Conservative Care Options for Work-Related Mechanical Shoulder Conditions

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Purpose and Intended Use

This document updates a 2010 resource developed by the Industrial Insurance Chiropractic Advisory Committee (IICAC) of the Washington State Department of Labor and Industries. It provides concise summaries of published clinical and scientific literature regarding utility and effectiveness of commonly used conservative approaches for work-related mechanical shoulder conditions; history, examination and special studies, recommendations for supportive, manual, and rehabilitative care including practical clinical resources (useable without licensing/charge in practice for non-commercial use). It is intended to inform care options and shared decision-making. It is not a standard of care, claim management standard, or a substitute for clinical judgment in an individual case. This practice resource does not change L&I coverage or payment.

A comprehensive search of available scientific literature on conservative assessment and intervention procedures for mechanical shoulder conditions was conducted by the Policy, Practice, and Quality (PPQ) Subcommittee of the IICAC and department staff during early 2014. Literature was reviewed, assessed for relevance and quality and summaries were drafted by consensus of the subcommittee with expert content input from consultants and reviewers, including the department's Industrial Insurance Medical Advisory Committee and selected relevant professional societies in March 2014. An updated draft was posted for public comment and was revised and approved for distribution by the IICAC and department in April 2014. This resource is expected to be updated periodically by the IICAC. Interested parties are encouraged to submit new published scientific reports for consideration for future revisions.

This and other practice resources are in the public domain and are available for download at the State of Washington Department of Labor & Industries website. Contact information for public input and submission of studies for future revisions is available there.

http://www.lni.wa.gov/ClaimsIns/Providers/ProjResearchComm/IICAC

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PRACTICAL APPLICATION POINTS

- Work-relatedness usually involves direct or indirect trauma to the shoulder, or prolonged, awkward or overhead arm use.
- Differential shoulder diagnosis is typically based on clinical criteria. Fracture or dislocation are important to rule in, however diagnostic precision for soft tissue conditions may not yield many differences in conservative manual care options as treatment typically involves passive and active interventions for the entire shoulder girdle.
- Rapid functional improvement gains should be evident with conservative care, particularly with severely restricted shoulder range of motion. Baseline and progress functional tracking instruments should be routinely used.

Work-Related Mechanical Shoulder Conditions

Work-related shoulder conditions of mechanical origin for which patients seek conservative care typically present as shoulder pain with full or limited movement following an identifiable workplace exposure. Serious underlying conditions, associated with acute mechanically-triggered shoulder pain and restriction, are extremely rare. Flags for non-mechanical conditions include pain at rest, erythema, and unexplained swelling. Posttraumatic deformity and inability to perform any movements are flags for fracture or dislocation. Patient history, location of tenderness, and character of pain guide diagnosis. Examination is useful for discerning between articular, soft tissue, and referred pain sources. Imaging is not indicated initially in the absence of significant precipitating trauma, sudden onset of pain and swelling, palpable mass or deformity, or pain at rest. Acute onset, mild overuse/trauma, and lower shoulder disability scores predict a good outcome with conservative care. Increased age, female gender, severe or recurrent symptoms at presentation, concurrent neck pain, and higher disability scores are associated with poorer outcomes.

Case Definition

- Clinical presentation of shoulder pain with full or limited movement following mechanical workplace activity/exposure.
- Work place exposures – falls, blunt force, or extended periods of overhead or awkward arm position.
- Diagnosis of a shoulder condition is usually based on clinical criteria. Imaging should be reserved for patients presenting with specific red flags or non-response to 4-6 weeks of appropriate conservative care.

Evaluation Summary

- Rule-out potential red flag shoulder conditions that require a prompt specialty referral: such as shoulder pain associated with muscle weakness or inability to raise the arm/shoulder, deformity, swelling, fever/chills, suspected malignancy or shoulder instability or dislocation,
- Rule-in mechanical causes prior to initiating manual care. Suspected full thickness rotator cuff tears should be referred to specialist for urgent evaluation.
- Monitor health-related quality of life and shoulder function (e.g., shoulder questionnaires such as the Simple Shoulder Test (SST) or Shoulder Pain and Disability Index (SPADI) to establish a baseline to assess improvement over time.
- Provocative testing may correlate with diagnostic categories, but impact on specifying conservative treatment options appears minimal.

Intervention Summary

- Limited evidence supports a combined manual approach of mobilization/manipulation, active/passive exercise, and soft tissue techniques for most mechanical shoulder conditions. Early improvement in pain and function is expected for recent acute injuries. Recovery may be delayed in chronic conditions.
- Consider reassessment and specialist consult if there is inadequate response to 4 weeks of conservative care.

The Department of Labor & Industries' Shoulder Conditions Diagnosis & Treatment Guideline has additional information, particularly related to surgical intervention
www.lni.wa.gov/ClaimsIns/Providers/Treatment/TreatGuide/default.asp

Typical Interventions and Approximate Response Thresholds

1-2 wks

- ***Initially:*** *Patients with red flags or persistent severe pain should be referred to a specialist for urgent evaluation.*
- ***Uncertain mechanical etiology, severe pain/restriction:*** *rule out fracture & dislocation; expect some measurable improvement w/ combined active exercise and manual work within patient tolerance.*
- ***Known mechanical etiology:*** *expect early significant improvement for acute capsulitis/tendonosis, however recovery may be delayed in chronic conditions.*

3-6 wks

- ***Early:*** *Re-assess pain/function within 3- 4 weeks of beginning care.*
- ***Good improvement****: Shoulder function (painful arc, compound movements –e.g. overhead, behind back) improves measurably & perceptively by patient. Continue, emphasize self care.*
- ***Inadequate improvement:*** *Worsening or no change in function (e.g., lower score on SST or SPADI). Consider additional diagnostics, specialist consultation. If only small improvement, consider change in intervention (e.g., supervised exercise, more intense manual).*

7-8 wks

- ***Response should be evident:*** *With persistent loss of mobility beyond 4-6 weeks, chronic adhesion likely in traumatic onset. Recovery may be delayed in such cases.*
- ***Good improvement:*** *At or near pain free, nearly full function. Transition to self-care, periodic follow-up assessment.*
- ***Inadequate improvement:*** *Pain & function limitations persist, minimal improvement. Consider specialist referral.*

Beyond 8 wks

- ***Resolution:*** *Shoulder conditions should respond significantly with appropriate care.*
- ***Good improvement:*** *Most acute mechanical shoulder problems should resolve fully. If chronic adhesive capsulitis, improvement in function should be significant and measurable. Consider continuing combined care approach.*
- ***Inadequate improvement****: Consider additional diagnostics, specialist consultation.*

SHOULDER PROGRESS CHECKLIST

Voluntary educational / practice aid – Not an L&I documentation requirement

Assessment / Progress

Baseline	1-2 wks	3-6 wks	7-8 wks	Beyond 8 wks
Date:	Date:	Date:	Date:	Date:
Work limitation: ☐ Off work ☐ Weight restriction:_____ ☐ Activity limits: _____ ☐ Awkward work tolerance: _____ hrs	*Work limitation improvement:* ☐ Off work ☐ Weight restriction:_____ ☐ Activity limits: _____ ☐ Awkward work tolerance: _____ hrs	*Work limitation improvement:* ☐ Off work ☐ Weight restriction:_____ ☐ Activity limits: _____ ☐ Awkward work tolerance: _____ hrs	*Work limitation improvement:* ☐ Off work ☐ Weight restriction:_____ ☐ Activity limits: _____ ☐ Awkward work tolerance: _____ hrs
Function Score (e.g., SST or SPADI) Baseline: _____	*Function Score* (e.g., SST or SPADI) Baseline: _____	*Function Score* (e.g., SST or SPADI) Baseline: _____	*Function Score* (e.g., SST or SPADI) Baseline: _____
Pain Interference w/ activity: None Total 0 1 2 3 4 5 6 7 8 9 10	*Pain Interference w/ activity*: None Total 0 1 2 3 4 5 6 7 8 9 10	*Pain Interference w/ activity:* None Total 0 1 2 3 4 5 6 7 8 9 10	*Pain Interference w/ activity:* None Total 0 1 2 3 4 5 6 7 8 9 10
Baseline (check all that apply): ☐ Arm weakness ☐ Stiffness ☐ Shoulder pain ☐ Pain interferes with sleep	*Percent Improvement* (pt. perception): ___ Arm weakness ___ Stiffness ___ Shoulder pain ___ Pain interferes with sleep	*Percent Improvement* (pt. perception): ___ Arm weakness ___ Stiffness ___ Shoulder pain ___ Pain interferes with sleep	*Percent Improvement* (pt. perception): ___ Arm weakness ___ Stiffness ___ Shoulder pain ___ Pain interferes with sleep

Intervention Options

Manual

- Combined mobilization, initial active and passive exercise, and soft tissue work typically reduce pain and improve function for mechanical shoulder problems. Treatment frequency reported in trials was usually 2-3 times per week.

Modalities/Medications

- Modalities or NSAIDs do not appear to add benefit to manual interventions.
- Non-NSAID analgesics may provide pain relief.
- Subacromial steroid injection may be helpful for rotator cuff tears and tendinoses that do not respond with manual methods, although multiple or prolonged use is discouraged.

Manual

- Incrementally increasing intensity of manual techniques within patient tolerance is recommended. Consider modification of methods in absence of meaningful functional improvement.
- Patients should receive home exercise and range of motion instructions. Supervised exercise may be beneficial with rotator cuff conditions and adhesive capsulitis. Trials generally reported twice weekly frequency for 6-8 weeks.
- Surgical intervention for rotator cuff tears may be of greatest benefit for younger individuals whose response to 4-6 weeks of manual methods is inadequate.

Response

- 10-20% improvement at 2 wks is typical without care. Therapeutic target should be 30% improvement.

Good Improvement

- Natural progression of uncomplicated shoulder problems is typically ~50% improvement in pain and function in 4-6 weeks and fully resolved in 8-12 weeks.
- When mechanical etiology is identifiable, reduction in pain, and increased ranges of combined movements (e.g., reaching behind head and back) can be expected with 4-6 weeks of treatment.
- Acute shoulder-only conditions respond very quickly to conservative intervention. Chronic shoulder conditions and conditions with neck and shoulder involvement typically respond slower (e.g., adhesive condition may last several months).

Inadequate improvement

- Reassessment for red flags, further diagnostics, and specialist consultation is warranted in non-responding cases.
- Specialist consults and supervised exercise should be considered when continuing response to manual interventions is stalled/unexplained after 6 weeks.
- Difficult shoulder conditions include refractory frozen shoulder, chronic conditions such as adhesive capsulitis, and more severe rotator cuff tears. Recovery may take several months.
- Posterior glenohumeral dislocations are difficult to diagnose and may account for failure to respond in suspected cases of frozen shoulder or early adhesive capsulitis. Trauma from the anterior associated with condition onset may be a diagnostic clue.

Simply circle Yes or No

Patient Name_____

Claim # _____

Date: _____

1. Is your shoulder comfortable with your arm at rest by your side? Yes No
2. Does your shoulder allow you to sleep comfortably? Yes No
3. Can you reach the small of your back to tuck in your shirt with your hand? Yes No
4. Can you place your hand behind your head with the elbow straight out to the side? Yes No
5. Can you place a coin on a shelf at the level of your shoulder without bending your elbow? Yes No
6. Can you lift 1 lb (a full pint container) to the level of your shoulder without bending your elbow? Yes No
7. Can you lift 8 lb (a full gallon container) to the level of the top of your head without bending your elbow? Yes No
8. Can you carry 20 lb (a bag of potatoes) at your side with the affected arm? Yes No
9. Do you think you can toss a softball underhand 10 yards with the affected arm? Yes No
10. Do you think you can throw a softball overhand 20 yards with the affected arm? Yes No
11. Can you wash the back of your opposite shoulder with the affected arm? Yes No
12. Would your shoulder allow you to work full-time at your regular job? Yes No

_____

For office use - Comments

Score (Total # of "No"s)

___

Godfrey J, Hammoan R, Lowenstein S, Briggs K, Kocher M. Reliability, validity, and responsiveness of the simple shoulder test: psychometric properties by age and injury type. J Shoulder Elbow Surg 2007; 16:260-267.

Shoulder Pain & Disability Index (SPADI)

Voluntary educational / practice aid – Not an L&I documentation requirement

How severe is your pain?

1. At its worst: *(No pain)* 0 1 2 3 4 5 6 7 8 9 10 *(Worst Pain Imaginable)*
2. When lying on involved side: *(No pain)* 0 1 2 3 4 5 6 7 8 9 10 *(Worst Pain Imaginable)*
3. Reaching for something on a high shelf: *(No pain)* 0 1 2 3 4 5 6 7 8 9 10 *(Worst Pain Imaginable)*
4. Touching the back of your neck: *(No pain)* 0 1 2 3 4 5 6 7 8 9 10 *(Worst Pain Imaginable)*
5. Pushing with the involved arm: *(No pain)* 0 1 2 3 4 5 6 7 8 9 10 *(Worst Pain Imaginable)*

Patient Name_____

Claim # _____

Date: _____

_____

FOR OFFICE USE

How much difficulty do you have?

1. Washing your hair: *(No difficulty)* 0 1 2 3 4 5 6 7 8 9 10 *(So difficult - help is required)*
2. Washing your back: *(No difficulty)* 0 1 2 3 4 5 6 7 8 9 10 *(So difficult - help is required)*
3. Putting on an undershirt or pullover sweater: *(No difficulty)* 0 1 2 3 4 5 6 7 8 9 10 *(So difficult - help is required)*
4. Putting on a shirt that buttons down the front: *(No difficulty)* 0 1 2 3 4 5 6 7 8 9 10 *(So difficult - help is required)*
5. Putting on your pants: *(No difficulty)* 0 1 2 3 4 5 6 7 8 9 10 *(So difficult - help is required)*
6. Placing an object on a high shelf: *(No difficulty)* 0 1 2 3 4 5 6 7 8 9 10 *(So difficult - help is required)*
7. Carrying a heavy object of 10 pounds: *(No difficulty)* 0 1 2 3 4 5 6 7 8 9 10 *(So difficult - help is required)*
8. Removing something from your back pocket: *(No difficulty)* 0 1 2 3 4 5 6 7 8 9 10 *(So difficult - help is required)*

Scoring

Pain score:

_____ / 50 x 100 = ____%
Sum of #'s circled in pain section

Disability Score:

_____ / 80 x 100 = ____%
Sum of #'s circled in disability section

Total Score:

_____ / 130 x 100 = ____%
Sum of #'s circled in both section s

Roach KE, Budiman-Mak E, Songsiridej N, Lertratanakul Y. Development of a shoulder pain and disability index. Arthritis Care Res. 4[4], 143-149. 1991.

OCCUPATIONAL SHOULDER CONDITION CLINICAL ASSESSMENT SUMMARY

Occupational Shoulder Conditions

Clinical presentation [1, 2]

- Typically, shoulder pain is reproducible during particular movements.
- Movement may be restricted (pain precludes movement) or full (movement can be performed but causes pain).
- Onset follows mechanical workplace exposure.

Work place exposure: work injury

- Direct trauma (e.g., blunt force blow to shoulder, fall onto shoulder).
- Indirect trauma (e.g., fall onto outstretched arm/elbow that leverages sudden impact to shoulder).
- Identifiable work activity that triggers a specific episode of shoulder condition

Work place exposure: occupational disease [3]

- Overhead work for extended periods (e.g., >15 minute intervals), prolonged repetitive use of arms in awkward position or combined with heavy force, pushing or pulling heavy loads.
- In addition to such exposures known to contribute to or cause shoulder conditions, case law requires the establishment that the workplace activities contributed to the development or worsening of the condition on a more-probable-than-not basis compared to the risks in everyday life. (Dennis V. Dept of Labor & Industries, 1987)

Corroboration of diagnosis is usually clinical [1]

- History (exposure, painful restricted movement).
- Shoulder function questionnaire to document disability (e.g. SST, SPADI).
- Imaging may be helpful early in substantial trauma or to evaluate non-mechanical etiology such as tumor or infection.
- Imaging for mechanical shoulder problems is not routinely indicated unless there are red flags for underlying pathology or response is inadequate to appropriate conservative intervention.

HISTORY – Diagnostic/Severity Indicators

Patient Presentation [1, 4]

Nature

- Pain upon shoulder movement or local tissue provocation.
- Stiffness with or without pain is common with adhesive capsulitis, posterior dislocation, and other arthritis.
- Instability or hypermobility may suggest ligamentous damage
- Weakness (distinct from movement avoidance due to pain) may be associated with muscle tears and neural injury.
- Numbness/tingling may be a sequel of neural trauma or vascular involvement.

Pain location and tenderness

- Identification of specific anatomical pain generators has not withstood scientific scrutiny.
- For some shoulder conditions such as deltoid or sub acromial bursitis, tenderness may be useful for targeting inflamed structures.

Mobility

- Restriction of most any movements following trauma is a red flag for fracture or dislocation.
- Restriction of most movement due to pain following little or no trauma suggests bursitis or adhesive capsulitis.

Onset

- Positional (e.g. pain and restriction followed extended overhead/awkward work).
- Trauma (e.g. a fall on or direct blow to the shoulder at work).

- Repetitive arm activity, particularly in prolonged/awkward positions.
- Insidious onset, unexplained erythema, swelling, elevated tissue temperature, or pain at rest are flags for non-mechanical causes and warrant consideration for specialist referral.

Age

- Instability is more common in younger workers (<35 years).
- Rotator cuff tears and tendonosis are more common in older workers (>35 years)

Nature of Trauma

The mechanical nature of initiating events may frequently help identify structures involved. [1]

Sudden arm traction – consider:

- Gleno-humeral subluxation, brachial plexus injury

Fall on outstretched straight arm (land on hand) – consider:

- Acromio-clavicular separation or clavicle fracture
- Posterior dislocation
- Labrum tear
- Rotator cuff tear

Blow/fall on > 90° flexed shoulder with external rotation (fall and tumble on face, arms overhead and elbow flexed) – consider:

- Anterior gleno-humeral dislocation
- Labrum tear

Anterior blow to shoulder – consider:

- Gleno-humeral dislocation or subluxation
- Contusion

Superior blow/fall on shoulder – consider:

- Acromio-clavicular separation, distal clavicle fracture
- Contusion (pointer)

Sudden pain on heavy loading (without dislocation, e.g. weight-lifting) – consider:

- Muscle/tendon rupture
- Labrum tear

HISTORY – Prognostic Indicators

Risk Factors for Developing Shoulder Pain

In a Finnish epidemiological of 7000 adults, an association was reported for the risk of shoulder pain and the following factors[5]

- Mental status
- Obesity
- Older age, and
- Physically strenuous work and work with the trunk forward flexed or with the hand above shoulder level

After adjustment for other risk factors, the presence of depressive symptoms predicted the occurrence of shoulder pain as did a perception of

a low-level of job control. [6, 7]

Risk Factors for Prolonged Disability

A number of factors have been identified that correlate with greater likelihood of prolonged disability with shoulder conditions: [5, 8-11]

- Baseline indicators – longer duration of symptoms, higher severity, gradual onset (each independently predicts longer term disability and poorer recovery).
- Older age, female gender, and a chronic history of shoulder pain and restriction predict poorer outcomes.
- A SPADI disability score above 10, symptom duration longer than one month, receiving an injection at consultation, and having a past history of shoulder pain are significantly associated with poorer 6 month outcomes.
- Patients with severely restricted passive elevation at baseline (less than 101 degrees) have poorer 6 months outcomes.
- A history of minimal trauma or onset following extended use is associated with more favorable outcomes, especially with rotator cuff tendinosis.
- In patients with shoulder pain associated with capsulitis and/or other glenohumeral etiologies, concomitant neck pain at presentation and initial treatment is associated with poorer outcome.
- Higher age, overload at work, and working with a hand above shoulder level are associated with increased the risk of persistent severe shoulder pain.
- The overall natural progression of general shoulder pain for which care is sought by 166 patients in one British primary care setting was complete recovery in 21% of patients by 6 months and 49% of patients by 18 months. Longer recovery times correlated with longer symptom durations and more prior episodes.

CLINICAL EXAMINATION – Functional Deficit

Range of Motion

- Flexion, abduction, and external rotation assessed by visual, goniometric and photographic methods have fair to good reliability, but measurement errors are large. [12-14]
- Internal rotation measured by reaching behind back is unreliable due to elbow movement. [15]
- Intrarater reliability of 4 physiologic shoulder movements was high. The standard error (SE) for **angular inclinometer measurements** of 2 physiological shoulder movements (flexion, abduction in a standing position, inclinometer positioned at deltoid insertion) is about 5°. Internal rotation measured visually using a visual midline between the humeral epicondyles starting from a maximal external rotation position (thumb out) to a maximal internal rotation position had a standard error of 13°. External rotation measured linearly (from a standing position using a tape measure between umbilicus and ulnar styloid) had a standard error of 1.6 cm. [16]
- **Gravity inclinometer** measurements show high intra- and inter-rater reliability for hand behind back & flexion. Intra- and inter-rater reliability is poor for abduction, external or internal rotation in abduction. [17, 18]

Functional Disability Questionnaire

There are a large number of shoulder function questionnaires available for assessing shoulder function and disability. A systematic review of 16 questionnaires for which substantial evidence was available concluded the Disability of the Arm, Shoulder, and Hand Scale (DASH), the Shoulder Pain and Disability Index (SPADI), and the American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES) were all satisfactory but each had limitations (particularly sample size) and none were adequate for all properties scored (validity, reproducibility, responsiveness, inter probability, and practical burden). The Simple Shoulder Test (SST) or the Shoulder Pain and Disability Index (SPADI) are both simple validated instruments that are available for use without licensing requirements (examples are included at the beginning of this document). [19]

- **Simple Shoulder Test (SST)** is a 12 question shoulder activity scale developed at the University of Washington that has high patient utility, is highly reliable across age groups and is sensitive to change. [20, 21]

- **Shoulder Pain and Disability Index (SPADI)** is a valid measure to assess pain and disability in community-based patients reporting shoulder pain due to musculoskeletal pathology. It is not useful for initial differential diagnosis but appears sensitive to change especially for range of motion with adhesive capsulitis. It appears to be useful for assessing change over time (response to care). [22-25]
- **Disability of Arm, Shoulder, Hand (DASH) Scale** has the best clinometric properties and has a work component. It's been used increasingly as an outcome measure for upper limb pathology. It assesses entire upper arm function including elbow and hand. Reliability and reproducibility have been demonstrated in several studies. [26]
- **QuickDASH** is easier to use but underestimates symptoms and overestimates disabilities. It does not measure identical content as the DASH. QuickDASH is less specific than the DASH in the subdomains, especially in symptoms. [27]
- American Shoulder & Elbow Surgeons (ASES) Assessment Form – is a subjective shoulder pain scale that has acceptable correlation with SF-36 physical functioning, role physical, and bodily pain domains. [28]

Pain Interference

Specific attention to how a patients' pain interferes with their ability to perform usual activities has been shown to be useful in predicting chronicity for low back and other musculoskeletal problems, particularly in injured worker populations. A fast and simple approach to track the impact of the patient's pain on their function could be a simple anchored 0-10 scale such as: [29-31]

In the last month, how much has your shoulder pain/problem interfered with your daily activities? (Use a scale from 0 to 10, where 0 is "no interference" and 10 is "unable to carry on any activities")

Strength – Weakness

Rotator cuff tendinosis: [32-34]

- In general, tests for rotator cuff muscle weakness appear to correlate well in patients with cuff tears. Tests, based on presence or location of subscapular pain, do not appear to correlate well.
- Detectable subscapular weakness (usually indicating a partial or full-tear) by performing the **Lift-Off** test (patient places hand behind back and lifts it posteriorly) correlates well with rotator cuff tears.
- The internal rotation **Lag Sign** is more sensitive but less specific than the Lift-Off test. It is more sensitive for partial subscapular ruptures compared to the Lift-Off test.
- **Full/Empty Can** (aka supraspinatus strength) test (arms flexed 90°, abducted 30°, resists downward pressure in thumbs-up, then in thumbs-down position) - has slightly higher correlation with arthroscopy findings of rotator cuff tears than pain tests.
- The external rotation Lag sign is less sensitive than the Empty Can test but more specific.
- Infraspinatus strength/weakness tests (elbow at side, flexed 90° forearm externally rotated against resistance), has more correlation with arthroscopy findings than pain tests.

CLINICAL EXAMINATION – Provocation - Relief

Point provocation

General shoulder pain/restriction: [33]

- Assessment of tenderness has good inter and inter-rater reliability.

Rotator cuff tendinosis: [33]

- Eliciting tenderness at the insertion sites of some tendons is based on specific shoulder positioning. Palpation of the tendon insertion is not possible; creation of tenderness is the objective.
- Supraspinatus tendon insertion is reliably palpable below the AC joint with extension and internal rotation (flexed elbow behind back, reaching up to scapula and lifted posteriorly).
- Infraspinatus and teres minor tendons are palpable below the posterior acromion with 90° flexion, 10° adduction, and 20° external rotation (flexed elbow in front of nose, hand/forearm rotated laterally).

Dislocation: [35]

- Acromioclavicular (AC) region tenderness with deformity secondary to trauma suggests AC separation or distal clavicle fracture.
- Discrete AC tenderness without deformity suggests minor AC separation or local contusion. May indicate distal clavicle osteolysis in individuals with continued extreme loading (e.g. weightlifter).

Contractile provocation

Resisted contraction assessments of shoulder movements are often used for the purpose of localizing where pain occurs when specific contractile tissues are recruited. Studies of these tests have generally not correlated with surgical or imaging studies and are considered unreliable for localization or diagnosis. [13]

Positional provocation

General shoulder pain/restriction:

- **Painful Arc test** (painful active midrange abduction at 70°-100° with decreased pain above 100°) has good intra/inter rater reliability. When a pain occurs in this range on active movement, but not on passive movement, contractile tissue is likely involved. When a painful arc is found on both active & passive movement, any number of soft tissues may be involved (contractile, bursa, etc.) and is not helpful. [1, 24]
- Overall, the inter-examiner reliability of Cyriax classification of types of lesions has been demonstrated to be poor and unacceptable. However, experienced examiners may be able to differentiate between normal palpatory joint end feel and pathological palpatory joint end feel of passive shoulder end range. Examiners' findings of pathological end feel moderately correlates with patient report of pain. However, classic anatomic categorizations of end feel (e.g. Cyriax "capsular," "tendinous," etc end feel) may not reflect restrictions coming from the named structures. [13, 36]

Rotator cuff tendonosis:

- **Drop Arm Test** - Inability to control lowering outstretched arm from abducted position suggests rotator cuff involvement. [37]

Adhesive capsulitis:

- Multidirectional limitations equally restricted in both active AND passive movement suggest adhesive capsulitis, particularly when forward flexion is the least limited.
- Inability to perform most movements suggests early inflammation (e.g. bursitis, beginning adhesive capsulitis).
- Shoulder hunching during movement suggests compensation for restricted movement (e.g. with adhesive capsulitis, DJD). [1]

Labrum tear:

- Sharp, reproducible pain at a discrete point on active moment (that can be avoided with alternative movement) suggests internal Glenohumeral derangement such as labrum tear. [1]

Dislocation:

- Post traumatic avoidance of most-all movement generally suggests fracture or dislocation.
- Inability to flex the shoulder while maintaining forearm supination (palm up) suggests posterior dislocation. [1]

Miscellaneous provocation and orthopedic tests

Rotator cuff tendonosis:

- Combining **Painful Arc**, **Drop Arm**, and **infraspinatus strength** tests appear to have a higher positive predictive value for correlating with surgical finding of rotator cuff tear than individual tests. [37]
- Diagnosis of a full-thickness rotator cuff tear cannot be conclusively reached using one or more of the lag signs. [38]

Impingement syndrome:

- Subacromial impingement can be evaluated by combining **Hawkins-Kennedy**, **Painful Arc** & **infraspinatus strength** tests. They

appear to have higher positive predictive value for finding impingement syndromes in surgery than individual tests. [37]

- Posterior-superior impingement is evaluated using the **Apprehension sign** followed by the **Relocation sign**. Pain felt with the apprehension sign relieved by the relocation sign is an indication of posterior-superior impingement of the posterior capsule and labrum.

Labrum tear:

- Individual clinical provocation tests do not have good general predictability for findings of labrum tear on advanced imaging or during surgery. However, when combined tests are positive (specifically **Crank**, **Apprehension**, and **Load & Shift** tests), and there is a **consistent presentation & history** (e.g., clicking & locking), the tests help to rule in the condition. [39-41]
- One small study with well-trained specialists reported reasonable correlation for Biceps Load, Mimori Pain Provocation and internal rotation resistance strength with arthroscopic findings; however, arthroscopy remains the diagnostic standard. [42]
- **The Active Compression** (**O'Briens test**), and the following tests **Yergason**, **Jobe**, **Relocation**, **Anterior Slide**, **Hawkins**, **Speed**, **Neer** have good negative predictability to help rule out labrum tears even though they are not each specifically designed for labrum testing. [43]

Instability:

- **Relocation** & **Anterior Release** tests are reported to have good predictability for obvious instability but are of questionable value for subtle lesions. Other orthopedic tests (including Apprehension, Clunk, Release, Load & Shift tests, and the Sulcus sign) are not useful for determining glenohumeral instability. [40]
- **Point tenderness** correlates with surgical findings of acromioclavicular lesions. Cross body adduction stress test and AC resisted extension test have high sensitivity, specificity and negative predictive value for correlating with surgical findings of AC lesions. [44]

DIAGNOSTIC CATEGORIZATION

Occupational Shoulder Conditions Diagnostic Classification

Diagnostic conclusions of occupational shoulder conditions require elements of workplace exposure related to condition onset, presentation, and clinical findings. Despite the extensive availability of clinical examination methods and "conventional wisdom" regarding differential diagnosis of shoulder problems, reliability and validity of various clinical assessments for shoulder conditions have been shown to be of limited value. Further, a similar mix or conservative interventions (e.g., passive and active movement) appear to provide benefit for a large variety of shoulder conditions which suggests that the importance of precise differential diagnosis of mechanical contributors may be of minimal importance. [13]

Shoulder conditions can be generally categorized pathologically along the lines of: [1]

- General shoulder pain/restriction
- Rotator cuff tendinosis
- Impingement syndromes
    - Subacromial impingement syndrome – often related to rotator cuff tendinopathies
    - Capsular impingement syndromes – frequently involving posterior capsule
- Chronic tendinosis, bursitis, DJD
- Adhesive capsulitis
- Labrum tear
- Dislocation
- Instability

Intra- and inter-rater agreement of diagnostic classification was reported as moderate between two trained therapists for 201 shoulder pain and restriction patients. Six diagnostic criteria recommended by the Dutch College of General Practitioners included: Capsular Syndrome - *capsulitis, arthritis*; Acute bursitis; Acromioclavicular syndrome - *joint and superior muscle lesions including spine and scapula*; Subacromial syndrome - *tendinosis, chronic bursitis*; Rest Group - *non-mechanical, unexplained*; Mixed clinical picture -multiple

contributing structures). Diagnostic grouping was especially difficult for patients with high pain severity, chronic, and bilateral conditions. [45, 46]

IMAGING STUDIES

Imaging

Imaging for shoulder conditions is useful in some circumstances. A key issue when considering imaging is to anticipate how the result of an imaging study would modify a conservative care trial. For most pain and restriction conditions associated with a workplace exposure, imaging should only be considered if the condition does not respond to 4 weeks of conservative treatment. Circumstances where imaging should be considered include: [2]

- Acute, severe trauma (blunt force, suspicion of fracture, abnormal shape/suspicion of dislocation).
- Non-mechanical pain (unrelenting pain at rest, constant or progressive symptoms and signs, pain not reproduced on assessment-particularly if patient has history of cancer, enlarging mass, unexplained deformity, pain at multiple sites, age > 50, pain at rest, unexplained weight loss).
- Suspicion of infection (red skin, fever, systemically unwell, history of immunosuppression, penetrating wound).
- Substantial activity and/or work restriction lasting beyond 4 weeks.
- Failure to respond to conservative care by 4 weeks (e.g., no change, worsening, increasing disability).

Plain film radiography is useful for assessing:

- Impingement – using Outlet view and Zanca (15 degree cephalad view) for subacromial impingement due to a hooked acromion or osteophytic impingement.
- Anterior dislocation – using AP internal rotation or anterior oblique (Y view), axillary projection for viewing glenoid
- Posterior dislocation – using the Y view or transthoracic view.
- AC joint separation – Zanca view is best; bilateral views (weighted and non-weighted) have not been shown to alter management.
- Instability
    - Osteolysis or fractures of the distal clavicle – using a Zanca view
    - Sternoclavicular joint – using Hobb's and serendipity views
    - Humeral head fractures – seen primarily on true AP internal and external rotation

Advanced imaging includes magnetic resonance imaging (MRI), computed tomography (CT), and ultrasonography (US). These should typically be reserved for cases where conservative care has failed to resolve the problem.

- MRI may be useful when patients are unresponsive to conservative care.
    - Standard MRI
    - Contrast MRI
- CT
    - CT arthrograms are used mainly for glenoid labrum and rotator cuff tears.
    - Plain film arthrograms
- US (diagnostic ultrasound) is valuable for detecting full thickness cuff tears. Partial tears are sometimes detectable.

General shoulder pain/restriction

- MRI findings appear to have better correlation with clinical findings than ultrasound.

Shoulder pain/restriction attributed to "subacromial girdle" (acromioclavicular and glenohumeral joint) lesion (pain & restriction with specific localized findings)

- **A-C joint disorders –** Radiographs not initially indicated of non-traumatic origin. Plain film radiographs may be indicated to assess AC joint separation. AC dislocations (Types IV, V and VI) should be referred for orthopedic evaluation. MRI is more sensitive to A-C joint degeneration than plain film studies. Reactive bone edema on MRI is more reliable predictor of symptomatic A-C joint than degenerative changes seen on MRI. MRI allows assessment of adjacent soft tissues. [47, 48]

- **Adult patients with significant shoulder/glenohumeral joint trauma –** Radiograph is recommended to rule out fracture or dislocation. However, patients are unlikely to require initial radiographic examination if there is a fall and pain at rest but no swelling, palpable mass or deformity and normal ROM. Advanced imaging and specialist referral recommended. Repeat x-rays in 10 days if fracture remains a possibility, alternatively consider referral for CT.

Rotator cuff tendonosis

- Ultrasound is preferred over MRI for large rotator cuff tears and & biceps pathologies. Ultrasound is highly operator-dependent but is significantly less expensive than MRI.
- Radiographs are not initially indicated, however may be useful for ruling out suspected comorbidities.

Impingement syndrome

- Subacromial bursa inflammation on MRI correlates with impingement tests, thus MRI may only be warranted if improvement is not evident with an adequate trial of conservative care.

Chronic tendonosis, bursitis, DJD

- **Osteoarthritis (DJD):** Radiography is indicated if pain is not relieved after 4 weeks of conservative care or if there is a suspected underlying pathology such as a tumor.
- **Glenohumeral joint inflammatory arthritis:** Early MRI and rheumatologist referral is recommended in suspected septic and rheumatic arthritis.
- **Bursitis:** MRI is useful for assessing subacromial bursa effusion.

Adhesive capsulitis

- Radiographs are not routinely indicated, but may be used to exclude complicating factors.
- Arthrography is frequently used to evaluated capsular restrictions and may provide relief if rupture of adhesions occurs during the procedure.

Labrum tear

- MRI is superior to US for assessing labrum tears.
- Adding MRI with the shoulder in abduction and external rotation may reveal associated articular-sided rotator cuff tears.
- Greater pain, higher DASH, or restricted extension predicts labrum tear on MRI.
- Arthrogram may be useful in detection of labrum tear.

Dislocation

- **Glenohumeral dislocation –** Typically results from significant soft tissue injury (e.g., glenohumeral ligament or rotator cuff tear). Conventional x rays can usually establish the presence of dislocation, however, not instability.
  - Note that post-reduction, it is important to obtain AP views with a Y view, and if possible, an axillary view to detect commonly associated Hill-Sachs fractures, humeral tuberosity fractures, and glenoid rim fractures.
- **Acromioclavicular (AC) dislocation –** Severity of injury determines the degree of clavicular displacement. Rockwood Classification (Rockwood 1998) Types III-VI are true dislocations and are best imaged with conventional x-ray. AC sprains (Type I) are unlikely to be identified radiographically while AC subluxations (Type II) may be detectable on x-ray. [49]

PROGNOSTIC AND MANAGEMENT ISSUES

Prognostic Indicators

Numerous risk factors for shoulder pain in workers have been identified including:[5, 7, 50-59]

- Duration of employment - Prolonged employment (10 years) in shoulder stressing occupations was associated with supraspinatus tendinitis, shoulder pain with and without disability.

- Repetitive work.
- Awkward working position (e.g. sitting for long periods of time, reaching overhead) and concurrent exposure to multiple exposures (manual handling, working with hands above shoulders, working with vibration) increased risk.
- Physically demanding work (e.g. lifting >50 kg per hour at or above shoulder level).
- Job dissatisfaction, low level of control at work, little support.
- Anxiety, mental stress.
- Age - older age (workers over 50) was associated with sustaining severe shoulder sprain/strain and time loss associated with shoulder injury.
- Gender *(Female)*
- Obesity *(BMI>30)*
- High job related mechanical exposure was associated with heightened risk for neck and shoulder pain in men and women.
- A high psychological job demand with low job decision latitude was associated with increased neck and shoulder pain in women.

Among 436 workers with repetitive shoulder use, significant baseline differences on the SF-36 were reported in physical health, perception of general health, and social support between workers who developed rotator cuff and other shoulder symptoms those who remained asymptomatic participants over a 1 year period. [60]

QuickDASH may serve as a useful screening tool for early identification of workers with significant shoulder activity exposure who may be at greater risk of becoming chronic. [61]

WORKERS' COMPENSATION ASSESSMENT ISSUES

Causation & Work Relatedness

Exceptionally clear medical justification for specific work exposure(s) is essential for fair and timely decisions. In Washington State, occupational conditions that may be a result of cumulative workplace exposure across multiple employers may have claim and experience costs apportioned to both former and current employers. Worker and employer appeals rights can factor into adjudication decisions and contribute to delays that are associated with worse outcomes. [62, 63]

To establish a diagnosis of an occupational disease, all of the following **are required**: [3]

1. Exposure: Workplace activities that contribute to or cause shoulder conditions, **and**

2. Outcome: A diagnosis of a shoulder condition that meets the diagnostic criteria in this guideline, **and**

3. Relationship: Generally accepted scientific evidence, which establishes on a more probable than not basis (greater than 50%) that the workplace activities (exposure) in an individual case contributed to the development or worsening of the condition relative to the risks in everyday life. In epidemiological studies, this will usually translate to an odds ratio (OR) ≥ 2.

In order for a shoulder condition to be allowed as an occupational disease, the provider must document that the work exposures created a risk of contracting or worsening the condition relative to the risks in everyday life, on a more-probable-than-not basis. [3]

Assessment of Re-exposure on RTW

No studies were identified with current search strategies.

Physical Capacity and Work Restrictions

No studies were identified with current search strategies.

OCCUPATIONAL SHOULDER CONDITIONS CONSERVATIVE INTERVENTIONS SUMMARY

Manipulation & Mobilization
Glenohumeral, Acromioclavicular, Cervico-Thoracic

A 2011 systematic review of manipulative therapy for common shoulder conditions identified 35 studies that met evidence criteria of (A) Good, (B) Fair, (C) Limited out of 211 retrieved (the remainder graded as (I) Insufficient). [64] There was fair evidence (B) for benefit with rotator cuff disorders, shoulder disorders, adhesive capsulitis, and soft tissue disorders using manual or manipulative therapy to the shoulder, shoulder girdle, and/or the full kinetic chain (FKC) combined with or without exercise and/or multimodal therapy.

General shoulder pain/restriction

- A Dutch study of 150 patients presenting with both neck and shoulder pain assessed cervico-thoracic spinal manipulation (not including shoulder manipulation) of up to 6 sessions in 12 weeks combined with usual medical care (including corticosteroid injection) compared to usual medical care alone. At 12 weeks, 43% of the combined group reported full recovery compared to 21% of the usual care group. No difference in full recovery rates were reported during the first 6 weeks. Both groups also reported similar degrees of improvement after one year. [65] A subsequent factor analysis which collapsed related outcome domains into four categories shoulder pain, neck pain, shoulder mobility and neck mobility reported that there was significantly greater improvement in all four domains in the manipulation group at 12 weeks and 26 weeks**.** [66] An economic evaluation conducted in concert with this trial identified that the addition of manipulation to usual care was associated with higher costs for manipulation and time off work for the manipulation sessions. [67]
- Fifty-two men and women were randomly assigned to either an exercise only treatment group or an exercise with manual therapy group. All subjects were diagnosed with shoulder impingement syndrome, rotator cuff tendinitis, or shoulder tendinitis. Both groups improved in function and pain, however, improvement was significantly greater among those in the manual therapy plus exercise group. [68]
- A posteriorly directed joint mobilization technique was more effective than anteriorly directed mobilization technique for improving external rotation ROM in patients. Both directions of mobilization significantly reduced pain. [69]
- In a randomized prospective trial of 98 subjects with general shoulder pain and minimal restriction, adding mobilization to exercise provided no additional benefit. [70]

Shoulder pain/restriction attributed to "shoulder girdle" (cervical and thoracic spine and scapular regions) lesion (pain/restriction with non-specific findings)

- A Dutch study of 198 patients categorized diagnostically into two groups: shoulder girdle lesions (pain & restriction with non-specific clinical findings) and synovial lesions (attributed to subacromial structures (i.e. the AC and GH joints, with localized clinical findings). The shoulder girdle group consisted of 58 patients was randomized to manipulation (non-standardized, therapist discretion) and physiotherapy (modalities). At 5 weeks, 70% of manipulation patients reported themselves as fully recovered compared to 10% of the physiotherapy group. [71, 72]

Shoulder pain/restriction attributed to "subacromial girdle" (acromioclavicular and glenohumeral joint) lesion (pain & restriction with specific localized findings)

- The synovial lesion group from the above study (Winters 1997) consisted of 114 patients was randomized to manipulation (non-standardized, therapist discretion), physiotherapy (modalities), and corticosteroid injection. At 5 weeks, 75% of corticosteroid injection group manipulation patients reported themselves as fully recovered compared to 40% of the manipulation group and 20% of the physiotherapy group. [71, 72]

Impingement syndrome

- Two small trials have demonstrated that active ROM, stretching and strengthening exercise combined with modalities and education was more effective in providing short term improvements in pain & function (range of motion, strength, and activity) than modalities and education alone. Functional improvement was sustained over the longer term. Adding Maitland mobilization provided substantial addition benefit in pain reduction at 4 weeks. [73, 74]
- Another small RCT (n=30) reported significant 1 month pain reduction (VAS, SFMPQ, algometry) and ROM improvement in impingement syndrome patients for EMT compared to detuned ultrasound. [75]
- A pre-test/post-test study (n=56) assessed thoracic thrust manipulation on patients diagnoses with shoulder impingement syndrome. Significant decreases in self-reported measures pain (numeric pain scale), function (Neer impingement sign, Hawkins impingement sign, resisted empty can sign, resisted internal rotation, active abduction) and disability (SPADI) scores were reported at 48 hours post treatment. [76]

Rotator cuff tendonosis

- A systematic review of 11 published trials concluded that combining mobilization with exercise resulted in additional benefit when compared to exercise alone for rotator cuff disease. [77]

Chronic tendonosis, bursitis, DJD in elderly

- A small randomized study of 29 elderly patients with chronic, symptomatic shoulder degenerative changes compared osteopathic muscle-energy manipulation (end range contract-relax techniques) to end range positioning with no contract relax technique. Both groups reported short-term improvement in pain and range of motion with the contract-relax group sustain the benefit while the control groups benefit decreased over several months. [78]

Adhesive capsulitis

- A randomized trial of 100 adhesive capsulitis patients compared 12 weeks of high grade mobilization (passive stretch at end/painful range) versus low grade (passive movement within pain free range only). High grade had slightly better disability scores and greater ROM (external rotation and passive abduction) at 1 year than patients treated with low grade mobilization. [79]
- In a small 4 group trial of steroid injection, ice, mobilization and placebo showed no differences in pain and function at 4 weeks, although a slightly faster improvement was seen with steroid injections. [80]

Glenohumeral Dislocation/Instability

- If only one dislocation has occurred, reduction followed by 1 – 2 weeks of immobilization, then 6 to 8 weeks of incrementally increasing mobility and active exercise appears to be effective. [1]
- Surgical intervention in active individuals under age 35 appears to be associated with a lower recurrence rate. [3, 81, 82]
- For individuals suffering two or more dislocations within 3 months, surgical consultation is recommended. It should be noted that arthroscopic and open procedures appear to have similar outcomes. [3, 83, 84]

Summary – Mobilization is reasonably well studied; high velocity manipulation is poorly studied. More aggressive mobilization compares more favorably to less aggressive forms. Effects seen in studies are with 5-24 sessions within 12-16 weeks and benefit usually detectable/reported within 4-6 weeks. [1]

The Council on Chiropractic Guidelines and Practice Parameters (CCGPP) have made the following expert opinion statements regarding High-Velocity Manipulation:

The expert opinion of the CCGPP Upper Extremity Team supports the use of high-velocity, short-amplitude (HVSA) manipulation (adjustment) of the shoulder with some recommendations for use that include avoidance of any anticipated risk. Further evaluation and management may be required for patients with a failure to respond to treatment within a reasonable period of time.

- For all patients who have fracture, suspected fracture, dislocation, severe generalized or local osteoporosis, infection, tumor, or infection HVSA manipulation is contraindicated.

- For patients who have had surgery of the shoulder, consider date of surgery, extent of surgery, type of procedure, and other related factors in making decisions about use of HVSA manipulation.
- For all patients, an evaluation for joint stability must be performed. Based on the findings, it is recommended that no HVSA manipulation be used for patients with medical subluxation, hypermobility syndromes (e.g. Marfan's, Ehlers-Danlos syndrome), or gross looseness indicating multidirectional instability. Mobilization such as applying a load-and-shift or Maitland grade 1-4 type of translational movement may be appropriate in these case settings.
- For patients with adhesive capsulitis or any acute inflammatory condition such as rheumatoid arthritis, active hemiarthrosis or extensive swelling, rheumatoid variant disease, crystalline disease (e.g. gout), or acute bursitis it is recommended not to use HVSA. There is some literature evidence that aggressive mobilization may worsen or prolong the natural history of adhesive capsulitis. Based on this evidence and the experience of our panel, we feel that an HVSA approach is highly risky for certainly the early stages of adhesive capsulitis. For the middle and later stages of adhesive capsulitis chiropractors should consider a progressive application of increasing the grade of amplitude of manipulation. It is recommended that by using patient feedback and response as a guide, increasing grades of amplitude may be applied.
- For patients with impingement syndrome with a known structural cause (e.g. type 3 acromion, arthritis, etc.), we strongly recommend that any HVLA manipulation not be applied in a superior direction.

Modalities

With few exceptions, physiotherapeutic modalities are generally of little benefit for most shoulder conditions. [74]

General shoulder pain/restriction

- Bipolar interferential current was no better than placebo in improving pain and function in a randomized trial of 145 general shoulder pain patients.
- Laser was ineffective in reducing pain or improving active motion in a small randomized trial (n=40) that compared 10 exercise sessions with laser to exercise with detuned laser. [85]

Rotator cuff tendonosis

- Ultrasound, pulsed electromagnetic field, or laser was no better than placebo in two trials.[86, 87]
- Pulsed electromagnetic field was associated with reduced short term pain for rotator cuff disease in the short term. [88]

Chronic tendonosis, bursitis, DJD

- Several treatments per week of pulsed ultrasound US (1 mHz at 2.5 wts/square cm; 1:4 duty cycle) & pulsed electromagnetic field were reported in one study to be superior to natural history or placebo for resolution of pain and dispersion of calcium deposits. [86, 87]
- Radial shock-wave therapy was studied in a single blind, placebo-controlled randomized trial of 90 patients with painful shoulders that failed to improve with 6 months of conservative care. Subjects also had radiographically verified calcific deposits in shoulder muscle tendons (excluding AC and GH deposits). The treatment group experienced improvement in pain and shoulder function (UCLA shoulder rating scale) with radiographic resolution of calcification in 88% of treated subjects compared to partial resolution in 9% of controls. [89, 90] Shockwave therapy appears to provide optimal benefit when delivered at lower intensities over more treatment periods.[91, 92] Currently, this modality is a non-covered service in Washington workers compensation.

Adhesive capsulitis

- Laser treatment provided short term pain improvement for adhesive capsulitis in three trials. [93]
- No evidence that physiotherapy modality interventions alone were of benefit. [94]

Soft tissue techniques

Massage, Trigger Point, Passive Stretch

Adhesive capsulitis

The Cyriax method of rehabilitation (deep friction massages and mobilization exercises) provides a faster and better response than the conventional physical therapy methods in the early treatment phase of patients. [95]

Exercise

General shoulder pain/restriction

- Supervised exercise therapy, corticosteroid injections with multiple physical modalities, and range of motion exercises have all been shown effective for short term reduction shoulder pain. [96]
- A trial, with a two and a half year follow up demonstrated sustained significant benefit with respect to function for exercise over placebo in rotator cuff disease. [97]
- Rapidity of muscle response measured by EMG in trapezius myalgia patients is improved by strength training compared to nonspecific general fitness training. [98]
- Based on a systematic review of randomized controlled trials of patients who were treated for various complaints of arm, neck, or shoulder pain & restriction, there is limited evidence supporting the effectiveness of exercise compared to massage alone, massage as an add-on to manual therapy, and manual therapy as an add-on to exercise. No differences between types of exercises have been reported in studies comparing different types of exercise. [55, 99, 100]
- An Australian trial of 138 unilateral chronic mechanical shoulder pain patients were randomized to dynamic stabilizing exercise therapy, corticosteroid injection, or modalities and range of motion exercises. All three groups improved significantly at 5 weeks in pain and function (active ROM, strength, self-reported difficulty in shoulder tasks) with steroid injection or exercise alone being the lowest cost. [96]

Rotator cuff tendonosis

- In a Canadian randomized trial of postal workers with complaints of chronic rotator cuff tendinosis 85 patients were randomized into naturopathic care (anti-inflammatory diet counseling, acupuncture, enzyme supplementation) and physical exercise (passive, active assisted, and active exercise with a matched supplementation placebo). Both groups improved with the naturopathic care group achieving better function and quality of life scores. [101]
- Based on a systematic literature review of 11 randomized trials, exercise was effective in improving shoulder pain and function in subjects with rotator cuff impingement syndromes. Supervised exercise was no more effective than home exercise; however, the addition of manual therapy enhanced the magnitude of the effect. [77]
- Supervised exercise regime may be of benefit in the short and long term for mixed shoulder disorders and rotator cuff disease. [102]
- An Australian randomized trial randomized 66 adults with localized mechanical shoulder pain (categorized mostly as rotator cuff syndromes or tendinitis) to a physical therapy group (1 month of shoulder stretching, strengthen and stabilization exercise according to therapist discretion) or no treatment controls. The treatment group improved in pain intensity, range of motion, muscle strength and self-assessment of improvement while the control group deteriorated in functional measurement scores. [103]

Impingement syndrome

- Progressive resistance training in patients with shoulder impingement syndrome was demonstrated to be effective in reducing pain and improving function. Exercises also help decrease analgesic and NSAID use. [104]
- Low quality evidence suggests exercise and mobilization may improve pain and function in subacromial impingement syndrome.[105]

Adhesive capsulitis

- Individualized 4 weeks rehabilitation program improved shoulder ROM except for internal and external ROM. Exercise therapy and rehabilitation also increased shoulder muscle isometric strength and endurance, and decreased shoulder pain. [100]

Types Of Exercise

- There are many specific approaches within the physical therapy, sports medicine, and chiropractic literature on types of shoulder exercises for improving range of motion and strength. All should be performed gradually with incremental increases in degree of motion as condition and comfort permit. Exercise should include at least active assisted range of motion and home based strengthening exercises. Regular incremental increases in movement distances and loading appear to be essential elements for shoulder rehabilitation. Kuhn provided some basic low tech evidence-based exercises for impingement syndromes:[77]

    - **Range of Motion:** Simple postural exercises beginning within patient tolerance including *Shoulder shrugs*, *Shoulder retraction* (place hands on hips and lean back), *Glenohumeral motion* (lean forward supporting one side on a table edge and swing free arm in small to increasingly larger circles). Progress gradually to active assisted movements- *Frontal arm elevation* (hold a cane with both hands in a supine position starting with hands/cane over hip region and lift arms up an towards head as far as patient tolerance allows; gradually increase distance over time as comfort permits); *Lateral arm elevation* (in front of mirror, raise arms laterally without shrugging shoulders, gradually increasing distance as progress is made); *Anterior shoulder stretch* (stand with hands at shoulder level and lean forward onto a door or corner of the room and hold the stretch); *Posterior shoulder stretch* (cross affected arm in front of chest and place elbow of opposite arm underneath to help pull until involved arm is stretched to tolerance).

    - **Strengthening Exercises:** Focus should be on rotator cuff and scapular stabilizing musculature, again to patient tolerance. For rotator cuff- *Resisted internal and external rotation* (can be done upright with elastic band moving band with bent elbow side to side creating rotation of the humerus. Alternate with resistance to internal rotation then external rotation; can also be done in side laying using small hand weights); For scapular stabilizers- *Chair press* (while seated place hands at side of body on chair and attempt to lift body up from chair); *Push up* (on all fours, arch upper back using hands pressed against floor to really push the back ceiling-ward); *Press up* (Lying on back extend arm straight up gripping weight in hand. Push weight ceiling-ward); *Upright rows* (Lean forward against table. Hang free arm down, gripping weight. Pull weight up, using shoulder and keeping elbow straight); *Seated/Standing* rows (with arms abducted and elbows bent, pull elastic bands back by pinching shoulder blades together); *Low trapezius* (stand with arms at side and pull elastic band backwards).

Acupuncture

Evidence supporting benefit of acupuncture for shoulder conditions is limited. In a Cochrane review of nine trials of various methodology, acupuncture was of benefit over placebo in improving the Constant Murley Score (a measure of shoulder function) at four weeks (WMD 17.3). However, by 4 months, the difference between acupuncture and placebo groups, although still statistically significant, was no longer likely to be clinically significant (WMD 3.53). The review concluded that there is inadequate evidence to support or refute the effectiveness of acupuncture for shoulder pain. [106]

General shoulder pain/restriction

- One small trial (n=52) showed significant improvement in range of motion after acupuncture compared to placebo 4 weeks post-intervention; however, the difference was no longer significant after 4 months.
- In other studies, no significant difference in improvement was observed when comparing acupuncture to steroid injections, ultrasound (n=60), or mobilization (n=24). Additionally, no significant difference in adverse events was demonstrated when comparing acupuncture to placebo therapy.

Adhesive capsulitis

- A small trial (n=35) comparing acupuncture and exercise to exercise alone for adhesive capsulitis showed a significant difference favoring acupuncture plus exercise. This improvement was observed for 5 months.

Shoulder pain/restriction attributed to "subacromial girdle" (acromioclavicular and glenohumeral joint) lesion (pain & restriction with specific localized findings)

- In a Spanish randomized trial of 425 chronic, unilateral subacromial pain patients, single point acupuncture in association with physiotherapy was reported to improve shoulder function and alleviates pain compared with physiotherapy as sole treatment. Pain was assessed using a numeric pain scale; Shoulder function was assessed using the Constant-Murley Score (CMS) which combines pain, daily activities, range of motion and strength. [107]

Other Non-surgical Interventions

Taping

Rotator cuff tendonosis

- Elastic taping over the lower trapezius muscle to elevate the scapula improved symptoms and muscle function in baseball players with rotator cuff impingement. [108]

Steroid injections

Rotator cuff tendonosis

- Corticosteroid injections are superior to physiotherapy (modality) interventions. [11]

Impingement syndrome

- Both blind and US-guided injection techniques are equally accurate; thus blind injections should be the technique of choice. [71, 72, 80, 109]

Adhesive capsulitis

- Intra-articular corticosteroids have additive effects related to rapid pain relief, mainly in the first weeks of the exercise treatment period. At twelve weeks, combination of corticosteroid injection and therapeutic exercise is equally effective compared to therapeutic exercise alone. [110]
- Corticosteroid injections are effective for capsulitis of the shoulder in the short term. Physical therapy is effective in improving ROM at 6 weeks. Failure to improve is probably less likely with injections AND physical therapy. [111]
- Physical therapy gives the best results in capsulitis treatment. Sodium hyaluronate (SH) injections can be used as an alternative to PT and steroid injections. [112]
- There is no significant difference in outcomes for hydrodilatation with injection of corticosteroid and injection of corticosteroid alone. [113]

Oral steroids & NSAIDS

Adhesive capsulitis

- Based on a Cochrane review of 5 small randomized trials (n=149), oral steroids may decrease pain and improve ROM in the shoulder in the short term. The benefits of oral steroids are short term – about 6 weeks. Adverse effects are minimal in those who take oral steroids. There is limited evidence demonstrating a significant difference between oral steroids and steroid injections.

Platelet Rich Protien (PRP, Autologous Blood) Injection

- PRP is created by taking a patient's own blood and spinning it down into a platelet concentrate. It has been hypothesized that growth factors in PRP will augment healing and repair. Pain relief seems consistent across studies but comparison to control groups is rarely utilized in the study design and long-term changes in the structure of tendons and joints have not been demonstrated. The American Academy of Orthopedic Surgeons (AAOS) has approved PRP protocols only for use in research; PRP is not recommended for treatment purposes and is not covered under Washington workers' compensation. [114-116]

Naturopathic Management

Rotator Cuff Tendonosis

- A combination of counseling for an anti-inflammatory diet, acupuncture, and Phlogenzym (an anti-inflammatory hydrolytic enzyme) may benefit patients with rotator cuff tendinitis. In a randomized controlled trial of 85 Canadian postal workers, this combination resulted in significantly lower pain scores and significantly higher SF-36 scores (physical, mental, emotional, social) compared to exercise alone. Further studies are needed to determine the benefit of an anti-inflammatory diet, acupuncture, and a hydrolytic enzyme independently. [101]

Capsular Distention Therapy / Hydrodilatation

Adhesive capsulitis

- Distention of the articular capsule occurs during steroid injections and when arthrograms are performed. Injecting air has also been used to distend the capsule. There have been reports of improved pain and function following such procedures attributed to rupturing of restrictive adhesions. A Cochrane review on the effectiveness and safety of arthrographic distention of the glenohumeral joint concluded that there is evidence that arthrographic distension with saline and steroid provides short-term benefits in pain, range of movement and function in adhesive capsulitis but it is uncertain whether this is better than alternative interventions. [117]
- A randomized trial involving 76 patients compared a series of three steroid injections with hydrodilation to three steroid injections without hydrodilation and found no differences between groups. [112]

Surgical Interventions

In general, shoulder conditions that respond well to immediate surgical interventions include shoulder displacement fractures (e.g., Acromio-clavicular Grade 3 or higher, proximal humeral) and labral tears (SLAP).[3] Full thickness rotator cuff tears also respond well with surgery in patients under 50, who are nonsmokers with normal BMI's, less than 2 years of onset of symptoms, and without the presence of fatty infiltrate of the rotator cuff muscles. [3]

Rotator cuff tendonosis

- Based on the most recent available Cochrane Collaboration review of 14 randomized trials, there are no significant differences in outcome between open or arthroscopic subacromial decompression surgery and active non-operative treatment for rotator cuff impingement. Evidence from six trials indicates there are no significant differences in safety or outcome between arthroscopic and open subacromial decompression although four trials reported earlier recovery with arthroscopic decompression. [118]

Dislocation

- Based on a Cochrane review of 4 small randomized trials (n=163), surgery can significantly reduce subsequent instability, either redislocation or subluxation (partial dislocation) in patients who have a primary anterior shoulder dislocation as a result of injury. Such patients may also see a greater improvement in function compared to those treated conservatively. [98]
- Surgery for AC dislocations should be considered only when at least 3 months of conservative care fails. For patients with type III dislocation and high physical demands on the shoulder, early orthopedic surgical consultation and or surgery may be indicated. [81, 82]

WORKERS' COMPENSATION INTERVENTION ISSUES

Employer Contact for Accommodation

This is considered a best practice in occupational health in order to facilitate effective return to work, however no studies were found specific to occupational shoulder conditions.

- Interviews of injured workers in Ontario with prolonged claims identified numerous system and bureaucratic issues that were significant factors in prolonging a claim, particularly systematic issues impeding implementation of return-to-work options. [119]

Administrative Interventions

Breaks, Duration

Low quality evidence suggests that administrative ergonomic interventions did not decrease pain in the short term but did decrease pain at the long term. For behavioral and other interventions, there was no evidence of a consistent effect on any of the outcomes. [120]

Ergonomic Interventions

Engineering Interventions, Work Site Modification, Multiple Component Interventions

No specific studies on work and task modification for recovery from occupational shoulder injuries were identified in our searches. Potentially related studies may help inform some clinical issues for modifying shoulder work.

- Training new assembly line workers on lower stress upper body and arm postures was associated with lower incidences of shoulder and arm complaints compared to untrained controls in their first year of employment. No differences were found between trained and untrained experience assembly line workers however. [121]
- For various neck, arm, shoulder pain & restriction complaints, a systematic review of randomized studies concluded that evidence for ergonomic interventions over no interventions is conflicting. There is limited evidence that breaks during prolonged computer work is beneficial in symptom reduction. [120]
- In a randomized controlled trial of 200 subjects who use a visual display terminal for at least 20 hours per week, ergonomic intervention plus an informative brochure resulted in greater improvement in posture and musculoskeletal symptoms than the brochure alone. Ergonomic intervention included advice and supervision from a physical therapist, adjustment of workstations, adjustment and alteration of existing furniture and equipment, and postural advice during daily tasks. The brochure included information on work posture and the benefit of "microbreaks". [122]
- One-hundred eighty two call center operators were randomized to one of four groups: ergonomic intervention, intervention plus trackball (mouse) use, intervention plus forearm support board, or intervention plus trackball (mouse) and forearm support board. The armboard significantly reduced neck and shoulder pain and right upper extremity pain. A wide forearm support board may be beneficial to patients with upper body musculoskeletal disorders and pain after several weeks of use. [123]

Conditioning & Work Hardening Interventions

- Workplace-based rehabilitation intervention is more effective than conventional clinic-based rehabilitation in terms of decrease in perceived pain and disability, improvement in function, and prevention of further work disability. A job coach can help minimize psychosocial problems that interfere with return to work (e.g. separation from work, peer group and/or the employer) [124]

Return-to-Work Assistance

No studies were identified with current search strategies.

Personal Controls

Ergonomics Training, Braces, Biofeedback, On-the-job Exercise Programs

- In a randomized controlled trial of 79 female computer-users with work-related neck & shoulder complaints, myofeedback therapy plus ergonomic counseling (discussion adjusting activities and arrangement in the workplace) improved pain intensity and disability. The odds of improvement, however, were not significantly different than those for ergonomic counseling alone. [125]
- In a randomized controlled trial of 36 women, myofeedback training plus ergonomic counseling benefited those who had high levels of initial discomfort and disability and especially those who ignored their pain. [126]

Workflow/task Modifications	Well done studies demonstrating clinical benefit or reductions in work-related shoulder conditions were not identified with the current search strategy.
Documentation of Progress	Function questionnaires such as the SST, SPADI, or QuickDASH should be used to establish a baseline functional level and re-administered at 2-4 week intervals to assess improvement.

OCCUPATIONAL SHOULDER CONDITION TERMINOLOGY

Adhesive Capsulitis (Frozen Shoulder): Restricted and painful condition of the capsular ligaments of the shoulder resulting from scaring related to inflammatory processes. This is not a degenerative process nor is it necessarily the result of trauma; often insidious in onset.

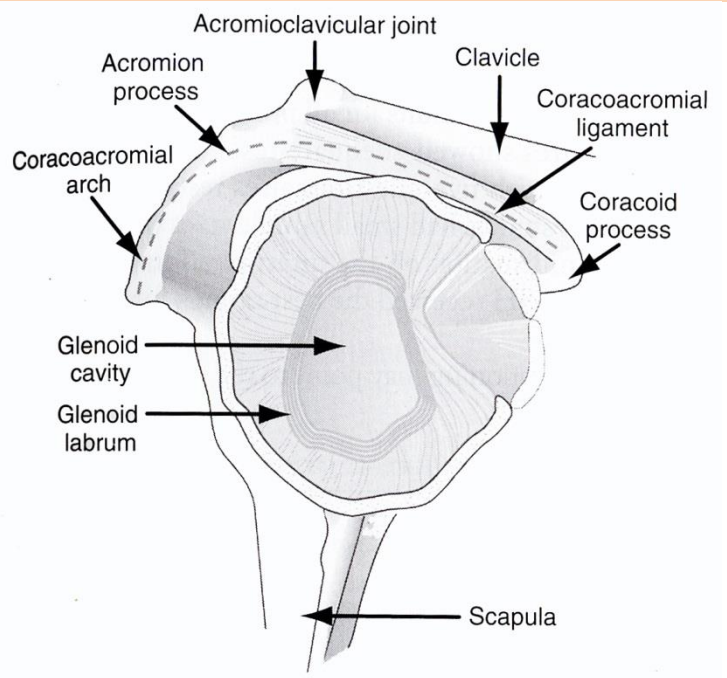
Chronic Tendonosis, Bursitis, Degenerative Joint Disease (DJD): Prolonged degenerative and or inflammatory process of soft tissues become painful and restricted. Chronically inflamed structures may become enlarged and/or infiltrated with scar tissue and calcium, e.g., calcific bursitis. Inflammation results from many causes including local trauma and overuse.

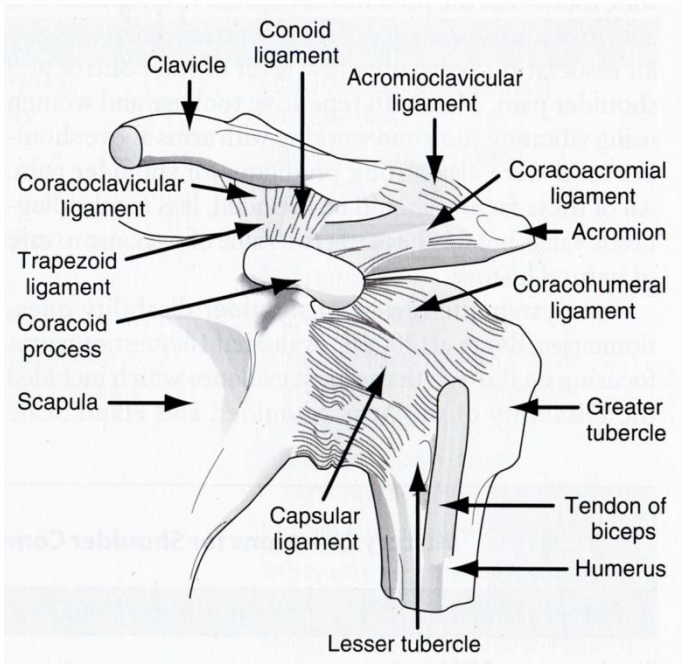
Dislocation: Dislocation typically results from excessive trauma to the shoulder leading to substantial rupture of the stabilizing ligaments and tendons. The most common and recognizable is an anterior dislocation which presents with an obvious history, swelling and deformity. Posterior dislocations are less common, more difficult to diagnose and may mimic other shoulder conditions.

Impingement Syndrome: Shoulder pain resulting from irritation of rotator cuff tendons and/or the subacromial bursa usually due to mechanical friction of these structures against bony structures.

Labrum Tear: Typically an avulsion of the glenoid cartilage which rings the scapular surface of the shoulder joint. The structure provides some stability by providing some depth to the "socket" side of the joint. Tears have been implicated as internal derangements that may cause restriction, clicking, and sometimes painful limitation of arm movement. Inferior tears are common with dislocation. Tears may also occur with sudden or excessive biceps contraction on the upper part of the labrum where the biceps tendon inserts. They are commonly categorized by location and severity as superior labral anterior to posterior (SLAP) lesions with Type I being least severe and Type IV being most severe.

Rotator cuff tendonosis/tear: The rotator cuff consists of the supraspinatus, infraspinatus, subscapularis, and teres minor muscles which originate on the scapula and whose tendons insert on the humerus. When damaged by sudden trauma, overuse, or overexertion, fibers of the tendon become sprained and inflamed. Partial supraspinatus tears are the most common and may occur on the bursal side or the articular side of the tendon.





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PROVOCATIVE SHOULDER TESTS

General Shoulder Pain Restriction

- **Painful Arc test** – Active abduction from hand at side to hand over head is pain free until mid-range (~70°-100°) then reduced pain thereafter. Pain in midrange is positive.
- **Drop Arm test** – Arm is passively abducted to 90° then actively lowered. Inability to control lowering is a positive test.

Rotator Cuff Impingement

- **Neer's test** – assesses for possible rotator cuff impingement. Stabilize the scapula (place your hand firmly upon the acromion, or hold the inferior angle of the scapula with your hand) and with the thumb pointing down and passively flex the arm. Pain is a positive test.
- **Hawkins test** – assesses for possible rotator cuff impingement. Stabilize the scapula, passively abduct the shoulder to 90° , flex the shoulder to 30°, flex the elbow to 90°, and internally rotate the shoulder. Pain is a positive test.

Rotator Cuff Tears

- **Abduction test** – Active abduction to 90° while providing resistance proximal to the elbow (primary abductor: supraspinatus).
- **External Rotation test** – Examiner places one hand on the medial elbow and the other on the lateral aspect of the distal forearm. Instruct the patient to externally rotate the shoulder while you provide resistance. It is important to stabilize the patient's elbow against their side to prevent them from substituting abduction for external rotation. Compare the strength of the involved shoulder with that of the uninvolved shoulder. This test may also elicit pain indicating inflammation and weakness in the external rotators (primary external rotator: infraspinatus).
- **Lateral Jobe test** – Patient holds their arm at 90° abduction in the coronal plane with elbows flexed at 90 degrees and hands pointing inferiorly with the thumbs directed medially. A positive test consists of pain or weakness on resisting downward pressure on the arms or an inability to perform the tests.

Acromioclavicular Joint

- **Crossed Arm Adduction test** – Flex the shoulder to 90° and adduct arm across body (reaching for opposite shoulder). Pain at the acromioclavicular joint is a positive test.

Labral Tears, Tendon Disorders, Dislocations

- **Apprehension test** – Evaluates for anterior glenohumeral stability. With the patient supine, abduct shoulder to 90° and externally rotate arm to place stress on the glenohumeral joint. If the patient feels apprehension that the arm may dislocate anteriorly, the test is positive. The apprehension test is usually followed by the relocation test: with hand, place a posteriorly directed force on the glenohumeral joint. Relief of apprehension for dislocation is a positive test.
- **Biceps Load test** – Supinate the arm, abduct shoulder to 90°, flex elbow to 90°, externally rotate arm until patient becomes apprehensive and provide resistance against elbow flexion. Pain indicates possible bicipital tendinopathy or a labral tear.
- **Hawkins-Kennedy test** – Abduct the shoulder 90° and flex it forward 90° while passively internally rotating the humerous. Pain on this motion is a positive test
- **Load & Shift (L&S) test** – Manually assesses directional stability. From behind patient stabilize scapula with one hand and humeral head with other. Load shoulder by poster to anterior pressure toward glenoid to test anterior stability; pull backward to assess posterior stability. Pull down on arm to assess inferior stability. An observable sulcus may be visible under the acromion with multidirectional instability.
- **O'Brien's test** – Point the thumb down, Flex shoulder to 90° and adduct the arm across midline. Provide resistance against further shoulder flexion and evaluate for pain. Repeat with thumb pointing up and again evaluate for pain. If pain was present with the thumb down but relieved with the thumb up, it is considered a positive test, suspicious for a labral tear.
- **Relocation test** – Simply conduct the Apprehension test while stabilizing the front of the humerous with a posterior force to see if the pain and or sense of apprehension is relieved.
- **Speed's test** – Flex the shoulder to 90° with the arm supinated. Provide downward resistance against shoulder flexion. Pain indicates possible bicipital tendinopathy or a labral tear.
- **Yergason' s test** – Flex elbow to 90° , shake hands with patient and provide resistance against supination. Pain indicates possible bicipital tendinopathy or a labral tear.

Acromioclavicular Injuries (Rockwood Classification) *Note: Types IV-VI are rare.*

- ***Type I:*** Sprain of the acromioclavicular or coracoclavicular ligament.
- ***Type II:*** Subluxation of the acromioclavicular joint associated with a tear of the acromioclavicular ligament; coracoclavicular ligament is intact.
- ***Type III:*** Dislocation of the acromioclavicular joint with injury to both acromioclavicular and coracoclavicular ligaments.
- ***Type IV:*** Clavicle is displaced posteriorly through the trapezius muscle.
- ***Type V:*** Gross disparity between the acromion and clavicle, which displaces superiorly.
- ***Type VI:*** Dislocated lateral end of the clavicle lies inferior to the coracoid.

Additional Resources for Clinical Examination of Shoulders

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http://www.shoulderdoc.co.uk/article.asp?section=497

http://at.uwa.edu/special%20tests/specialtests/UpperBody/shoulder%20Main%20Page.htm

http://sitemaker.umich.edu/fm_musculoskeletal_shoulder/shoulder_exam_manuevers

EVIDENCE & METHODOLOGY

Intervention/Experimental Studies

Randomized Controlled Trial (RCT) – A study that randomly allocates patients to treatment groups, usually blinding patients, therapists and/or study evaluators. Typically of high quality as randomization assures similarities of subjects within treatment groups.

Observational Studies

Cohort Design – Cohort (retrospective or prospective) – A study that follows patients who self-allocate to treatment groups through the course of their care for a given occurrence of a condition. Larger, well-designed cohort studies may be of good quality, but lack of randomization predisposes to heterogeneity issues within groups, some of which may be able to be adjusted for with statistical methods.

Cross sectional – Involves observing a population to measure disease and exposure status. It is usually thought to be a "snapshot" of the frequency and characteristics of a disease in a population at a specific given time.

Case control – Is a study that compares patients who have an outcome (cases) of interest with patients who do not have the disease or outcome (controls). The study may retrospectively to compare how frequently the exposure was present in a group to determine risk factors.

Case series – Is a study that describes a series of patients with an outcome of interest, may be of variable quality. Better designs use consecutive patients and include robust baseline and follow up outcome measures.

Case reports – Describes an individual case, typically only achieving publication if it represent a unique or unusual clinical experience.

Blinding

Blinding minimizes potential bias. Typically three levels of blinding are sought: patient, treating provider and evaluator. Many conservative interventions do not allow for patient blinding (e.g. someone is likely to know if they received a splint or a pill). At a minimum, single blinding of the evaluator as to what group a subject was in is expected.

Literature Reviews

Quantitative systematic reviews – Studies that review previously published clinical trials that include quantitative comparisons (e.g. meta-analyses). Systematic reviews should have rigorous and comprehensive methodology to identify relevant published research and include appraisal of study quality. Cochrane reviews frequently are of this type.

Qualitative systematic reviews – Similar to quantitative reviews but without systematic quantitative comparison or data pooling.

Narrative literature reviews – Such reviews typically do not include rigorous study selection methodology and may be subject to significant author bias

Literature Retrieval and Review

1. **Initial systematic searches** of electronic databases (e.g. PubMed). Search terms used typically included MeSH terms for tests and interventions with conditions being addressed. Follow-up searches also included population attributes (e.g., workers compensation, occupational).
2. **Abstract screening** for relevance.
3. **Original paper retrieval** with review for relevance, quality, outcome meaningfulness, and effect magnitude.
4. **Additional studies identified** through clinical summaries (e.g., reviews, texts), citation tracking, and feedback from public.

About Evidence for Physical Examination and Conservative Interventions

Conservative musculoskeletal care is typically care of first resort based on long standing practices. Typically 'low tech,' low cost, with minimal and rare side effects, it is frequently delivered in primary care settings, and by various health providers. The rigor and quality expected of high cost, higher risk, emerging, and tertiary interventions is less common for many routine physical examination procedures and conservative interventions. Much of the evidence summarized here would be considered Class "C" or "III" in ratings systems. Thus, the committee has not presented explicit *recommendations*, rather, *evidence summaries* guided by expert consensus to assist in formulating care options. Further, significant emphasis is made regarding tracking and documenting meaningful functional improvement with patients. Study attributes most likely to strengthen or limit confidence are characterized in the evidence descriptions.

Assessing Study Methodologic Quality

Attributes of study methodology quality vary according to the clinical procedure (eg, diagnostic, therapeutic intervention) looked at, and specific research questions being studied. The American Academy of Neurology's Clinical Practice Guideline Process Manual [127] offers a comprehensive guide to systematic evidence review, quality attributes and consensus process that generally serves as the approach taken by IICAC.

General attributes identified when extracting evidence from studies include identification of population, the intervention and co-interventions and outcomes being addressed in each study. The clinical questions addressed such as diagnostic accuracy, therapeutic effectiveness, or causation are determined. Studies are extracted into evidence tables including quality attributes and/or ratings which are reviewed both by department staff and committee members (usually 2 per study).

Specific quality attributes include: Diagnostic Accuracy – design, spectrum of patients, validity and relevance of outcome metric; Therapeutic Interventions – comparison groups (no treatment, placebo, comparative intervention), treatment allocation, blinding/masking (method and degree: single, double, independent), follow-up (period and completion), and analysis (statistical power, intent-to-treat). Specific attention is paid to several factors including reporting of outcomes (primary vs. secondary), relevance of outcome (eg, function vs. pain), and meaningfulness (clinically important change vs minimally detectable change).

Synthesizing Evidence

Consideration of study quality (class), significance (statistical precision), consistency across studies, magnitude of effect, and relevance to populations and procedures were taken into account in preparing draft summaries. Special attention was given to clarifying conclusions related to the clinical questions of interest. Evidence, particularly with low tech and highly diffused examination and conservative procedures addressed here, is rarely truly "definitive," even when multiple studies exist. Inconsistent conclusions typically reflect error (systematic, random) and/or bias in studies. Data pooling via meta-analysis is useful to reduce random error when studies are of sufficient power and methodologic strength. Larger meaningful effect size may increases confidence in findings.

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