Immobilisation in external rotation after first-time traumatic anterior shoulder instability reduces recurrent instability: a meta-analysis


ABSTRACT

Importance Cadaveric and MRI findings have demonstrated significantly less labral separation and displacement when the shoulder is placed in external rotation as compared with internal rotation.

Objective The purpose of the current study is to meta-analyse the randomised controlled trials in the literature to compare immobilisation in external versus internal rotation after first-time anterior shoulder dislocation.

Evidence review A literature search of MEDLINE, EMBASE and the Cochrane Library was performed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Randomised controlled trials comparing immobilisation in external rotation versus internal rotation for first-time anterior shoulder dislocation were included.

Findings Nine randomised controlled trials with 795 patients were included. The mean age of included patients was 29 years, 82.4% were male and the mean follow-up was 25.5 months. As compared with immobilisation in internal rotation, compliance was significantly higher (74.5% vs 67.4%, p=0.01), and the rate of recurrent dislocations was significantly lower (22.2% vs 33.4%, p=0.02) with immobilisation in external rotation. Additionally, in patients 20–40 years old the rate of recurrent dislocations was significantly lower in those treated with immobilisation in external rotation than internal rotation (12.1% vs 31.4%, p=0.006). Immobilisation in external rotation also resulted in a higher rate of return to preinjury level of play (60.1% vs 42.6%, p=0.001).

Conclusions and relevance Immobilisation of the shoulder in external rotation after a traumatic first-time anterior shoulder dislocation results in a higher compliance rate, a lower recurrent dislocation rate and a higher rate of return to play as compared with immobilisation in internal rotation.

Level of evidence Level I.

INTRODUCTION

Anterior shoulder instability is a common clinical problem, with a reported incidence ranging from 8 to 25 per 100 000 person-years in the general population, and higher rates in young, athletic patients.1–3 Historically, patients presenting after a first-time dislocation event have been managed non-surgically. Typically, this consists of immobilisation in internal rotation for 3–6 weeks, followed by initiation of a progressive shoulder range-of-motion and strengthening programme. However, recurrent dislocation rates of up to 100% have been reported with non-surgical treatment.4–6

Itoi et al7–8 initially proposed the concept of shoulder immobilisation in an external rotation orthosis after a first-time anterior shoulder instability event. This was based on cadaveric and MRI findings demonstrating that labral separation and displacement were both significantly less when the shoulder is placed in external rotation as compared with internal rotation. The authors subsequently conducted a randomised controlled trial (RCT) comparing immobilisation in external versus internal rotation after first-time anterior shoulder dislocation to assess whether these findings translated to clinically improved healing rates.9–10 They found a significantly reduced recurrence rate and increased compliance rate with immobilisation in external rotation. However, several systematic reviews looking at the outcomes of immobilisation
in external versus internal rotation have failed to find a significant difference in any clinical parameters between the protocols. 11–17 In recent years, multiple RCTs have been published on the subject of immobilisation after traumatic anterior shoulder instability, with some finding reduced rates of recurrent dislocation using an external rotation orthosis. 18 19 Given this, we felt an updated meta-analysis incorporating the most recent evidence was warranted. Therefore, the purpose of the current study is to meta-analyse the RCTs in the literature to compare immobilisation in external versus internal rotation after first-time anterior shoulder dislocation. It was hypothesised that immobilisation in external rotation would result in lower rates of recurrent dislocation.

METHODS
Ethical approval was not required for this meta-analysis.

Study selection
Two independent reviewers performed the literature search based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and reviewed the search results, with a senior author arbitrating on any disagreement. 20 The title and abstract were reviewed for all search results and potentially eligible studies received a full-text review. Finally, the reference lists of the included studies and literature reviews found in the initial search were manually screened for additional articles meeting the inclusion criteria.

Search strategy
The following search terms were used in MEDLINE, EMBASE and the Cochrane Library databases in April 2020 as the search algorithm: (Shoulder OR glenohumeral OR anterior shoulder) AND (conservative OR nonoperative OR nonsurgical OR physiotherapy OR immobilization) AND (instability OR dislocation). No time limit was given to publication date.

Eligibility criteria
The inclusion criteria were the following: (1) RCT comparing immobilisation in external and internal rotation, (2) published in a peer-reviewed journal, (3) published in English or translation freely available, and (4) full text of studies available. The exclusion criteria were the following: (1) non-randomised design, (2) review studies, (3) cadaver studies, (4) biomechanical studies, and (5) abstract only.

Data extraction/analysis
The relevant information regarding the study characteristics including the study design, the level of evidence (LOE), the methodological quality of evidence (MQOE), population, the outcomes measured and the follow-up time points was collected by two blinded reviewers using a predetermined data sheet, with the results compared. When required information was not available in the text, the authors were contacted. The LOE was evaluated based on the criteria by Wright et al. 21 The MQOE and risk of bias were evaluated using the Cochrane Collaboration risk of bias tool. 22 Studies were considered as having a low risk of bias when every single item was scored as ‘low risk’. Studies were considered as moderate risk of bias when ‘high risk’ or ‘unclear risk’ on one or two items of bias was scored. Studies were considered as high risk of bias when more than two ‘high risk’ or ‘unclear risk’ were scored.

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) study selection flow diagram.

Outcomes measured
The outcomes measured focused on (1) compliance, (2) recurrent dislocations, and (3) return to play.

Statistics
All statistical analyses were performed using Review Manager (RevMan) (Macintosh). V.5.3. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014. Heterogeneity between studies was quantified using the I² statistic. 23 Random-effects models were used when I² was >50%, and >3 studies evaluated the outcome. Results were presented as risk ratio (RR) for dichotomous outcomes and with a 95% CI. A p value <0.05 was considered to be statistically significant.

RESULTS
Literature search
The initial literature search resulted in 5164 total studies. After removal of duplicates, the articles were screened for inclusion and exclusion criteria, 3804 unique studies were evaluated and 30 full texts were assessed for eligibility. Ten clinical trials with 795 patients were included in this review. The PRISMA flow chart is shown in figure 1.

Study characteristics/patient demographics
There were nine RCTs 18 19 24–28 (LOE I) comparing 408 patients immobilised in external rotation to 387 patients immobilised in internal rotation. The majority of these patients (82.4%) were male, with an average age of 29 years and average follow-up time of 25.5 months. The majority of studies (6) used 3 weeks of immobilisation, and the rest (3) used 4 weeks of immobilisation, with each study using identical immobilisation times for each group. Five of the included studies had a low risk of bias, and four studies had a high risk of bias due to quasi-randomisation or inadequate reporting of randomisation. The baseline age, gender and reported risk factors for recurrent instability were similar between the cohorts (p>0.05). The study characteristics are shown in table 1.
Clinical outcomes

Recurrent dislocations

The rate of recurrent dislocation was reported in nine studies, with 401 patients immobilised in external rotation and 386 patients immobilised in internal rotation. Overall, 89 patients (22.2%) immobilised in external rotation experienced recurrence as compared with 215 patients (33.4%) immobilised in internal rotation. There was a statistically significant difference favouring immobilisation in external rotation (RR 0.62, 95% CI 0.42 to 0.92, I²=55%, p=0.02). Additionally, the rate of recurrent dislocations in 20–40 year-olds was reported in five studies, with 165 patients immobilised in external rotation and 172 patients immobilised in internal rotation. Overall, 20 patients (12.1%) immobilised in external rotation experienced recurrence as compared with 54 patients (31.4%) immobilised in internal rotation. There was a statistically significant difference favouring immobilisation in external rotation (RR 0.36, 95% CI 0.17 to 0.75, I²=48%, p=0.006). The forest plot for recurrent dislocations is shown in figure 2, and the forest plot for recurrent dislocations in those 20–40 years old is shown in figure 3. Recurrence in patients with full-time brace application was reported in six studies, with 230 patients immobilised in external rotation and 214 immobilised in internal rotation. Overall, 48 patients (20.9%) immobilised in external rotation experienced recurrence as compared with 82 patients (38.3%) immobilised in internal rotation. There was a statistically significant difference favouring immobilisation in external rotation (RR 0.53, 95% CI 0.40 to 0.72, I²=39%, p<0.0001). The forest plot for recurrence in patients with full-time brace application is shown in figure 4.

Compliance

Compliance with the immobilisation protocol was reported in seven studies, with 345 patients immobilised in external rotation and 324 immobilised in internal rotation. Overall, 258 patients (74.5%) immobilised in external rotation were compliant, as compared with 215 patients (67.4%) immobilised in internal rotation. There was a statistically significant difference favouring immobilisation in external rotation (RR 0.75, 95% CI 0.60 to 0.94, I²=44%, p=0.01). The forest plot for compliance is shown in figure 5.

Return to play

The rate of return to play at the same preinjury level was reported in two studies, with 187 patients immobilised in external rotation and 176 patients immobilised in internal rotation. Overall, 114 patients (60.1%) immobilised in external rotation returned to play, as compared with 75 patients (42.6%) immobilised in internal rotation. There was a statistically significant difference favouring immobilisation in external rotation (RR 0.65, 95% CI 0.52 to 0.81, I²=87%, p=0.0001). The forest plot for return to play is shown in figure 6.

DISCUSSION

The most important finding of this study is that immobilisation in external rotation resulted in a lower rate of recurrent dislocation after primary anterior shoulder instability, including younger patients who may be at higher risk of recurrent instability. Despite concerns that immobilisation in external rotation may be more uncomfortable for patients, patient compliance was shown to in fact be higher with this protocol. Additionally,
a higher rate of return to play at the same preinjury level was found with immobilisation in external rotation. Several systematic reviews looking at the outcomes of immobilisation in external versus internal rotation have failed to find a significant difference in any clinical parameters between the protocols.11–17 However, several new RCTs have been published, which allowed an updated meta-analysis, and lead to our study determining there was a difference in recurrence rates. Overall, all but one included study showed that immobilisation in external rotation reduced the rate of recurrence to some extent. While there was heterogeneity in the outcome measures used due to the study by Liavaag et al finding a slightly higher rate of recurrence with immobilisation in external rotation, we employed a random-effects model to account for this and the result was still statistically significant. Additionally, our study established that immobilisation in external rotation reduced the recurrence in patients 20–40 years old, which had not been established in previous systematic reviews.

Immobilisation in external rotation reduces the rate of recurrent dislocation by placing the Bankart lesion in a more anatomic position, allowing for healing to occur.7–8 Itoi et al7 8 used the term ‘coaptation’ to refer to the position in external rotation where the Bankart lesion approximates the glenoid, and this has been validated by other MRI studies.30–34 Additionally, this position leads to increased subscapularis tension which creates an intra-articular tamponade effect, thereby reducing the formation of a haematoma and further improving the approximation of the Bankart to the glenoid. Liavaag et al31 found that immobilisation in external rotation resulted in greater labral healing on MRI, and that the separation distance was less than with internal rotation. However, it remains unclear how long patients need to be immobilised for healing to occur. Scheibel et al35 found that in a prospective study immobilisation in external rotation for 5 weeks leads to a lower recurrence rate than those immobilisation for 3 weeks. However, Itoi et al36 found that prolonged immobilisation after 3 weeks did not reduce recurrence.

Recurrence rates of up to 100% have been reported elsewhere in the literature.4–6 In this review, we found a much lower overall rate of recurrence, regardless of which immobilisation protocol was used. This is likely due to the clearly defined criteria for non-surgical management employed by the RCTs included for review. The decision to treat a patient non-surgically after a traumatic first-time anterior shoulder dislocation should be individualised based on their risk factors for recurrence, namely age, hand dominance, participation in sports, timing in season and amount of glenohumeral bone loss.37–39 Surgeons have an important responsibility to appropriately counsel their patients and discuss the various treatment options available to them, while emphasising the risk of recurrence associated with each plan. Allowing patients with multiple risk factors for recurrence to return to play can lead to further instability events and increased glenohumeral bone loss. This may result in the patient necessitating a more invasive procedure at the time of surgery, when an arthroscopic Bankart repair may have otherwise sufficed.40 41

Patient compliance is a concern with immobilisation, and no included study had 100% compliance with their protocol. Overall, those treated with immobilisation in external rotation had a higher compliance rate, despite concerns that this position may be less tolerable for patients. Chan et al19 found in their study that immobilisation in external rotation resulted in greater labral healing on MRI, and that the separation distance was less than with internal rotation. However, it remains unclear how long patients need to be immobilised for healing to occur. Scheibel et al35 found that in a prospective study immobilisation in external rotation for 5 weeks leads to a lower recurrence rate than those immobilisation for 3 weeks. However, Itoi et al36 found that prolonged immobilisation after 3 weeks did not reduce recurrence.

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Systematic review

Warth et al found that the ability to return to play is the single most important driving factor for patients who decide to have their shoulder stabilised, more so than the risk of recurrent instability with non-surgical treatment. It is worth noting that the rates of return to play at the same preinjury level in this study are lower than those reported in systematic reviews on surgical stabilisation. A systematic review by Memon et al found a high rate of return to play following arthroscopic Bankart repair, with 81% of patients returning to play and 66% returning to their preinjury level. Similarly, Hurley et al found that 89% of patients were able to return to play and 72% were able to return to their preinjury level following the Latarjet procedure. Additionally, a double-blind RCT by Robinson et al showed that patients undergoing arthroscopic Bankart repair after first-time dislocation had a higher rate of return to play than those undergoing arthroscopic lavage alone (87.5% vs 57.6%). Another RCT by Dickens et al determined that collegiate collision athletes are more likely to successfully return to sport without experiencing recurrence instability the following season if they undergo surgical stabilisation in the off-season (90% vs 40%). Thus, while we found that immobilisation in external rotation may improve rates of return to play, the desire to return to play in certain athletes may be a contraindication to non-surgical treatment.

Limitations
This study has several limitations and sources of potential biases, including the limitations of the included studies themselves. While all of the included studies were randomised, it was not possible to blind the patients to their treatment groups. Additionally, it was not possible to adjust for age, gender and type of sports played; however, there were no significant differences in patient demographics between the two groups. The overall heterogeneity (ie, statistical measure of differences between studies) was high in terms of recurrence of instability and rate of return to play, which indicates inconsistency between the results in the studies. There were also patient dropouts in some of the studies, which explains why there is a discrepancy between the overall numbers and the numbers used to compare outcome measures.

CONCLUSION
Immobilisation of the shoulder in external rotation after a traumatic first-time anterior shoulder dislocation results in a higher compliance rate, a lower recurrent dislocation rate and a higher rate of return to play as compared with immobilisation in internal rotation.

Figure 5 Forest plot of compliance. ER, external rotation; IR, internal rotation.

Figure 6 Forest plot of return to play.
REFERENCES