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# The Effectiveness of Shoulder Stretching and Joint Mobilizations on Posterior Shoulder Tightness

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***Clinical Scenario:*** It has been suggested that posterior shoulder tightness is a common contributor to shoulder impingement in overhead-throwing athletes. The incidence of shoulder pain in the general population has been reported to be as high as 27%, and as many as 74% of the patients who were seen for shoulder issues had signs of impingement. Particularly regarding physically active adults, shoulder impingement is frequent among overhead-throwing athletes and may lead to lost participation in sport, as well as other injuries including labral pathologies. Therefore, finding an effective mechanism to reduce posterior shoulder tightness in overhead athletes is important and may help prevent impingement-type injuries. Typically, posterior shoulder tightness is identified by measuring horizontal humeral adduction; although another clinical measure that is commonly used is the bilateral measurement of glenohumeral internal-rotation (IR) range of motion (ROM). It is important to note, however, that the measurement of glenohumeral IR ROM specifically aims to identify glenohumeral IR ROM deficits (GIRD). Although GIRD is believed to be a leading contributor to posterior shoulder tightness, this measure alone may not capture the full spectrum of posterior shoulder tightness. While treatment interventions to correct any ROM deficits typically include a stretching protocol to help increase IR, joint mobilizations have been found to produce greater mobility of soft tissue and capsular joints. However, it is unclear whether the combination of both joint mobilizations and a stretching protocol will produce even larger gains of ROM that will have greater longevity for the patient suffering from posterior shoulder tightness.
***Focused Clinical Question:*** Does the use of joint mobilizations combined with a stretching protocol more effectively increase glenohumeral IR ROM in adult physically active individuals who participate in overhead sports and are suffering from posterior shoulder tightness, compared with a stretching protocol alone?

***Keywords:*** shoulder impingement, manual therapy, overhead athletes, glenohumeral internal-rotation deficits

## Clinical Scenario

It has been suggested that posterior shoulder tightness is a common contributor to shoulder impingement in overhead-throwing athletes.[1,2] The incidence of shoulder pain in the general population has been reported to be as high as 27%,[3] and as many as 74% of the patients who were seen for shoulder issues had signs of impingement.[4] Particularly regarding the physically active adult population, shoulder impingement is frequent among overhead-throwing athletes and may lead to lost participation in sport, as well as other injuries including labral pathologies.[1] Therefore, finding an effective mechanism to reduce posterior shoulder tightness in overhead athletes is important and may help prevent impingement-type injuries. Typically, posterior shoulder tightness is identified by measuring horizontal humeral adduction; although another clinical measure that is commonly used is the bilateral measurement of glenohumeral internal rotation (IR) range of motion. It is important to note, however, that the measurement of glenohumeral IR range of motion specifically aims to identify glenohumeral IR range-of-motion deficits (GIRD). Although GIRD is believed to be a leading contributor to posterior shoulder tightness, this measure alone may not capture the full spectrum of posterior shoulder tightness. While treatment interventions to correct any range-of-motion deficits typically include a stretching protocol to help increase IR, joint mobilizations have been found to produce greater mobility of soft tissue and capsular joints.[5] However, it is unclear whether the combination of both joint mobilizations and a stretching protocol will produce even larger gains of range of motion that will have greater longevity for the patient suffering from posterior shoulder tightness.

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## Focused Clinical Question

Does the use of joint mobilizations combined with a stretching protocol more effectively increase glenohumeral IR range of motion in adult physically active individuals who participate in overhead sports and are suffering from posterior shoulder tightness, compared with a stretching protocol alone?

## Summary of Search, "Best Evidence" Appraised, and Key Findings

- The literature was searched for level 2 evidence or higher that investigated the effect of posterior shoulder stretching and joint mobilizations on shoulder range of motion.
- The literature search returned 3 possible studies related to the clinical question.
- Two high-quality randomized controlled trials and 1 single-blinded prospective cohort study were included.
- All 3 studies reported that joint mobilizations in combination with a stretching protocol were effective at increasing glenohumeral IR range of motion.

## Clinical Bottom Line

There is moderate evidence to support the use of the combination of posterior glenohumeral joint mobilizations that approach end range of motion and cross-body adduction stretching in both symptomatic and asymptomatic patients with posterior shoulder tightness or GIRD. Joint mobilizations should be performed twice per week for a total of 15 minutes per treatment session, while the stretching protocol should consist of the cross-body adduction stretch (5 repetitions of 30 s) and can be completed daily as a home exercise program. Additional studies are needed, however, to determine the effectiveness of these interventions for symptomatic and asymptomatic athletes who participate in overhead-specific sports.

**Strength of Recommendation**: Grade B evidence exists to support the combination of posterior glenohumeral joint mobilizations and a stretching protocol as a more effective treatment intervention for increasing glenohumeral IR range of motion and therefore decreasing posterior shoulder tightness than a stretching protocol alone.

## Search Strategy

### Terms Used to Guide Search Strategy

- **P**atient/Client group: posterior shoulder tightness or shoulder and GIRD or shoulder and tightness
- **I**ntervention/Assessment: joint mobilization or posterior glides and stretching, nonangular stretching or angular stretching
- **C**omparison: shoulder and stretching or angular stretching
- **O**utcome: range of motion increase or decreased posterior shoulder tightness

### Sources of Evidence Searched

- MEDLINE
- Cochrane Evidence PLUS
- Essential Evidence Plus
- StatRef!
- CINAHL
- Additional resources obtained via review of reference lists and hand search

## Inclusion and Exclusion Criteria

### Inclusion Criteria

- Studies that investigated posterior shoulder joint mobilizations combined with posterior shoulder stretching
- Level 2 evidence or higher
- Limited to publications of the last 10 years (2003–2012)
- Limited to English

### Exclusion Criteria

- Studies that did not identify glenohumeral IR range of motion as a primary outcome
- Studies that used techniques for IR range of motion other than posterior joint mobilizations or posterior shoulder stretching
- Studies that utilized adolescent and/or geriatric populations
- Studies investigating range-of-motion changes in participants with adhesive capsulitis

## Results of Search

Three articles[5–7] were located that met the inclusion criteria and were appraised for level of evidence as shown in Table 1 (based on Levels of Evidence, Oxford Centre for Evidence-Based Medicine, 2011).

**Table 1 Summary of Study Designs of Articles Retrieved**

| Level of evidence | Study design | Number located | Reference |
|---|---|---|---|
| 1b | Randomized controlled trial | 2 | Manske et al[5]<br>Cools et al[6] |
| 2b | Single-blinded cohort | 1 | Tyler et al[7] |

## Best Evidence

The studies selected for inclusion in this critically appraised topic (CAT) were identified as the best available evidence (Table 2). Reasons for selection of these studies included a rating of level 2 evidence or higher and having investigated the effects of joint mobilizations and stretching on posterior shoulder tightness.

## Implications for Practice, Education, and Future Research

While stretching exercises tend to be a common intervention administered for patients experiencing posterior shoulder tightness, this treatment may not address all aspects of the patient's ailment. Posterior shoulder tightness is a multifaceted condition that can be a resultant of bony, muscular, and/or capsular problems.[8] Particularly among adults, IR deficits may be caused from thickening of the glenohumeral joint capsule.[8] Therefore, the inclusion of joint mobilizations in addition to a stretching protocol may benefit the patient, as this treatment intervention aims to simultaneously address both muscular and capsular restrictions.

All 3 of the studies found significant improvements to glenohumeral IR range of motion when participants were treated with combined joint mobilization and stretching protocols.[5–7] These improvements were consistent in both symptomatic[6,7] and asymptomatic[5,6] patients with posterior shoulder tightness. In addition, Cools et al[6] found significant decreases on a self-reported visual analogue scale for pain in patients receiving joint mobilization and stretching protocols. The findings also support improved patient-reported function and pain in symptomatic patients, as well as prevention of symptoms in asymptomatic patients with posterior shoulder tightness. Therefore, these studies provide support for the use of posterior glenohumeral joint mobilizations combined with the cross-body adduction stretch to increase glenohumeral IR range of motion in patients experiencing posterior shoulder tightness.

While each investigation reported significant improvements after a combined joint-mobilization and stretching protocol in the intervention group,[5–7] it is important to note that the control group, which utilized a stretching-only protocol,[5,6] also had significant improvements to posterior shoulder tightness. Previous literature has suggested that the cross-body stretch, which was utilized by each study,[5–7] is the most effective stretch for decreasing posterior shoulder tightness when performed to mild discomfort at least 1 time per day for 5 repetitions of 30 seconds each.[8] While each investigation appraised in this CAT included a different stretching delivery mechanism (ie, home stretching protocol,[5] in-clinic treatment sessions,[6] combination of in-clinic and home stretching protocol[7]), utilizing the cross-body stretch showed significant increases in IR range of motion in both symptomatic patients[6,7] and asymptomatic patients[5,6] across all studies.

In addition to a stretching protocol, the intervention group of each study incorporated grade IV posterior glenohumeral joint mobilizations and found significant improvements to IR range of motion.[5–7] Two of studies reported an increase in IR, ranging from 13°[6] to 19°,[5] after joint mobilizations. Furthermore, 1 study[7] reported that patients' GIRD decreased approximately 26° over the course of treatment, indicating that posterior mobilizations performed in both the scapular plane and with the shoulder in 90° of horizontal abduction and 90° of IR were beneficial.

In each study, measurements were taken after the conclusion of the intervention period and showed significant improvement to glenohumeral IR range of motion.[5–7] Two of the studies,[5,6] however, utilized a postintervention follow-up measurement, which occurred approximately 3 to 4 weeks after the conclusion of the treatment periods. While there was no statistically significant increase found between stretching and joint-mobilization groups from baseline to the postintervention follow-up, the findings suggest that continued treatment to produce long-term effects may become statistically significant over time.[5,6] Further research needs to be conducted in this area before we can make a more conclusive statement about the possibility of long-term effects.

Cools et al[6] found that the gains of glenohumeral IR range of motion in asymptomatic participants were greater than gains in symptomatic patients and that GIRD was almost eliminated. These results suggest that stretching and joint mobilizations may be an easy yet effective way to help prevent the development of pathologies related to posterior shoulder tightness. While GIRD is a common condition in athletic throwing populations, it usually does not create problems for the individual if it is limited to a deficit of less than15° compared bilaterally.[1] However, if an athlete is found to have greater than 15° of GIRD, it is likely that symptoms will arise and may result in an overhead-related injury (eg, shoulder impingement).[1] Preparticipation physical exams offer an easy way to identify at risk individuals, as well as allowing clinicians to ascertain which individuals may benefit from a combined joint-mobilization and stretching protocol to prevent the occurrence of posterior shoulder tightness.

Based on the appraisal of this CAT, a protocol that includes posterior joint mobilizations that approach end range of motion in combination with the cross-body stretch appears to be an effective intervention to increase glenohumeral IR range of motion, as well as decrease posterior shoulder tightness.[5–7] For optimal results, the cross-body stretch should be performed to mild discomfort for 5 repetitions of 30 seconds and should be conducted daily either in the clinic or at home.[9] Joint mobilizations, which should be performed in the clinic a minimum of twice a week for a total of 15 minutes per session,[5–7] should be directed posteriorly in both the scapular plane and with the shoulder placed in 90° abduction and 90° IR.

Further research should include prospective studies that assess the effectiveness of a combined joint-mobilization and stretching protocol as a rehabilitative

**Table 2 Characteristics of Included Studies**

| | Cools et al[6] | Manske et al[5] | Tyler et al[7] |
|---|---|---|---|
| Study design | Randomized controlled trial | Randomized controlled trial | Single-blinded cohort |
| Participants | 60 participants with and without shoulder impingement symptoms, 29 men and 31 women.<br>Mean age of asymptomatic group was 25.4 ± 6.7 y; mean age of symptomatic group was 24.5 ± 7.8 y.<br>Only the dominant shoulder was treated for the asymptomatic group; dominance/nondominance for the symptomatic group was unspecified.<br>Asymptomatic group had 30 participants; symptomatic group had 30 participants.<br>Gender makeup of groups was unspecified.<br>All participants were actively participating in overhead sports.<br>Asymmetry of greater than 20° internal rotation for both control and intervention groups.<br>Participants were allocated into symptomatic and control groups based on number of positive impingement tests and then into angular- and non-angular-stretching groups.<br>Symptomatic group had at least 3 positive impingement tests.<br>Control group was only allowed to have 1 positive impingement test.<br>*Exclusion Criteria:* history of shoulder dislocation, shoulder surgery, current cervical spine symptoms, or documented structural injuries to the shoulder complex | 39 healthy college-age participants with asymptomatic posterior shoulder tightness, 7 men and 32 women.<br>Unspecified age or range of college students.<br>Shoulder dominance was unspecified.<br>Participants were stratified by gender before randomly assigned to groups.<br>Group 1 had 20 participants, 4 men and 16 women.<br>Group 2 had 19 participants, 3 men and 16 women.<br>No participants were actively participating in overhead sports.<br>Only subjects with a 10° asymmetry in internal-rotation range of motion were included in the study.<br>No control group was used.<br>Two intervention groups: cross-body stretching and cross-body stretching + posterior joint mobilizations.<br>*Exclusion Criteria:* history of shoulder surgery, shoulder symptoms requiring medical attention within last year, and shoulder pain at time of study | 22 participants with symptomatic internal impingement, 11 men and 11 women.<br>Mean age was 41.0 ± 13.0 y.<br>18 participants with symptoms in the dominant arm; 4 participants with symptoms in the nondominant arm.<br>Unspecified if stratification occurred.<br>Separate groups were not identified, and all participants received the same care.<br>11 participants reported they were actively participating in overhead sports.<br>Asymmetry was not used as a measure of interest.<br>No control group was used.<br>*Exclusion Criteria:* anterior instability, full-thickness rotator-cuff tear, and subacromial impingement as determined by a physical examination and MRI |

*(continued)*

**Table 2** *(continued)*

| | Cools et al[6] | Manske et al[5] | Tyler et al[7] |
|---|---|---|---|
| Intervention investigated | Sleeper and cross-body stretches were performed on symptomatic and control angular-stretching groups by a therapist.<br>Symptomatic and control non-angular-stretching groups received high-grade end-range dorsal and high-grade midrange caudal glide mobilizations by a therapist.<br>All 4 groups were treated 3 times/wk for 3 wk in the clinic.<br>Each mobilization technique was applied for 30 s with a 30-s rest period between sets and repeated until 15 min of treatment elapsed.<br>High-grade end-range dorsal mobilizations performed with patient lying supine in maximum glenohumeral internal rotation; dorsal glide was performed.<br>High-grade midrange caudal mobilizations were performed with the patient lying supine with 90° of glenohumeral abduction.<br>Stretches were held for 30 s for a 15-min treatment period.<br>Sleeper stretch performed with the patient side-lying on the affected shoulder with 90° forward flexion; scapula is manually fixed into retraction and movement is controlled.<br>Cross-body stretch performed with the patient lying supine while arm is passively moved into horizontal adduction and scapula is fixed into retraction.<br>Participants were instructed to continue normal activities, no home exercises or protocols were given. | Intervention group 1 was given the cross-body stretch.<br>Intervention group 2 was given the cross-body stretch and posterior joint mobilizations.<br>Grade 3 and 4 posterior joint mobilizations were performed a minimum of twice weekly for 10-min sessions.<br>Joint mobilizations were performed separately from stretches.<br>Subjects were instructed to stretch at home to mild discomfort, once daily for 5 repetitions of 30 s.<br>All participants were given a daily log to complete to show compliance.<br>They were given written instructions, as well as an image of the cross-body stretch.<br>Participants were required to complete 15 stretching sessions during the 4-wk period with a minimum of 3–4 sessions/wk.<br>Missed sessions were allowed due to illness, vacation, and other considerations.<br>Assessors were blinded, and the same clinician took the original measurements and follow-up measurements at 4 wk and 8 wk. | All participants received the same treatment protocol.<br>Participants had 3 clinical visits per week and were given a daily home exercise program.<br>Grade 4 posterior joint mobilizations were performed in the clinic 3 times/wk in the scapular plane.<br>Grade 4 posterior joint mobilizations were performed in the clinic 3 times/wk with 90° of shoulder abduction and maximal glenohumeral internal rotation.<br>Active-assisted cross-chest adduction with manual scapular stabilization was performed in the clinic.<br>Sleeper stretch was performed in the clinic.<br>External rotation and scapular-stabilization strengthening exercises were performed in the clinic.<br>Sleeper stretch, cross-chest adduction stretch, external rotation, and scapular strengthening exercises all at home.<br>No parameters were stated for stretching or strengthening exercises.<br>Intervention was continued until relief of symptoms and return to full activity.<br>Intervention was stopped and patient was referred back to physician if a plateau effect was apparent. |
| Outcome measures | *Primary Outcome:* To improve glenohumeral internal rotation in symptomatic and asymptomatic overhead athletes using angular (stretching) and nonangular stretching (joint mobilizations). Range of motion was measured with a goniometer.<br>*Secondary Outcome:* To decrease pain using visual analogue scale scores during impingement and instability special tests and increase function using the modified Rowe score in symptomatic participants. | *Primary Outcomes:* To improve glenohumeral internal-rotation range of motion using cross-body stretch and end-range joint mobilizations. Range of motion was measured with an inclinometer.<br>*Secondary Outcome:* No secondary outcome was assessed. | *Primary Outcome:* To resolve pain using joint mobilizations, stretching, and strengthening exercises. Pain resolution was tracked by using the Simple Shoulder Test.<br>*Secondary Outcome:* To improve posterior shoulder tightness, glenohumeral internal rotation, and glenohumeral external rotation using stretching and joint mobilizations. All ranges were assessed using a digital level. |

*(continued)*

**Table 2** *(continued)*

| | Cools et al[6] | Manske et al[5] | Tyler et al[7] |
|---|---|---|---|
| Main findings | No significant differences were found for age, height, weight, and training frequency.<br><br>*Compliance:* Rate was not reported for treatment session.<br><br>*Conclusion of Treatment:* Asymptomatic groups showed significant internal-rotation improvement of 20.5° and 19.3° in angular- and non-angular-stretching groups, respectively. Symptomatic groups showed significant internal-rotation improvement of 9.2° and 12.6° in both angular- and non-angular-stretching groups respectively. Nondominant and noninjured angular-stretching and non-angular-mobilization groups showed no significant increases or decreases.<br><br>*3-Wk Follow-Up:* Asymptomatic groups showed significant internal-rotation increase of 19.8° and 19° in angular- and non-angular-stretching groups from baseline, respectively. Symptomatic groups showed internal-rotation increase of 12.1° and 11.2° in both angular- and non-angular-stretching groups from baseline, respectively. Nondominant and noninjured angular-stretching and non-angular-mobilization groups showed no significant increases or decreases. No measure of external rotation was reported. | No significant differences were found for height and weight between groups.<br><br>*Compliance:* The stretching group averaged 20.33 sessions, and the joint-mobilization group averaged 21.27 sessions.<br><br>*Conclusion of Treatment:* Treated-shoulder groups showed significant internal-rotation improvement of 15.4° and 19° in stretching and stretching + mobilization groups, respectively. Nontreated-shoulder internal-rotation stretching group and stretching + mobilization group showed no statistically significant increase or decrease.<br><br>*4-Wk Follow-Up:* Treated-shoulder groups showed significant internal-rotation increase of 11.8° and 11.1° in stretching and stretching + mobilization groups from baseline, respectively. Nontreated-shoulder internal-rotation stretching group and stretching + mobilization group showed no statistically significant increase or decrease. The change in external rotation for all groups remained statistically insignificant. | No significant differences were found for age, height, and weight.<br><br>*Compliance:* Rate was not reported for home exercise program.<br><br>*Conclusion of Treatment:* Simple Shoulder Test showed an improvement of 6 points on a 12-point scale. Glenohumeral internal-rotation deficit was decreased by 26°. External-rotation deficit decreased from 23° to 9°. Posterior shoulder tightness improved from 35° to 7°. Improvement in posterior shoulder tightness was greater in patients who had complete resolution of symptoms. Improvements in glenohumeral internal-rotation deficit and external-rotation loss were not different between groups. |
| Level of evidence | 1b | 1b | 2b |
| Validity score | PEDro 6/10 | PEDro 6/10 | N/A |
| Conclusion | Improvements were seen in both symptomatic and asymptomatic participants for both angular-stretching and non-angular-mobilization groups at the conclusion of the 3-wk study period.<br><br>Improvements remained significant 3 wk after the conclusion of the study.<br><br>Pain decreased immediately postintervention and continued to decrease at 3-wk postintervention follow-up.<br><br>Functional scores improved significantly from baseline to postintervention; however, improvements were not maintained when measured 3 wk after conclusion of treatment. | Increases in internal-rotation range of motion for the treated shoulders of both the stretching-only and stretching + mobilization groups were statistically significant after 4 wk of intervention.<br><br>The study also found that both interventions showed statistically significant internal-rotation improvements after 8 wk.<br><br>Although not statistically significant, the increase seen in the stretching + mobilization group was larger than that of stretching-only group. | Manual mobilizations combined with stretching and a take-home protocol were found effective at decreasing posterior shoulder tightness and glenohumeral internal-rotation deficit.<br><br>Resolution of internal impingement symptoms was associated with correction of posterior shoulder tightness but not with correction of glenohumeral internal-rotation deficit. |

intervention in a variety of patient populations (eg, symptomatic athletes, adolescent overhead-throwing athletes) and as a preventive tool for asymptomatic athletes who participate in overhead-specific sports. In addition, studies should assess the comparative effectiveness of different joint-mobilization protocols (eg, treatment duration, appropriate grade of mobilization) to determine the most effective treatment parameters to increase IR range of motion and alleviate the symptoms of shoulder impingement. The articles included in this CAT restricted their intervention periods to 3 and 4 weeks with limited or no continuation of treatment. Considerations for future research in this area should also include studies that focus on continued treatment, as well as assess the potential of long-term effects from prolonged care. This CAT should be reviewed in 2 years or when additional information becomes available to determine whether additional information has been published that may change the clinical bottom line for the research question posed in this review.

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