## Supplemental Table 1. Occupational Therapy Interventions for Work-Related Injuries and Clinical Conditions of the Shoulder

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<tr>
<th>Author/Year</th>
<th>Study Objectives</th>
<th>Level/Design/Participants</th>
<th>Intervention and Outcome Measures</th>
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<th>Study Limitations</th>
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<tr>
<td>Bingo¨l et al. (2005)</td>
<td>To assess the role of low-power gallium-arsenide laser treatment in the relief of pain and the improvement of joint ROM in patients with shoulder pain</td>
<td>Level I Double-blind RCT 40 patients who presented to the clinic with unilateral shoulder pain</td>
<td>Intervention&lt;br&gt;Active laser group: laser and exercise&lt;br&gt;Placebo group: placebo and exercise&lt;br&gt;<strong>Outcome Measures</strong>&lt;br&gt;Pain VAS, palpation sensitivity, and goniometric measurement</td>
<td>Significant improvements were noted for sensitivity in the laser group and for some active and passive motions in both groups. Comparison between the 2 groups showed better results in the laser group for palpation sensitivity ($p &lt; .001$) and passive extension ($p &lt; .05$).</td>
<td>Elapsed time</td>
<td>The use of low-energy laser therapy treatment of patients with unilateral shoulder pain was not demonstrated to be a significantly more efficacious preparatory modality than therapeutic exercise.</td>
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<tr>
<td>Diercks &amp; Stevens (2004)</td>
<td>To establish the effect of supervised neglect on idiopathic frozen shoulder compared with an intensive physical therapy regimen</td>
<td>Level II Quasi-experimental design with a successive cohort as a control group 77 patients diagnosed with idiopathic frozen shoulder</td>
<td>Intervention&lt;br&gt;Supportive therapy and supervised neglect group: education and home program within pain-free range&lt;br&gt;Passive mobilization and stretching group: standard protocol of active exercises, passive stretches and manipulation, and home exercises aimed at stretching and maximal reaching&lt;br&gt;<strong>Outcome Measures</strong>&lt;br&gt;Constant score</td>
<td>In the supervised neglect group 89% of patients reached a Constant score of $\geq 80$, reporting no pain and almost complete glenohumeral motion. In the passive mobilization and stretching group, 63% of patients reached a Constant score of $\geq 80$, reporting no pain and almost complete glenohumeral motion.</td>
<td>Specific parameters of therapeutic and home exercise programs were not given for either group. In addition, a time effect cannot be ruled out secondary to study design. Finally, evaluators were not blinded to group assignment, creating a possible bias in evaluation.</td>
<td>Less aggressive therapeutic techniques were shown to be more effective for patients with idiopathic frozen shoulder than those techniques that surpass the pain threshold. Both treatment groups required $\geq 12$ mo to recover pain-free glenohumeral ROM.</td>
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<td>Ejnisman et al. (2005)</td>
<td>To review the efficacy and safety of common interventions for tears of the rotator cuff in adults</td>
<td>Level I Systematic review 8 studies involving 455 people (393 analyzed in this review)</td>
<td>Intervention&lt;br&gt;Studies investigating rotator cuff tears treated either surgically or conservatively&lt;br&gt;<strong>Outcome Measures</strong>&lt;br&gt;Pain, shoulder scores (such as the Shoulder Pain and Disability Index), ROM, manual muscle testing, patient satisfaction, reported success or failure of treatment</td>
<td>No RCTs were identified that compared conservative and operative management of rotator cuff tears. Little evidence supported or refuted the efficacy of common interventions for rotator cuff tears.</td>
<td>Small sample size limits generalization. Methodological quality of studies included in review was limited.</td>
<td>Little evidence to support or refute conservative or surgical management of rotator cuff tears</td>
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<td>Geraets et al. (2005)</td>
<td>To assess whether graded exercise therapy is more effective than usual care after 12 wk of treatment in terms of</td>
<td>Level I RCT</td>
<td>Intervention&lt;br&gt;Graded exercise therapy group: behavioral program based on graded activity,</td>
<td>Significant differences were found between groups for the main complaints instrument and for changes in</td>
<td>18 patients withdrew from the study, and 8 patients were missing for posttreatment analysis.</td>
<td>Graded exercise therapy was shown to have a minimally greater benefit than usual care for patients with chronic</td>
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<td>Gibson et al. (2004)</td>
<td>To determine the effectiveness of conservative management as a primary strategy in the treatment of shoulder instability</td>
<td>Level I Systematic review 14 articles</td>
<td>Intervention Nonoperative management including immobilization, stretching, strengthening, stabilization exercise, biofeedback, and modalities</td>
<td>Weak yet positive support was found for conservative methods, including an immobilization period of 3–4 wk followed by ROM and stabilization exercises over a 12-wk period. 1 low-quality RCT was found to support electromyography biofeedback as a beneficial, adjunctive method of treatment.</td>
<td>Critical appraisal tool was not designed for cohort or case series designs. Common problems of individual studies included lack of randomization, control groups, blinding, and statistical analyses.</td>
<td>Shoulder pain. These results seemed to be limited to participants who did not experience pain upon physical exam.</td>
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<tr>
<td>Grant et al. (2004)</td>
<td>To determine the effectiveness of surgical and conservative treatments for rotator cuff pathologies</td>
<td>Level I Systematic review 64 articles</td>
<td>Intervention Surgical and nonsurgical management of rotator cuff pathology including electrotherapy, physical therapy, exercise therapy, acupuncture therapy, shock wave therapy, laser therapy, needle aspiration, open surgical repair, mini-open surgical repair, and arthroscopic surgical repair</td>
<td>From the 64 articles reviewed, weak evidence was found to support the conservative techniques of electrotherapy, steroid injections, exercise therapy, and acupuncture.</td>
<td>Methodological quality of studies included in the review was mixed. Several studies had a small sample size.</td>
<td>The current research on rotator cuff pathology does not strongly support or refute any available intervention for this condition.</td>
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Supplemental Table 1. Occupational Therapy Interventions for Work-Related Injuries and Clinical Conditions of the Shoulder (cont.)
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<tr>
<th>Reference</th>
<th>Study Objective</th>
<th>Level I</th>
<th>Type of Study</th>
<th>Sample Size</th>
<th>Interventions</th>
<th>Outcome Measures</th>
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<tr>
<td>Green et al. (2005)</td>
<td>To complete a systematic review of RCTs as a means to determine the efficacy of interventions for shoulder pain</td>
<td>Level I</td>
<td>Systematic review</td>
<td>26 articles</td>
<td>Randomized controlled comparisons of physical therapy intervention and placebo, no treatment, another intervention, or varied interventions</td>
<td>Pain, ROM, function, disability, quality of life, strength, return to work, participants' perception of effect, global preference, physician preference, and adverse effects</td>
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<td>Guler-Uysal &amp; Kozanoglu (2004)</td>
<td>To compare the early response of rehabilitation for adhesive capsulitis with attention to clinical efficacy and cost-effectiveness</td>
<td>Level I</td>
<td>Randomized, comparative prospective clinical trial</td>
<td>40 patients with adhesive capsulitis who met specific inclusion criteria</td>
<td>Cyriax group: deep friction massage and manipulation, Physical therapy group: superficial heat modalities, active stretching and pendulum exercises, and a standardized home exercise program</td>
<td>Recovery rate, or the number of patients who achieved 80% of normal ROM at the end of the 2nd week of the study</td>
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<td>Handoll et al. (2003)</td>
<td>To gather and assess the evidence for various methods of treating proximal humerus fractures</td>
<td>Level I</td>
<td>Systematic review</td>
<td>12 studies (578 participants)</td>
<td>Conservative and surgical interventions used to treat or rehabilitate proximal humeral fractures</td>
<td>Anatomical reduction; clinical outcomes including strength, ROM, pain, satisfaction, and complications; functional outcomes including health-related quality of life; economic outcomes including attendance at outpatient appointments</td>
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Exercise was found to be effective for patients with rotator cuff pathology, and mobilization resulted in additional benefit. Laser was found to be effective for adhesive capsulitis but not rotator cuff disease. Ultrasound and pulsed electromagnetic field therapy were found to be beneficial for patients with calcific tendinitis.

Sample size of individual studies decreases generalizability and increases the risk of Type II error. Interventions were not researched as typically pursued in clinical settings.

Weak evidence supported some interventions for pain, stiffness, and disability of the shoulder, including exercise, mobilization, laser, pulsed electromagnetic field, and ultrasound.

The Cyriax method of rehabilitation was shown to produce significantly greater changes in glenohumeral flexion, rotations, and pain in a significantly decreased amount of treatment time compared with standard physical therapy using superficial and deep heat treatments.

Some evidence that immediate therapy resulted in less pain and both faster and better recovery for patients with nondisplaced 2-part fractures, that mobilization at 1 wk alleviated short-term pain, and that patients could achieve a satisfactory outcome without supervised therapy.

Small sample size limits generalizability.

Evidence to support decision making was limited. Early therapeutic intervention without immobilization might be appropriately pursued by occupational therapists for specific, nondisplaced fractures. The long-term benefits of surgical intervention are unclear.
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<td>Karjalainen et al.</td>
<td>To determine the effectiveness of multidisciplinary biopsychosocial rehabilitation for adults with neck and shoulder pain</td>
<td>Level I Systematic review</td>
<td><strong>Interventions</strong>&lt;br&gt;Multidisciplinary inpatient or outpatient programs including consultation with a physician and a psychological, social, or vocational intervention</td>
<td>Two studies met the inclusion criteria for this review. Neither study provided evidence to support multidisciplinary biopsychosocial rehabilitation programs as beneficial for working-age adults with neck and shoulder pain.</td>
<td>Small sample size limits generalization. Both studies included in the review were considered to be of low quality.</td>
<td>Scientific evidence to support multidisciplinary biopsychosocial rehabilitation programs as beneficial for working-age adults with neck and shoulder pain was limited. Because this approach is a common intervention, high-quality trials in this area are urgently recommended.</td>
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<td>Ludwig &amp; Bostad</td>
<td>To implement and evaluate a therapeutic exercise program intended to modify shoulder elevation and muscle activity abnormalities believed to be related to shoulder impingement among construction workers</td>
<td>Level I RCT 103 construction workers who regularly participate in overhead working conditions</td>
<td><strong>Intervention</strong>&lt;br&gt;Participants in the intervention group were given a home exercise program consisting of stretches, muscle relaxation exercise, and progressive resistance strengthening exercise. Participants in the control group received no intervention.</td>
<td>Participants in the intervention group showed significant improvements from pretest to posttest in their SRQ scores and in satisfaction ($p &lt; .001$). At the end of the study, work-related pain and disability scores of the intervention group remained significantly greater than those of the asymptomatic group.</td>
<td>Study consisted of a convenience sample of male construction workers.</td>
<td>This study supports the use of a shoulder home exercise program to improve shoulder function and reductions in symptoms for construction workers who have routine exposure to overhead work.</td>
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<td>Lundblad et al.</td>
<td>To compare physical therapy with Feldenkrais interventions in the reduction of complaints of the neck and shoulder</td>
<td>Level I RCT 97 female industrial workers who had complaints of neck and shoulder pain</td>
<td><strong>Intervention</strong>&lt;br&gt;Physiotherapy intervention group: education, exercise, and postural interventions&lt;br&gt;Feldenkrais group: individual and group treatment, audiocassettes with exercise and educational components</td>
<td>The Feldenkrais group had a significantly higher proportion of participants with improvements in the neck–shoulder index, a significant decrease in complaints from the neck and shoulders, and a statistically significant decrease in disability with respect to leisure participation.</td>
<td>The study had a high number of dropouts and included only female industrial workers, limiting generalization.</td>
<td>Despite long training times, the use of Feldenkrais interventions was demonstrated in this study to be a holistic, preparatory intervention that facilitates return to occupation. Further research is needed to justify Feldenkrais as an intervention for people with neck and shoulder complaints.</td>
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Michener et al. (2004)  
To examine the efficacy of nonsurgical and nonpharmacologic rehabilitation of subacromial impingement syndrome  
Level I  
Systematic review  
12 articles  
Control group: no intervention  
Outcome Measures  
Neck–shoulder index, pain, and measures of disability including sick leave  
Interventions  
Exercise, joint mobilizations, laser, ultrasound, and acupuncture performed in combination or in isolation  
Outcome Measures  
Pain and a direct measure of functional loss or disability  
Limited evidence supports exercise for strengthening and stretching. Joint mobilizations were found to increase effectiveness. In addition, laser appears to be beneficial when used in isolation, the use of ultrasound was not supported, and acupuncture yielded equivocal results.  
Small sample size limits generalization; foreign language articles were excluded.  
Limited evidence was found to support exercise and joint mobilizations for patients with subacromial impingement syndrome.

Randlev et al. (1998)  
To compare the effectiveness of 2 types of training on chronic neck–shoulder patients  
Level I  
RCT  
77 women ages 18–65 with chronic neck–shoulder pain for ≥6 mo  
Intervention  
Intensive training: Bicycling and stretching, followed by shoulder exercises with increasing resistance  
Lighter training: Superficial heat followed by bicycling and stretching  
Outcome Measures  
Pain, activities of daily living or disability, maximal voluntary isometric contraction of the flexors and extensors of the cervical spine  
Increased ADLs and decreased pain in both groups, with no significant difference between the two. Success rate was 50% at the conclusion of treatment and 60% at the 12-mo follow-up.  
The study lacked a control group and included only women, limiting generalizability.  
The use of either intensive or lighter training was shown to be beneficial in improving function for patients with chronic neck and shoulder pain.

Ryans et al. (2005)  
To examine the effectiveness of intra-articular steroid treatment and physiotherapy alone and in combination for patients with adhesive capsulitis  
Level I  
RCT  
Eighty participants with painful shoulder lasting between 4 wk and 18 mo  
Intervention  
Group A: injection of intra-articular steroid and physiotherapy  
Group B: injection only  
Group C: placebo injection and physiotherapy  
Group D: placebo injection and no physiotherapy  
Outcome Measures  
The SF–36, a hospital anxiety and depression scale, ROM, a shoulder disability  
At 6 wk, significant improvement in shoulder disability and global function were noted in the injection group. Significant improvement of passive external rotation was found in the physiotherapy group.  
The injections were given under radiological guidance and may not be able to be generalized to clinical practice. Dropouts may have affected the findings after 16 wk.  
Improvements were seen with injection and physiotherapy, but no interaction between the two was found, showing that positive effects of the treatments may be seen in different aspects of dysfunction.

(Continued)
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<td>Sjögren et al. (2005)</td>
<td>To test the effects of a workplace intervention on headaches, neck and shoulder symptoms, and upper-extremity strength in office workers.</td>
<td>Level II</td>
<td><strong>Intervention</strong> After baseline measures, patients were allocated into two treatment sequence groups: exercise and resistance intervention and no-physical-exercise intervention. Treatment consisted of physical exercise and light resistance training.</td>
<td>Physical exercise resulted in a slight yet significant decrease in headache and neck symptoms and an increase in extension strength. No effects on shoulder symptoms or flexion strength were noted.</td>
<td>Sample size and population drawn from limits generalization to the greater population of patients who complain of head, neck, and shoulder pain.</td>
<td>Limited evidence was provided that daily, light resistance training as guided by a therapist can decrease head and neck symptoms and increase shoulder extension strength for patients who perform physically light work.</td>
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<tr>
<td>Vermeulen et al. (2006)</td>
<td>This study compared the effectiveness of high-grade and low-grade mobilization techniques for patients with adhesive capsulitis of the shoulder</td>
<td>Level I RCT</td>
<td><strong>Intervention</strong> Participants were randomly assigned to the HGMT group or the LGMT group. At the conclusion of each treatment, passive PNF patterns and active pendulum exercises were completed.</td>
<td>Both groups improved significantly. Statistically significant improvements in passive abduction and active and passive external rotation were found for the HGMT group. The HGMT group was also found to have a significant trend difference in passive external rotation and SRQ/SDQ scores over a 12-mo period compared with the LGMT group.</td>
<td>Absence of a control group limits analysis of effectiveness. Sample size was small.</td>
<td>Limited evidence to support the efficacy of high-grade mobilization techniques compared with low-grade mobilization for the improvement of shoulder mobility and reduction of self-reported disability in patients with Phase 2 adhesive capsulitis.</td>
</tr>
<tr>
<td>Waling et al. (2000)</td>
<td>To evaluate the effectiveness of strength, endurance, and coordination programs on neck–shoulder pain in women with work-related trapezius myalgia</td>
<td>Level I RCT</td>
<td><strong>Intervention</strong> Participants were randomized into 1 of 4 treatment groups: strength (concentric resistance exercise), endurance (ergometer and abdominal and back exercises), coordination (body awareness therapy), or control (12-wk stress management) group.</td>
<td>VAS pain scale scores at worst decreased significantly ($p &lt; .05$) in the strength and endurance groups. Pressure sensitivity decreased significantly ($p &lt; .05$) in 4 trigger points in the exercise groups. Comparison of exercise groups with the control group showed significant reductions in VAS pain at present and at worst in the exercise groups.</td>
<td>Small sample limits ability to detect minor changes in pain. Use of fourth intervention group vs. no-treatment group was a limitation. Although another group would be helpful, the control group used helps to eliminate the attention bias that would have occurred if the no treatment had been used.</td>
<td>Limited evidence was provided to support the efficacy of exercise programs to reduce pain in work-related trapezius myalgia.</td>
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Outcome Measures
Pain VAS, pain trigger points using a Somedic pressure algometer, pain drawings, and a subjective evaluation of training effects on symptoms using a 5-grade categorical scale.

**Note.** ADL = activity of daily living; EuroQol–5D = European Quality of Life; FABQ–DV = Fear–Avoidance Beliefs Questionnaire; HGMT = high-grade mobilization technique; LGMT = low-grade mobilization technique; PCCL = Pain Coping and Cognition List; PNF = proprioceptive neuromuscular function; RCT = randomized controlled trial; ROM = range of motion; SDQ = Shoulder Disability Questionnaire; SPS = Shoulder Pain Score; SRQ = Shoulder Rating Questionnaire; TSK = DV Tampa Scale for Kinesophobia; VAS = visual analog scale.

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