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Is posterosuperior contact a normal occurrence in the shoulder?

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ABSTRACT

Posterosuperior (or internal) impingement at the shoulder is defined as contact between the underside of the supraspinatus or infraspinatus tendons with the posterosuperior labrum during extreme external rotation and abduction. In many cases, this contact damages the tendon and causes mirror posterosuperior labrum deterioration. The primary aim of this study was to define whether this contact occurs normally in patients who do not have a rotator cuff tear.

Methods: We evaluated 100 shoulders in 100 patients. All patients were operated on in the beach chair position. After introducing the scope through the posterior portal, contact between the articular side of the rotator cuff and the posterosuperior labrum was noted as being present or absent when the arm was cocked in 90° abduction and 90° external rotation (90/90) then the arm was cocked in 140° abduction and maximum external rotation (140/Max).

Results: Contact was observed in 69% of patients in the 90/90 cocked position and in 94% of patients in the 140/Max cocked position. We found a correlation between the presence of rotator cuff and/or labrum lesions and the patient regularly performing arm-cock movements ($p = 0.035$).

Discussion: Contact between the underside of the supraspinatus tendon and the posterosuperior labrum occurs physiologically. Repetitive arm-cock movements may contribute to macroscopic lesions of the underside of the rotator cuff and posterosuperior labrum.

Level of evidence: IV, basic science study

1. Introduction

Physiological contact between the underside of the supraspinatus tendon and the posterosuperior labrum and/or glenoid rim during arm-cock motions (abduction and external rotation, ABER) was described many years ago [1–5]. Several pathophysiological hypotheses have been put forward to explain this contact knowing that the intrinsic mobility of the scapulohumeral joint is limited by these two structures [3–5]:

- anterior instability or micro-instability [6–8] induces excessive external rotation during an abduction and external rotation movement, thus leading to contact between the underside of the rotator cuff and the posterosuperior labrum;
- posterior translation of the shoulder's center of rotation relative to contracture of the posterior capsule structures; this translation

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causes early contact of the posterosuperior labrum with the underside of the rotator cuff during ABER [9–11];
- reduction of humeral retrotorsion also contributes to early contact between the underside of the rotator cuff and the labrum [2].

When this contact becomes symptomatic, the patient is diagnosed as having posterosuperior impingement [12,13] or internal impingement [1]. This condition is mainly found in athletes who perform throwing motions or in athletes who repetitively place their arm in extreme external rotation and abduction [14]. This impingement has also been described in people who perform manual labor, especially in older adults [14,15].

Our working hypothesis was that the contact between the underside of the supraspinatus tendon and the posterosuperior labrum is a normal occurrence. The primary aim of this study was to determine whether this contact occurs even in patients who do not have a rotator cuff lesion. The secondary aim was to determine whether repeated arm-cock movements have an effect on this contact and any potential rotator cuff tears discovered.

2. Materials and methods

This was a single-center, single-surgeon, non-interventional study of 100 shoulders (100 patients). Included were patients undergoing arthroscopy for anterior instability, rotator cuff tendinopathy without tear, or extra-articular pathology. The exclusion criteria were the presence of known posterior impingement, hypermobility, posterior or multidirectional instability, rotator cuff tear or scapulohumeral stiffness. The patients' medical records were consulted to collect data on age, sex, sports activity and occupation while asking whether these activities required repeated arm-cock motions.

All patients were operated in the beach-chair position under regional or general anesthesia without the use of skeletal muscle relaxants. The scope was introduced in the glenohumeral joint through the standard posterior portal. The examination was first conducted in a dry joint and then repeated in a saline-filled joint without adrenalin. The arthroscopy pump was set at 30 mmHg.

The patient's arm was moved sequentially through these positions:

- arm-cock in 90° abduction and 90° external rotation (90/90);
- arm-cock in 140° abduction and maximum external rotation (140/max).

We determined whether contact occurred between the labrum and the underside of the posterior and superior rotator cuff (supraspinatus and/or infraspinatus tendons), whether tendon lesions were present (deep partial tear), whether posterosuperior labrum tears were present (degeneration/detachment) and whether chondral damage was visible on the humeral head.

The cohort was 67% male, with a mean age of 41 years (range, 18 to 64). In 71% of cases, the dominant arm was operated on. Regular arm-cock motions were used in 17% of patients during their sports activity (recreational or competitive): 5 handball players, 6 tennis players, 3 javelin throwers and 3 water polo players.

3. Results

The findings were the same for the dry and fluid-based examinations.

Posterosuperior contact was observed in 69% of shoulders for the 90/90 arm-cock position and in 94% of shoulders for the 140/max arm-cock position. There was no correlation between age, sex, dominant side and presence of anterior instability on the observed contact.

Among the lesions discovered intraoperatively were an isolated deep partial tear (less than 50% of tendon thickness) in 7% of cases, isolated labrum lesion in 9% of shoulders, and mirror lesions in 17% of shoulders (non-significant tendon lesions). There was also no correlation between these lesions and age, sex, dominant side and presence of anterior instability. However, there was a positive correlation with the patient regularly performing arm-cock movements ($p = 0.035$).

4. Discussion

This study found that the contact between the underside of the supraspinatus tendon and the posterosuperior labrum is a physiological phenomenon (94% of shoulders in the 140/Max arm-cock position). We also found that repetitively placing the shoulder in the arm-cock position may be responsible for macroscopic lesions of the underside of the rotator cuff due to true impingement, even if this impingement is not responsible for specific clinical symptoms (mainly pain). Unlike some studies [16], we found no evidence that instability contributes to internal impingement.

In cadaver studies, it was shown that the underside of the supraspinatus tendon can be compressed between the humeral head and the posterior rim of the glenoid cavity when the arm is placed in 90° abduction and maximum external rotation [3]. While this contact is physiological and asymptomatic, it appears that it may become symptomatic and pathological with repeated throwing motions or repeatedly placing the shoulder in the arm-cock position [17].

The limitations of our study were that it was purely observational and performed in patients under general anesthesia, thus slack (even though muscle relaxants were not used). Hence, we could not determine if muscle tone may delay or even aggravate this contact. Similarly, we do not know the consequences of joint distension with the addition of irrigation fluid at 30 mmHg. Another limitation of our study was its statistical power. Our cohort consisted of only 100 patients, with the distribution likely not representative of the general population. Lastly, we did not measure humeral torsion in this study. Thus we cannot draw any conclusions about the potential incidence of humeral retrotorsion as an etiology factor for internal impingement.

5. Conclusion

Contact between the underside of the rotator cuff and the posterosuperior labrum is physiological when the shoulder is placed in the arm-cock position (or ABER). Repeatedly adopting this position may lead to the development of lesions on the underside of the rotator cuff. Instability does not appear to be a predisposing factor for contact between these two structures, nor does it appear to contribute to lesions on the underside of the rotator cuff.

Disclosure of interest

P. Clavert: Consultant and product development forWright-Tornier, Associate editor for OTSR; C. Levigne: Consultant for and royalties from Wright/Tornier; J. Garret: Royalties from MoveUP Ortho, Wright, FH Orthope-dics and Consultant for Arthrex, Zimmer, Pfizer; J. Grimberg: Consultant for Smith & Nephew, royalties from Biomet-Zimmer. The other authors declare that they have no competing interest.

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Author contributions

All the authors contributed to performing the study or interpreting the results.

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