consists of the combination of deep transverse friction followed immediately by a manipulation to the elbow (Mill's manipulation). They found only one study that compared Cyriax physiotherapy to cortisone injections in the management of lateral epicondylitis (Verhaar et al.). The cortisone injections were more effective at the end of treatment but there were no significant differences at the one-year follow-up.

Vicenzino et al. (2001) looked at the effects of mobilization with movement (MWM) – a system of manual therapy interventions developed by Brian Mulligan which combine a sustained manual `gliding' force to a joint with concurrent physiologic (osteo-kinematic) motion of the joint, either actively performed by the patient, or passively performed by the operator for chronic lateral epicondylitis in 10 female and 14 male subjects (average age 46.4 years old) with symptoms greater than 6 weeks. The three treatment conditions were MWM, a placebo technique, and a control condition. The mobilization was a lateral glide performed during a pain-free gripping technique. Six repetitions were performed with a 15 second rest between repetitions. Outcomes were pain-free grip strength and algometry. There was a significant increase in pain-free strength in the mobilization group, but not in

the other two conditions. There was a significant decrease in the pressure-pain threshold after treatment, but at a much lower value.

Abbott (2001) measured shoulder ROM in patients with lateral epicondylitis after a single treatment of MWM. Subjects (18 male, 5 female) were measured for internal and external rotation of the shoulder pre and post treatment, in the affected and unaffected arms. The MWM used was applied to the medial proximal forearm during wrist extension while making a fist. While there were significant differences in external rotation in the affected arm before treatment, there was no significant difference post-treatment. There was a significant increase in external rotation and internal rotation ROM after the MWM which was also measured in the unaffected arm.

Kearns & Wang (2012) had a case study on the effectiveness of thrust manipulation to the elbow and carpals in the management of a 45-year-old woman with a diagnosis of cubital tunnel syndrome. The woman had a 6-week history of insidious onset medial elbow pain. A thrust manipulation was performed to the humeroulnar joint and to the carpal joints. Two manipulations were done to the elbow and 1 manipulation was done to the carpals over a course of 4 sessions. All pain and paresthesia were resolved. Clar et al. (2014) concluded that the evidence for manipulation alone for patients with lateral epicondylitis is inconclusive and non-favorable at this time. The evidence is stronger for mobilization of the elbow in addition to exercise for treatment of lateral epicondylitis; however, the results were still viewed as inconclusive (favorable). Hsu et al. (2016) conducted a randomized controlled trial and included 35 patients with lateral epicondylalgia for more than 2 months. Either manipulation treatment (n = 16) or acupuncture (n = 19) was given to these patients for 2 weeks and all patients' symptoms were followed up for 8 weeks after treatment. Both groups demonstrated changes in pain VAS score, grip strength, and DASH questionnaire. Lateral epicondylalgia patients who received manipulation treatment felt pain relief sooner than those who had acupuncture treatments during the first few treatments. However, authors concluded that both acupuncture and manipulation are effective, given no significant at the 8-week follow-up.

Lucado et al. (2018) sought to determine if joint mobilizations are effective in improving pain, grip strength, and disability in adults with lateral elbow tendinopathy. A total of 20 studies met the inclusion criteria; 7 were included in the meta-analysis. Authors concluded that there was compelling evidence that joint mobilizations have a positive effect on both pain and/or functional grip scores across all time frames compared to control groups in the management of LET. Westad et al. (2019) systematically reviewed the literature to establish whether MWM treatment is effective for improving pain and function in patients with MSK conditions related to peripheral joints. Seven published trials were identified in which all trials presented positive clinical outcome in pain and function of MWM. Low quality evidence for shoulder impingement syndrome (SIS) existed and low and very low-quality evidence for lateral epicondylalgia. Authors concluded that overall MWM

interventions applied to peripheral joints seems to be superior to placebo and no intervention controls, but not in comparison with other medical or physiotherapy interventions. There is a need for more high-quality trials that investigate the short and long-term effect of a series of MWM interventions.

Bagcaci et al. (2023) aim of this study was to compare the acute effects of mobilization with movement (MWM) and muscle energy technique (MET) on pain, grip strength, and functionality in patients diagnosed with lateral elbow tendinopathy (LET). Forty-five patients with LET aged 30-55 years were enrolled in this study. Patients were divided into three groups: MWM, MET, and control group. The control group received a 4-week home exercise program. In addition to the home exercise program in the MWM group, 12 sessions of MWM and 12 sessions of MET were performed in the MET group. Participants' pain, grip strength, and functionality were assessed before and after the study. After the treatment period, greater improvement in pain, grip strength, finger strength, and functionality were observed in the MWM and MET groups than in the control group, but no statistically significant difference was found between the MWM and MET groups. Authors concluded that this study shows that MWM and MET, used in addition to home exercises, can be used to relieve pain and increase grip strength, finger strength, and functionality.

Dunning et al. (2024) assessed the effects of adding electrical dry needling and thrust manipulation into a multimodal program of exercise, mobilization, and ultrasound in patients with lateral elbow tendinopathy. One hundred and forty-three participants (n = 143) with lateral elbow tendinopathy were randomized: cervical spine manipulation, extremity manipulation, and percutaneous tendon electrical dry needling plus multimodal physical therapy (n = 73) or multimodal physical therapy (n = 70) alone. The primary outcome was elbow pain intensity and disability as measured by the Patient-Rated Tennis Elbow Evaluation at baseline, 1 week, 4 weeks, and 3 months. Secondary outcomes included the Numeric Pain Rating Scale, Tennis Elbow Functional Scale, Global Rating of Change, and medication intake. The 2 × 4 analysis of covariance demonstrated that individuals with lateral elbow tendinopathy receiving electrical dry needling and thrust manipulation plus multimodal physical therapy experienced significantly greater improvements in disability, elbow pain intensity, and function than those receiving multimodal physical therapy alone at 3 months. The between-group effect size was large for pain and disability in favor of the electrical dry needling and thrust manipulation group. Authors concluded that the inclusion of percutaneous tendon electrical dry needling and thrust manipulation into a multimodal program of exercise, mobilization and ultrasound was more effective than multimodal physical therapy alone in individuals with lateral elbow tendinopathy.

Carpal Tunnel Syndrome (CTS)

Siu et al. (2012) describes the use of osteopathic manipulation to supplement traditional methods for management of CTS. Davis & Hulbert (1998) reviewed conservative and nonconservative treatment of CTS and concluded that CTS without axonal degeneration can be treated with manual procedures, but they did not find evidence on the efficacy of manipulation. Russell's case study (2003) discusses the use of manipulation of the wrist to resolve ulnar tunnel syndrome symptoms in 4 visits. A Cochrane review by Page et al. (2012) reviewed the efficacy and safety of mobilization methods in people with CTS. There were two studies that compared mobilization to a no treatment control, three compared one mobilization intervention to another, and three compared a mobilization intervention to another non-surgical intervention. Because of the heterogeneity of the interventions delivered, results could not be pooled across the studies. Their conclusion was that there was limited and very low-quality evidence for the use of mobilization as a treatment for CTS. These results were supported by Brantingham et al. (2013) in a systematic review of upper extremity manual techniques. Clar et al. (2014) noted favorable limited evidence for mobilization of the carpal bones in patients with CTS in improvement of symptoms over no treatment. However, given the limited available research, results are inconclusive at this time for mobilization in the treatment of CTS.

Ceylan et al. (2023) examined the effectiveness of MWM technique on pain, grip strength, range of motion, edema, hand reaction, nerve conduction, and functional status in patients with CTS. A total of 45 patients enrolled in the study. The MWM group (n = 18) completed a 4-week combined conservative physiotherapy and MWM program, whereas the control group (n = 18) received only the 4 weeks of conservative physiotherapy. Pain severity according to the numerical rating scale was used as primary outcome. Authors found an improvement within the subjects in resting pain, in activity pain and in night pain. For between the groups, a statistical difference was found for the activity pain, Disabilities of the Arm Shoulder and Hand Questionnaire score, Michigan Hand Outcomes Questionnaire (MHQ-1), and MHQ-5 parameters in favor of MWM group. This study showed that MWM compared to conservative physiotherapy might be more effective in reducing perceived symptoms in mild and moderate CTS patients. Authors concluded that MWM produced a small benefit to recovery of activity pain and upper extremity functionality level outcomes of patients with mild to moderate CTS when added to a traditional CTS physical therapy program.

Distal Forearm Fracture

Gutiérrez-Espinoza et al. (2022) sought to determine the effectiveness of manual therapy (MT) for functional outcomes in patients with distal radius fracture (DRF). Eight clinical trials met the eligibility criteria, six studies were included. For supervised physiotherapy plus joint mobilization versus home exercise program at 6 weeks follow-up, the mean difference (MD) for wrist flexion was 7.1 degrees (p = 0.20), and extension was 11.99 degrees (p = 0.16). For exercise program plus mobilization with movement versus exercise

program at 12 weeks follow-up, the Patient-Rated Wrist Evaluation (PRWE) was -10.2 points (p = 0.02), the Disabilities of the Arm, Shoulder and Hand (DASH) was -9.86 points (p = 0.0001), and grip strength was 3.9 percent (p = 0.25). For conventional treatment plus manual lymph drainage versus conventional treatment, for edema the MD at 3-7 days was -14.58 ml (p = 0.03), at 17-21 days -17.96 ml (p = 0.009), at 33-42 days -15.34 ml (p = 0.003), and at 63-68 days -13.97 ml (p = 0.002). Authors concluded that adding mobilization with movement and manual lymphatic drainage showed statistically significant differences in wrist, upper limb function, and hand edema in patients with DRF.

Upper Extremity

Heiser et al. (2013) examined the current evidence describing joint mobilizations for treatment of conditions of the elbow, wrist and hand. Twenty-two studies dated between 1980 and 2011 were included in the systematic review for analysis. The current evidence provides moderate support for the inclusion of joint mobilizations in the treatment of lateral epicondylalgia (LE). In particular, mobilization with movement as described by Mulligan is supported with evidence from nine randomized clinical trials as an effective technique for the treatment of pain. Other described techniques include those known as Kaltenborn, Cyriax physical therapy, and Maitland, but the evidence for these techniques is limited. There is also limited evidence for the joint mobilizations in the treatment of wrist and hand conditions. Authors concluded that there is limited support for joint mobilizations of the wrist and hand, and moderate support for joint mobilizations of the elbow for LE. There is moderate support for mobilization with movement.

Roll and Hardison (2017) evaluated the effectiveness of Occupational Therapy interventions for adults with musculoskeletal conditions of the forearm, wrist, and hand in a systematic review. They noted that mixed evidence exists for mobilization techniques and manual therapy for the treatment of CTS. For patients with loss of wrist ROM due to distal radial fracture, moderate evidence supports the use of joint mobilization, but no evidence supports the use of dynamic splinting. The paucity of evidence for occupation-based interventions and outcomes points to an opportunity and need to expand the scope of UE rehabilitation research.

Savva et al. (2021) summarized the available literature with regards to the potential analgesic effect and mechanism of joint mobilization and manipulation in tendinopathy. The effect of these techniques in rotator cuff tendinopathy and lateral elbow tendinopathy, applied alone, compared to a placebo intervention or along with other interventions has been reported in some randomized controlled trials which have been scrutinized in systematic reviews. Due to the small randomized controlled trials and other methodological limitations of the evidence base, including short-term follow-ups, small sample size and lack of homogenous samples further studies are needed. Literature in other tendinopathies such as medial elbow tendinopathy, de Quervain's disease and Achilles tendinopathy is limited since the analgesic effect of these techniques has been identified in few case series

and reports. Therefore, the low methodological quality renders caution in the generalization of findings in clinical practice. Studies on the analgesic mechanism of these techniques highlight the activation of the descending inhibitory pain mechanism and sympathoexcitation although this area needs further investigation. Authors concluded that this study suggests that joint mobilization and manipulation may be a potential contributor in the management of tendinopathy as a pre-conditioning process prior to formal exercise loading rehabilitation or other proven effective treatment approaches.

Liu et al. (2024) investigated the effect of Maitland joint mobilization technique on the recovery of upper extremity function in patients with spasticity after stroke. Seventy-one patients with upper extremity flexor spasm after stroke were recruited and randomly divided into experimental group (n = 35) and control group (n = 36). The control group was given conventional rehabilitation treatment, while the experimental group was treated with Maitland mobilization technique treatment of upper extremity joints on the basis of the control group. The experiment lasted for 8 weeks. Participants of the 2 groups were observed for Fugl-Meyer motor assessment-upper extremity (FMA-UE), box and block test (BBT) and Brunnstrom stage, modified Ashworth scale (MAS), and functional independence measure (FIM) at pre- and post-8 weeks study. There was no significant difference in gender distribution, hemiplegic side, diagnosis, past history, age, duration, body mass index, and mini-mental state examination between the 2 groups. After 8 weeks of intervention, both groups showed significant improvement in FMA-UE, Brunnstrom stage, BBT, FIM, and MAS of the shoulder; however, there was no significant change in MAS of the elbow, wrist, and finger joints. The posttreatment values showed a significant improvement in FMA-UE, BBT, and FIM in the experimental group compared to the control group. Comparing the changes in pretreatment and posttreatment, FMA-UE, BBT, and FIM in the experimental group were significantly improved compared with those in the control group. Authors concluded that Maitland joint mobilization can improve the motor function of upper extremity and the spasticity of shoulder joint complex in patients with stroke.

Peripheral Joint Pathologies

Stathopoulos et al. (2018) provided an updated systematic review and meta-analysis regarding the effectiveness of mobilization with movement (MWM) techniques on range of motion (ROM). Included were 18 studies with 753 participants in 10 separate meta-analyses for ROM. All studies were classified as high quality or medium quality. Peripheral joint MWM seems to produce better therapeutic results in comparison to sham, passive, other active, or no therapeutic approach, regarding improvement of joint ROM in specific peripheral joint pathologies, consistently in all movement directions for shoulder adhesive capsulitis and hip pain. Authors concluded that mobilization with movement produced a statistically and clinically significant ROM increase consistently in all movement directions for shoulder adhesive capsulitis and hip pain. However, for shoulder impingement, shoulder pain/dysfunction, hamstring tightness, knee osteoarthritis, and

chronic ankle instability pathologies, a therapeutic benefit regarding ROM could not be clearly established.

PRACTITIONER SCOPE AND TRAINING

Practitioners should practice only in the areas in which they are competent based on their education, training, and experience. Levels of education, experience, and proficiency may vary among individual practitioners. It is ethically and legally incumbent on a practitioner to determine where they have the knowledge and skills necessary to perform such services. It is best practice for the practitioner to appropriately render services to a patient only if they are trained, equally skilled, and adequately competent to deliver a service compared to others trained to perform the same procedure. If the service would be most competently delivered by another health care practitioner who has more skill and expert training, it would be best practice to refer the patient to the more expert practitioner.

Best practice can be defined as a clinical, scientific, or professional technique, method, or process that is typically evidence-based and consensus driven and is recognized by a majority of professionals in a particular field as more effective at delivering a particular outcome than any other practice (Joint Commission International Accreditation Standards for Hospitals, 2020).

Depending on the practitioner's scope of practice, training, and experience, a member's condition and/or symptoms during examination or the course of treatment may indicate the need for referral to another practitioner or even emergency care. In such cases it is prudent for the practitioner to refer the member for appropriate co-management (e.g., to their primary care physician) or if immediate emergency care is warranted, to contact 911 as appropriate. See the *Managing Medical Emergencies (CPG 159 – S)* clinical practice guideline for information.

References

Abbott JH. Mobilization with movement applied to the elbow affects shoulder range of movement in subjects with lateral epicondylalgia. *Man Ther*. 2001;6(3):170-177. doi:10.1054/math.2001.0407

American Medical Association. (current year) Current Procedural Terminology (CPT) Current year (rev. ed.), Chicago: AMA

Atkinson M, Matthews R, Brantingham JW, et al. A randomized controlled trial to assess the efficacy of shoulder manipulation vs. placebo in the treatment of shoulder pain due to rotator cuff tendinopathy. J Am Chiropr Assoc 2008;45:11-26

Bagcaci S, Unuvar BS, Gercek H, Ugurlu I, Sert OA, Yilmaz K. A randomized controlled trial on pain, grip strength, and functionality in lateral elbow pain: Mulligan vs muscle

energy techniques. J Back Musculoskelet Rehabil. 2023;36(2):419-427. doi:10.3233/BMR-220061

Bang MD, Deyle GD. Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. *J Orthop Sports Phys Ther*. 2000;30(3):126-137. doi:10.2519/jospt.2000.30.3.126

Bennell K, Wee E, Coburn S, et al. Efficacy of standardised manual therapy and home exercise programme for chronic rotator cuff disease: randomised placebo controlled trial. *BMJ*. 2010;340:c2756. Published 2010 Jun 8. doi:10.1136/bmj.c2756

Bergman GJ, Winters JC, Groenier KH, et al. Manipulative therapy in addition to usual medical care for patients with shoulder dysfunction and pain: a randomized, controlled trial. *Ann Intern Med*. 2004;141(6):432-439. doi:10.7326/0003-4819-141-6-200409210-00008

Brantingham JW, Cassa TK, Bonnefin D, et al. Manipulative therapy for shoulder pain and disorders: expansion of a systematic review. *J Manipulative Physiol Ther*. 2011;34(5):314-346. doi:10.1016/j.jmpt.2011.04.002

Brantingham JW, Cassa TK, Bonnefin D, et al. Manipulative and multimodal therapy for upper extremity and temporomandibular disorders: a systematic review. *J Manipulative Physiol Ther*. 2013;36(3):143-201. doi:10.1016/j.jmpt.2013.04.001

Bronfort G, Haas M, Evans R, Leininger B, Triano J. Effectiveness of manual therapies: the UK evidence report. *Chiropr Osteopat*. 2010;18:3. Published 2010 Feb 25. doi:10.1186/1746-1340-18-3

Brudvig TJ, Kulkarni H, Shah S. The effect of therapeutic exercise and mobilization on patients with shoulder dysfunction : a systematic review with meta-analysis. *J Orthop Sports Phys Ther*. 2011;41(10):734-748. doi:10.2519/jospt.2011.3440

Buchbinder R, Youd JM, Green S, et al. Efficacy and cost-effectiveness of physiotherapy following glenohumeral joint distension for adhesive capsulitis: a randomized trial. *Arthritis Rheum*. 2007;57(6):1027-1037. doi:10.1002/art.22892

Çelik D, Van Der Veer P, Tiryaki P. The Clinical Significance of Mulligan's Mobilization with Movement in Shoulder Pathologies: A Systematic Review and Meta-Analysis. J Integr Complement Med. 2025;31(2):134-142. doi:10.1089/jicm.2024.0200

Ceylan İ, Büyükturan Ö, Aykanat Ö, Büyükturan B, Şaş S, Ceylan MF. The effectiveness of mobilization with movement on patients with mild and moderate carpal tunnel

syndrome: A single-blinded, randomized controlled study. J Hand Ther. 2023;36(4):773-785. doi:10.1016/j.jht.2023.02.004

Chen JF, Ginn KA, Herbert RD. Passive mobilisation of shoulder region joints plus advice and exercise does not reduce pain and disability more than advice and exercise alone: a randomised trial. *Aust J Physiother*. 2009;55(1):17-23. doi:10.1016/s0004-9514(09)70056-x

Clar C, Tsertsvadze A, Court R, Hundt GL, Clarke A, Sutcliffe P. Clinical effectiveness of manual therapy for the management of musculoskeletal and non-musculoskeletal conditions: systematic review and update of UK evidence report. *Chiropr Man Therap*. 2014;22(1):12. Published 2014 Mar 28. doi:10.1186/2045-709X-22-12

Costantino C, Nuresi C, Ammendolia A, Ape L, Frizziero A. Rehabilitative treatments in adhesive capsulitis: a systematic review. J Sports Med Phys Fitness. 2022;62(11):1505-1511. doi:10.23736/S0022-4707.22.13054-9

Davis PT, Hulbert JR. Carpal tunnel syndrome: conservative and nonconservative treatment. A chiropractic physician's perspective. *J Manipulative Physiol Ther*. 1998;21(5):356-362

Dunning J, Mourad F, Bliton P, et al. Percutaneous tendon dry needling and thrust manipulation as an adjunct to multimodal physical therapy in patients with lateral elbow tendinopathy: A multicenter randomized clinical trial. Clin Rehabil. 2024;38(8):1063-1079. doi:10.1177/02692155241249968

Duzgun I, Turgut E, Eraslan L, Elbasan B, Oskay D, Atay OA. Which method for frozen shoulder mobilization: manual posterior capsule stretching or scapular mobilization?. *J Musculoskelet Neuronal Interact*. 2019;19(3):311-316

Eliason A, Harringe M, Engström B, Werner S. Guided exercises with or without joint mobilization or no treatment in patients with subacromial pain syndrome: A clinical trial. J Rehabil Med. 2021 May 11;53(5):jrm00190. Doi: 10.2340/16501977-2806

Guimarães JF, Salvini TF, Siqueira AL Jr, Ribeiro IL, Camargo PR, Alburquerque-Sendín F. Immediate Effects of Mobilization With Movement vs Sham Technique on Range of Motion, Strength, and Function in Patients With Shoulder Impingement Syndrome: Randomized Clinical Trial. *J Manipulative Physiol Ther*. 2016;39(9):605-615. doi:10.1016/j.jmpt.2016.08.001

Gutiérrez-Espinoza H, Araya-Quintanilla F, Olguín-Huerta C, Valenzuela-Fuenzalida J, Gutiérrez-Monclus R, Moncada-Ramírez V. Effectiveness of manual therapy in

patients with distal radius fracture: a systematic review and meta-analysis. J Man Manip Ther. 2022;30(1):33-45. Doi:10.1080/10669817.2021.1992090

Gutiérrez-Espinoza H, Pinto-Concha S, Sepúlveda-Osses O, Araya-Quintanilla F. Effectiveness of scapular mobilization in people with subacromial impingement syndrome: A randomized controlled trial. Ann Phys Rehabil Med. 2023;66(5):101744. doi:10.1016/j.rehab.2023.101744

Hando BR, Rhon DI, Boyles RE, Whitman JM, English JL. Translational manipulation under anesthesia for patients with frozen shoulder: a case series study with five-year health care utilization and post-manipulative arthroscopic findings. *J Man Manip Ther*. 2017;25(5):270-278. doi:10.1080/10669817.2017.1292615

Heiser R, O'Brien VH, Schwartz DA. The use of joint mobilization to improve clinical outcomes in hand therapy: a systematic review of the literature. *J Hand Ther*. 2013;26(4):297-311. doi:10.1016/j.jht.2013.07.004

Hoogvliet P, Randsdorp MS, Dingemanse R, Koes BW, Huisstede BM. Does effectiveness of exercise therapy and mobilisation techniques offer guidance for the treatment of lateral and medial epicondylitis? A systematic review. *Br J Sports Med*. 2013;47(17):1112-1119. doi:10.1136/bjsports-2012-091990

Hsu CY, Lee KH, Huang HC, Chang ZY, Chen HY, Yang TH. Manipulation Therapy Relieved Pain More Rapidly Than Acupuncture among Lateral Epicondylalgia (Tennis Elbow) Patients: A Randomized Controlled Trial with 8-Week Follow-Up. *Evid Based Complement Alternat Med*. 2016;2016:3079247. doi:10.1155/2016/3079247

Kearns G, Wang S. Medical diagnosis of cubital tunnel syndrome ameliorated with thrust manipulation of the elbow and carpals. *J Man Manip Ther*. 2012;20(2):90-95. doi:10.1179/2042618611Y.0000000019

Knebl JA, Shores JH, Gamber RG, Gray WT, Herron KM. Improving functional ability in the elderly via the Spencer technique, an osteopathic manipulative treatment: a randomized, controlled trial. *J Am Osteopath Assoc*. 2002;102(7):387-396

Kubuk BS, Carrasco-Uribarren A, Cabanillas-Barea S, Ceballos-Laita L, Jimenéz-Del-Barrio S, Pérez-Guillén S. The effects of end-range interventions in the management of primary adhesive capsulitis of the shoulder: a systematic review and meta-analysis. Disabil Rehabil. 2024;46(15):3206-3220. doi:10.1080/09638288.2023.2243826

Liu Z, Li Z, Duan C. Effects of Maitland mobilization technique on upper extremity function in stroke survivors with spasticity: An experimental study. Medicine (Baltimore). 2024;103(20):e38184. doi:10.1097/MD.0000000000038184

Lucado AM, Dale RB, Vincent J, Day JM. Do joint mobilizations assist in the recovery of lateral elbow tendinopathy? A systematic review and meta-analysis. *J Hand Ther*. 2019;32(2):262-276.e1. doi:10.1016/j.jht.2018.01.010

McHardy A, Hoskins W, Pollard H, Onley R, Windsham R. Chiropractic treatment of upper extremity conditions: a systematic review. *J Manipulative Physiol Ther*. 2008;31(2):146-159. doi:10.1016/j.jmpt.2007.12.004

Mundy S, Jones A, Brantingham J, Globe G, Jensen M, Price J. A randomized, single-blind placebo controlled clinical trial to evaluate the efficacy of chiropractic shoulder girdle adjustment in the treatment of shoulder impingement syndrome. J Am Chiropr Assoc 2007;44:6-15

Nicholson GG. The effects of passive joint mobilization on pain and hypomobility associated with adhesive capsulitis of the shoulder. *J Orthop Sports Phys Ther*. 1985;6(4):238-246. doi:10.2519/jospt.1985.6.4.238

Noten S, Meeus M, Stassijns G, Van Glabbeek F, Verborgt O, Struyf F. Efficacy of Different Types of Mobilization Techniques in Patients With Primary Adhesive Capsulitis of the Shoulder: A Systematic Review. *Arch Phys Med Rehabil*. 2016;97(5):815-825. doi:10.1016/j.apmr.2015.07.025

Olguín-Huerta C, Araya-Quintanilla F, Moncada-Ramírez V, Estrella-Flores E, Cuyúl-Vásquez I, Gutiérrez-Espinoza H. Effectiveness of scapular mobilization in patients with primary adhesive capsulitis: A systematic review and meta-analysis. Medicine (Baltimore). 2023;102(22):e33929. doi:10.1097/MD.0000000000033929

Page MJ, O'Connor D, Pitt V, Massy-Westropp N. Exercise and mobilisation interventions for carpal tunnel syndrome. *Cochrane Database Syst Rev*. 2012;(6):CD009899. doi:10.1002/14651858.CD009899

Page MJ, Green S, Kramer S, et al. Manual therapy and exercise for adhesive capsulitis (frozen shoulder). *Cochrane Database Syst Rev*. 2014;(8):CD011275. Published 2014 Aug 26. doi:10.1002/14651858.CD011275

Peterson DH and Bergmann TF. Chiropractic technique: principles and procedures. 2nd ed. St. Louis, MO: Mosby; 2002

Rahbar M, Ranjbar Kiyakalayeh S, Mirzajani R, Eftekharsadat B, Dolatkhah N. Effectiveness of acromioclavicular joint mobilization and physical therapy vs physical therapy alone in patients with frozen shoulder: A randomized clinical trial. Clin Rehabil. 2022;36(5):669-682. doi:10.1177/02692155211070451

Rangan A, Brealey SD, Keding A, Corbacho B, Northgraves M, Kottam L, Goodchild L, Srikesavan C, Rex S, Charalambous CP, Hanchard N, Armstrong A, Brooksbank A, Carr A, Cooper C, Dias JJ, Donnelly I, Hewitt C, Lamb SE, McDaid C, Richardson G, Rodgers S, Sharp E, Spencer S, Torgerson D, Toye F; UK FROST Study Group. Management of adults with primary frozen shoulder in secondary care (UK FROST): a multicentre, pragmatic, three-arm, superiority randomised clinical trial. Lancet. 2020 Oct 3;396(10256):977-989. doi: 10.1016/S0140-6736(20)31965-6

Riley SP, Harris J, O'Halloran BJ, Showalter CR, Learman KE. Symptom response to mobilization and outcomes in patients with subacromial pain syndrome: A cohort study. Physiother Res Int. 2021 Jul;26(3):e1914. doi: 10.1002/pri.1914

Roll SC, Hardison ME. Effectiveness of Occupational Therapy Interventions for Adults With Musculoskeletal Conditions of the Forearm, Wrist, and Hand: A Systematic Review. *Am J Occup Ther*. 2017;71(1):7101180010p1-7101180010p12. doi:10.5014/ajot.2017.023234

Rosa DP, Borstad JD, Ferreira JK, Gava V, Santos RV, Camargo PR. Comparison of specific and non-specific treatment approaches for individuals with posterior capsule tightness and shoulder impingement symptoms: A randomized controlled trial. Braz J Phys Ther. 2021;25(5):648-658. doi:10.1016/j.bjpt.2021.04.003

Russell BS. A suspected case of ulnar tunnel syndrome relieved by chiropractic extremity adjustment methods. *J Manipulative Physiol Ther*. 2003;26(9):602-607. doi:10.1016/j.jmpt.2003.08.005

Satpute KH, Bhandari P, Hall T. Efficacy of Hand Behind Back Mobilization With Movement for Acute Shoulder Pain and Movement Impairment: A Randomized Controlled Trial. *J Manipulative Physiol Ther*. 2015;38(5):324-334. doi:10.1016/j.jmpt.2015.04.003

Savva C, Karagiannis C, Korakakis V, Efstathiou M. The analgesic effect of joint mobilization and manipulation in tendinopathy: a narrative review. J Man Manip Ther. 2021;29(5):276-287. doi:10.1080/10669817.2021.1904348

Siu G, Jaffe JD, Rafique M, Weinik MM. Osteopathic manipulative medicine for carpal tunnel syndrome. *J Am Osteopath Assoc*. 2012;112(3):127-139

Stasinopoulos D, Johnson MI. Cyriax physiotherapy for tennis elbow/lateral epicondylitis. *Br J Sports Med*. 2004;38(6):675-677. doi:10.1136/bjsm.2004.013573

Stathopoulos N, Dimitriadis Z, Koumantakis GA. Effectiveness of Mulligan's Mobilization With Movement Techniques on Range of Motion in Peripheral Joint Pathologies: A Systematic Review With Meta-analysis Between 2008 and 2018. *J Manipulative Physiol Ther*. 2019;42(6):439-449. doi:10.1016/j.jmpt.2019.04.001

Surenkok O, Aytar A, Baltaci G. Acute effects of scapular mobilization in shoulder dysfunction: a double-blind randomized placebo-controlled trial. *J Sport Rehabil*. 2009;18(4):493-501. doi:10.1123/jsr.18.4.493

Teys P, Bisset L, Vicenzino B. The initial effects of a Mulligan's mobilization with movement technique on range of movement and pressure pain threshold in pain-limited shoulders. *Man Ther*. 2008;13(1):37-42. doi:10.1016/j.math.2006.07.011

Verhaar JA, Walenkamp GH, van Mameren H, Kester AD, van der Linden AJ. Local corticosteroid injection versus Cyriax-type physiotherapy for tennis elbow. *J Bone Joint Surg Br*. 1996;78(1):128-132

Vermeulen HM, Rozing PM, Obermann WR, le Cessie S, Vliet Vlieland TP. Comparison of high-grade and low-grade mobilization techniques in the management of adhesive capsulitis of the shoulder: randomized controlled trial. *Phys Ther*. 2006;86(3):355-368

Vicenzino B, Paungmali A, Buratowski S, Wright A. Specific manipulative therapy treatment for chronic lateral epicondylalgia produces uniquely characteristic hypoalgesia. *Man Ther*. 2001;6(4):205-212. doi:10.1054/math.2001.0411

Wang S, Chapple C, Farrell G, Quinn D, Tumilty S, Ribeiro DC. Dosage of joint mobilization for the management of patients with rotator cuff-related shoulder pain: A scoping review. Musculoskelet Sci Pract. 2024;70:102903. doi:10.1016/j.msksp.2023.102903

Westad K, Tjoestolvsen F, Hebron C. The effectiveness of Mulligan's mobilisation with movement (MWM) on peripheral joints in musculoskeletal (MSK) conditions: A systematic review. *Musculoskelet Sci Pract*. 2019;39:157-163. doi:10.1016/j.msksp.2018.12.001

Woods DA, Loganathan K. Recurrence of frozen shoulder after manipulation under anaesthetic (MUA): the results of repeating the MUA. *Bone Joint J*. 2017;99-B(6):812-817. doi:10.1302/0301-620X.99B6.BJJ-2016-1133.R1

Yang JL, Chang CW, Chen SY, Wang SF, Lin JJ. Mobilization techniques in subjects with frozen shoulder syndrome: randomized multiple-treatment trial. *Phys Ther*. 2007;87(10):1307-1315. doi:10.2522/ptj.20060295

Yang JL, Jan MH, Chang CW, Lin JJ. Effectiveness of the end-range mobilization and scapular mobilization approach in a subgroup of subjects with frozen shoulder syndrome: a randomized control trial. *Man Ther*. 2012;17(1):47-52. doi:10.1016/j.math.2011.08.006

Zhao Y, Yang T, Feng C, Li L, Pang L, Zhao S. Arthroscopic Capsular Release Versus Manipulation under Anesthesia for Refractory Frozen Shoulder: A Systematic Review with Meta-Analysis. Orthop Surg. 2024;16(7):1517-1529. doi:10.1111/os.14077