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Mid- to long-term results of postoperative immobilization in internal vs. external rotation after arthroscopic anterior shoulder stabilization

Marvin Minkus, MD^{a,1}, Julia Wolke, MD^{a,1}, Doruk Akgün, MD^a, Markus Scheibel, MD^{a,b,*}

^aCenter for Musculoskeletal Surgery, Department for Shoulder and Elbow Surgery, Charité-Universitätsmedizin Berlin, Berlin, Germany

^bSchulthess Clinic, Zürich, Switzerland

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Background: There is still a disagreement on the postoperative rehabilitation concerning position of immobilization of the shoulder after arthroscopic anterior shoulder stabilization and its influence on the clinical outcome. The aim of this study was to evaluate the clinical results and the recurrence rate after arthroscopic anteroinferior shoulder stabilization and postoperative immobilization in internal rotation vs. external rotation.

Methods: Twenty-five patients (22 male and 3 female, mean age 28.5 years) were included in this prospective nonrandomized cohort study. In group I (11 male, 2 female, mean age 28 years), the postoperative functional immobilization was carried out in internal rotation of 60°, and in group II (11 male, 1 female, mean age 30 years), 15° of external rotation of the arm for 4 weeks in both groups. The clinical follow-up was performed at 2, 4, and 6 weeks as well as at 3, 6, and 12 months postoperatively including assessment of range of motion and functional shoulder scores (Subjective Shoulder Value, Constant score, Rowe score, Walch Duplay score, Melbourne Instability Shoulder Score). Furthermore, shoulder instability was evaluated using the apprehension, relocation, and surprise tests. Mid-term follow-up data were additionally assessed after a minimum of 4 years.

Results: Twenty patients (19 male and 1 female) with an average age of 28 years were followed up for 62 (53–72) months after arthroscopic stabilization. The comparison of both groups showed almost equal results regarding the range of motion without any significant differences ($P > .05$). The evaluation of the shoulder function scores also showed no significant differences with an average Subjective Shoulder Value of 95% vs. 91%, Constant score of 89 vs. 88 points, Rowe score of 96 vs. 94 points, Walch Duplay score of 86 vs. 89 points, Melbourne Instability Shoulder Score of 96 points, and Western Ontario Shoulder Instability Index of 88% vs. 84% ($P > .05$). There was no recurrent dislocation in both groups.

Conclusion: The type of immobilization after arthroscopic shoulder stabilization does not influence the clinical results after a mid- to long-term follow-up.

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The frequency of arthroscopic capsular labral repair for the treatment of anteroinferior shoulder stabilization has increased significantly in recent years.^{20,23} Nevertheless, there is still a disagreement on the postoperative management after arthroscopic anteroinferior shoulder stabilization with respect to the immobilization of the arm and its impact on the clinical outcome.^{20,23}

Investigation performed at the Charité-Universitätsmedizin Berlin, Germany. This study was approved by the ethical committee from the Center for Musculoskeletal Surgery Charité-Universitätsmedizin Berlin (EA2/043/16).

*Corresponding author: Markus Scheibel, MD, Department of Shoulder and Elbow Surgery, Center for Musculoskeletal Surgery, Charité-Universitätsmedizin Berlin, Augustenburger Platz 1, 13353 Berlin, Germany.

E-mail address: markus.scheibel@charite.de (M. Scheibel).

¹ These authors contributed equally to this work.

In the past, the postoperative immobilization was performed predominantly in adduction and internal rotation with 90° of elbow flexion.^{1,3,6,9,10,13,16,21,22} By using this type of immobilization, satisfying short- and long-term results could be obtained regarding shoulder stability.^{1,3,6,9,10,13,16,21,22,20} Furthermore, the immobilization in internal rotation (IR) provides a “safe position” of the shoulder compared to the “at-risk position” in external rotation (ER).²⁵ That is why this form of immobilization was accepted without discussion over many years. However, restriction in range of motion, particularly the ER, after arthroscopic anteroinferior shoulder stabilization and immobilization in IR is frequently observed postoperatively.¹⁴ In recent years, various studies for immobilization in ER as a conservative treatment after primary traumatic anterior shoulder dislocation were published with different results concerning the recurrence rate.^{5,11,12,19,29,33} In a

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Cochrane analysis regarding immobilization after first-time traumatic anterior shoulder dislocation, the authors found less recurrent instability for the immobilization in ER. However, the difference was overall not significant, and the evidence for the superiority of immobilization in ER not sufficient.² Clinical results of Bankart repair with postoperative immobilization in ER has not been extensively investigated. Kim et al showed on MR arthrography after anterior shoulder stabilization a significantly better mean labral height and no medial overhang on the glenoid rim with the arm in ER.¹⁶

So far, no direct comparison of postoperative immobilization in IR and ER and its impact on the clinical outcome has been examined in a clinical study. We hypothesized that immobilization in ER after arthroscopic shoulder stabilization leads to superior clinical outcome. The aim of this study was the evaluation of mid- to long-term results of immobilization in IR vs. ER after arthroscopic anterior shoulder stabilization in terms of range of motion (especially ER), functional shoulder scores, as well as the subjective and objective shoulder stability.

Materials and methods

Study design and patient population

This prospective nonrandomized cohort study has been approved by the local ethics committee (EA2/043/16). Twenty-five patients with anterior shoulder instability without hyperlaxity (type B2 according to Gerber) and glenoid bone loss treated by arthroscopic soft-tissue stabilization in suture anchor technique were enrolled in this study. Exclusion criteria were patients with multidirectional or posterior instability; revision surgery; type B1, B3, B4, B5, and B6 instabilities according to Gerber; bony Bankart lesions; and fracture dislocations (including fractures of the greater tuberosity).⁷

The average age of the patients (22 male and 3 female) was 28 (15–49) years. In 9 cases, the right shoulder was the affected side, and in 16 cases, the left shoulder. In 40% (n = 10), the dominant side was affected. None of the patients had undergone a surgery of the affected shoulder before. All surgeries were performed by the senior author (M.S.).

Surgical technique

Anterior shoulder stabilization was performed arthroscopically with refixation of the anterior labrum and capsule in suture anchor technique (Bio-FASTak suture anchors; Arthrex, Naples, FL) in the lateral position of the patient. A diagnostic arthroscopy via a posterior portal was performed. Afterward, anteroinferior and anterosuperior portals were created, and the arthroscope was switched to the anterosuperior portal. Two 8.25-mm × 7-cm translucent twist-in cannulas (Arthrex, Naples, FL) were inserted in the anteroinferior and posterior portals. Then the capsulolabral complex was mobilized from the scapular neck. The bony anterior glenoid rim was debrided with the shaver to enhance healing. A bioabsorbable FASTak suture anchor was inserted at the 5:00 (right shoulder) or 7:00 position (left shoulder) on the glenoid surface. The capsulolabral tissue was penetrated deep anteroinferiorly using a Suture Lasso (Arthrex, Naples, FL), and the FiberWire (Arthrex, Naples, FL) sutures of the anchor were passed through the soft tissue. This creates a mattress-stitch configuration anterior to the labrum. With a sliding knot, the capsulolabral tissue was reattached for the primary refixation, and 3 reversed-post half-hitches locked the base knot. Two other suture anchors were aimed in the same way at the 4- and 2-o'clock (right shoulder) or at the 8- and



Figure 1 Postoperative immobilization in internal rotation.



Figure 2 Postoperative immobilization in external rotation.

10-o'clock positions (left shoulder) of the glenoid. No remplissage was necessary or performed among the patients.

Interventions and follow-up examination

Historically patients are immobilized in IR after arthroscopic shoulder stabilization. Patients were not randomized to either treatment option but prospectively evaluated. In a historic cohort, patients were included and treated by immobilization in IR (group I). In group II, patients were prospectively evaluated and

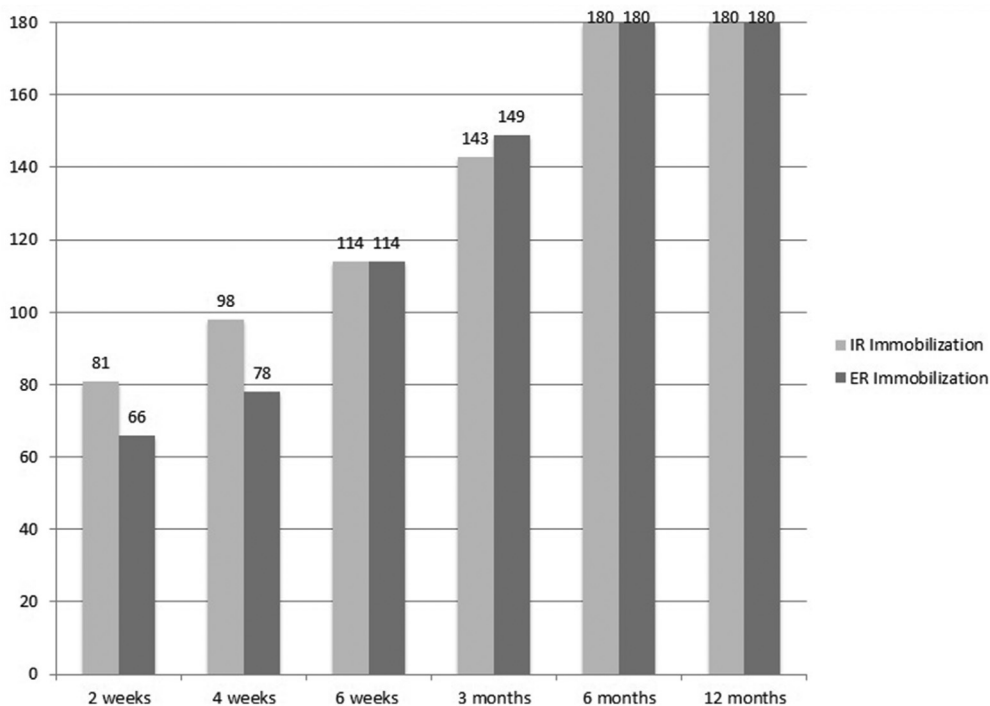


Figure 3 Development of the flexion over time from 2-week to 12-month follow-up after immobilization in IR vs. ER after anterior shoulder stabilization. IR, internal rotation; ER, external rotation.

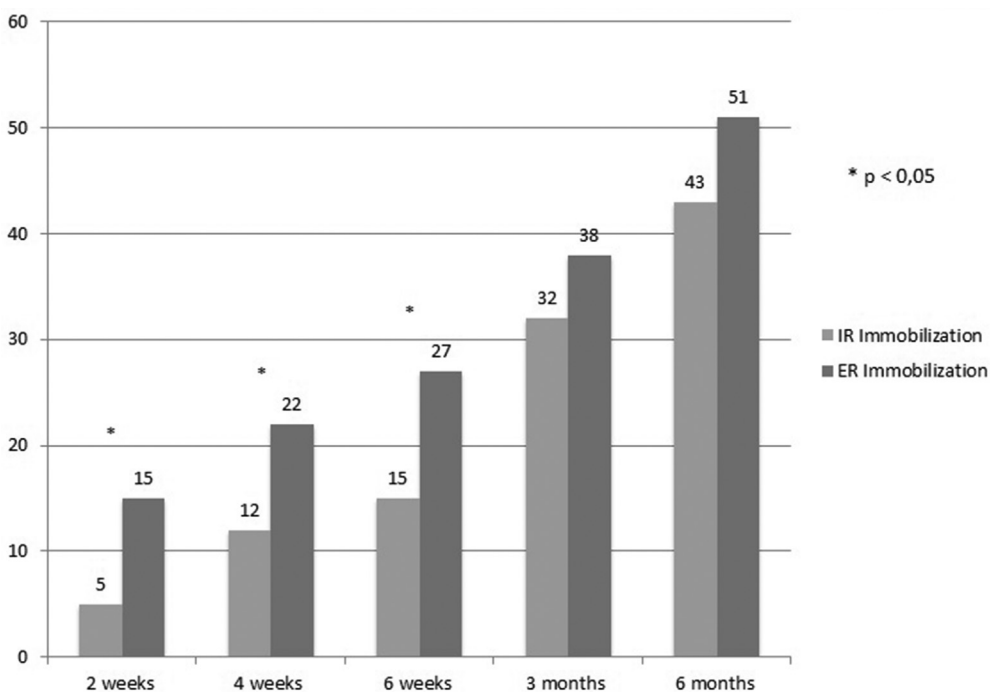


Figure 4 Development of the ER over time from 2-week to 12-month follow-up after immobilization in IR vs. ER after anterior shoulder stabilization. IR, internal rotation; ER, external rotation.

included as they were immobilized in ER after shoulder stabilization surgery. Patients in group I (n = 2 female, n = 11 male, mean age 27 [range 15 - 45] years) were immobilized in 60° of IR (Procure Shoulder Immobilizer; DJO) (Fig. 1), and patients in group II (n = 1 female, n = 11 male, mean age 30 [16-49] years) in 15° of ER

(Donjoy Ultrasling ER; DJO) (Fig. 2) for four weeks in both groups. From the second postoperative day on, the passive mobilization began with a flexion and abduction to 60°, ER to 15°, and IR to 60°. From week four on, the passive range of motion was increased to a flexion and abduction of 90°, and the ER was still limited to 15°.

From week seven on, free flexion and abduction and the beginning of mobilization in ER were allowed.

The clinical follow-up was performed at 2, 4, and 6 weeks as well as at 3, 6, and 12 months postoperatively and after a minimum follow-up of 4 years. Mid- to long-term follow-up was evaluated after a mean duration of 62 (range 53-72) months postoperatively. Numerical analog pain scale score and passive range of motion were evaluated until the 6-week follow-up examination. At 3 and 6 months postoperatively, the passive and active range of motion were measured using a goniometer and documented, as well as the Constant score (CS) and the Rowe score (RS). In addition, the apprehension, relocation, and surprise test were evaluated.^{4,27}

Long-term follow-up with a mean duration of 62 (53-72) months included the evaluation of the range of motion, the apprehension test, as well as the subjective shoulder function scores (Western Ontario Shoulder Instability Index, Subjective Shoulder Value, Melbourne Instability Shoulder Score) and partly objective and partly subjective scores (RS, CS, Walch-Duplay score).^{4,8,17,27,31,32} Follow-up examinations were performed by an independent examiner, who was not the surgeon.

Statistical analysis

The statistical analysis was performed using SPSS Statistics (IBM Corp., Armonk, NY, USA). The statistical analysis of differences in the extent of movement and the shoulder function scores comparing the immobilization in IR vs. ER was performed using the Wilcoxon test. The significance level was set at $P < .05$. Data were tested for normal distribution using the Kolmogorov-Smirnov test.

Results

Between 2 and 6 weeks after arthroscopic shoulder stabilization, the patients showed an average decrease of the numerical analog pain scale score from 2.3 to 0.3 in group I and an increase from 1.3 to 1.5 in group II. However, this difference was not found to be statistically significant ($P > .05$).

The flexion showed no significant difference between both groups at any time point ($P > .05$). The range of motion increased significantly over time. In group I, the average flexion increased from 81° to 180° from the 2-week follow-up to the 12-month follow-up, and in group II, from 66° to 180° (Fig. 3). The abduction was not significantly different in both groups ($P > .05$) at any time point. The average abduction increased from 66° to 180° in group I and from 64° to 178° in group II.

ER with the arm in adduction showed a significant difference between the two groups. The average ER was 5° in group I vs. 15° in group II at 2-week follow-up ($P = .005$), 12° vs. 22° at 4-week follow-up ($P = .032$), and 15° vs. 27° at 6-week follow-up ($P = .025$). However, these results were nullified over time, and no significant differences were observed at the latest follow-up visit (Fig. 4).

The evaluation of the functional shoulder scores also showed no significant difference in the short-term results (2 weeks to 12 months). The average CS was 71 vs. 74 points at the 3-month follow-up, 79 vs. 84 points at 6-month follow-up, and 89 vs. 86 points at 12-month follow-up ($P > .05$). The RS achieved an average of 71 vs. 81 points at three-month follow-up, 95 vs. 97 points at six-month follow-up, and 100 vs. 96 points at 12-month follow-up ($P > .05$) (Figs. 5 and 6).

The long-term results with an average follow-up duration of 62 (53-72) months could be obtained in 20 patients and showed no significant differences in range of motion and functional shoulder scores. The average flexion was 180° in both groups, the abduction was 178° in group I vs. 178° in group II, the ER was 48° vs. 46°, the

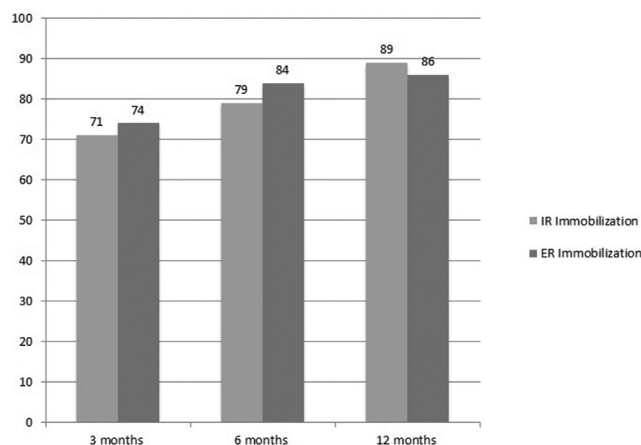


Figure 5 Development of the Constant score over time from 3-months to 12-month follow-up after immobilization in IR vs. ER after anterior shoulder stabilization. IR, internal rotation; ER, external rotation.

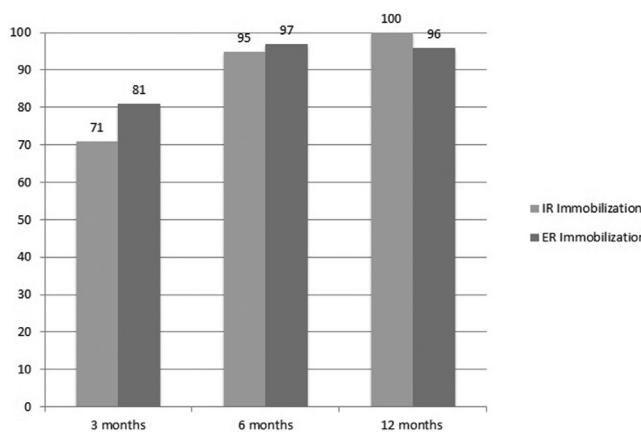


Figure 6 Development of the Rowe score over time from 3-months to 12-month follow-up after immobilization in IR vs. ER after anterior shoulder stabilization. IR, internal rotation; ER, external rotation.

high ER (in 90° abduction) was 78° vs. 74°, and the high IR achieved 85° vs. 84° ($P > .05$) (Fig. 7). The CS reached an average of 90 vs. 88 points, the RS 97 vs. 96 points, Walch-Duplay score of 91 vs. 93 points, Melbourne Instability Shoulder Score 97 vs. 97 points, Western Ontario Shoulder Instability Index 91% vs. 89%, and the Subjective Shoulder Value achieved 94% vs. 92% ($P > .05$) (Fig. 8). None of the patients reported any recurrent dislocation or subluxation, nor a subjective feeling of instability. The apprehension sign was positive in one patient of group II.

Discussion

The immobilization after arthroscopic anterior shoulder stabilization is traditionally performed in IR. Hereby, satisfying results in terms of stability with recurrence rates between 4% and 10% could be achieved.^{6,18,28,30} However, a restriction of mobility, especially ER, can often be observed.^{14,15,25,26}

Several decades ago, Rowe et al already questioned the role of the immobilization position for the clinical outcome after anterior shoulder instability.²⁷ They saw an advantage of the IR immobilization because of the “safe position,” whereas they suspected a potential disadvantage of the ER immobilization because of the “at-risk position” of the arm.²⁵ However, in our opinion, immobilization in ER of 15° is far away from a true “at-risk” position for

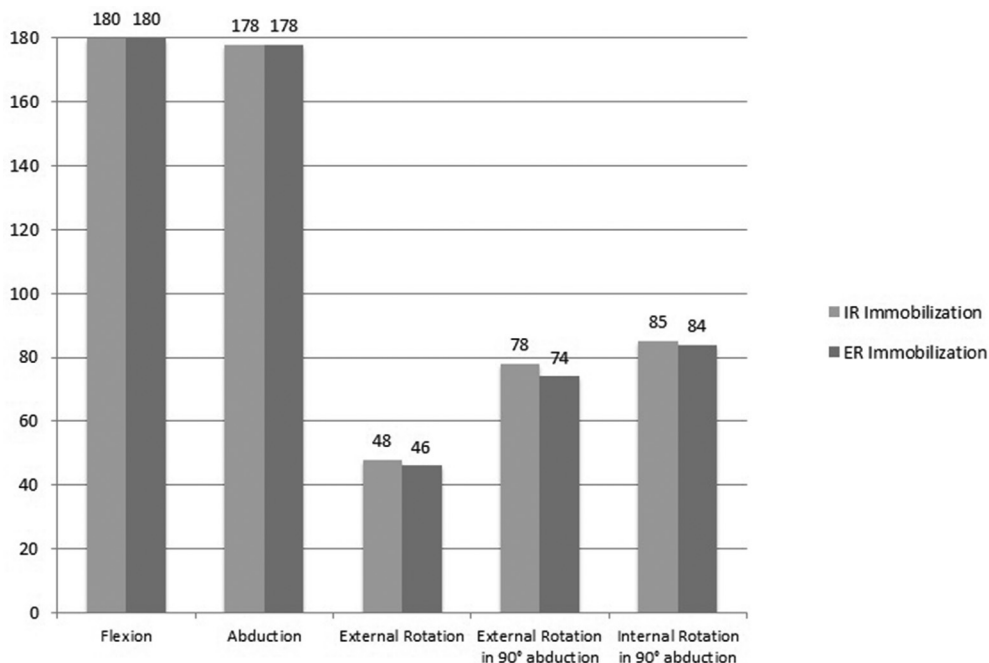


Figure 7 Range of motion at long-term follow-up after immobilization in IR vs. ER after anterior shoulder stabilization. IR, internal rotation; ER, external rotation.

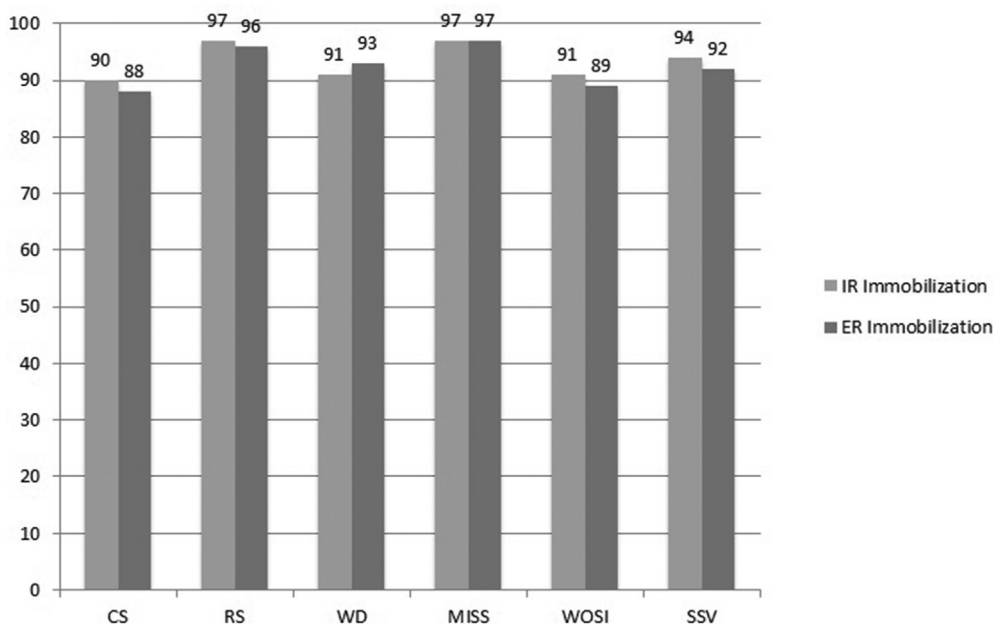


Figure 8 Functional shoulder scores at long-term follow-up after immobilization in IR vs. ER after anterior shoulder stabilization. IR, internal rotation; ER, external rotation.

recurrent dislocation, which is more likely in ER of more than 60° and additional abduction.

Kim et al performed magnetic resonance imaging studies to compare the position of the labrum after Bankart repair and subsequent immobilization in internal vs. ER immediately after surgery in 22 patients.¹⁶ They found a significantly higher increase of the labrum and height of the labrum in favour of immobilization in ER. In addition, a significantly lower medial overhang of the labrum with postoperative immobilization in ER was observed.¹⁶ However,

the study did not allow any conclusions on the impact of these results on the clinical outcome in terms of stability, range of motion, or shoulder function.

Yin et al first evaluated the influence of external immobilization on the postoperative range of motion and shoulder-specific function scores after arthroscopic stabilization surgery.³⁴ They studied 33 patients with a mean follow-up duration of 16 months and could show that the preoperative level of ER was achieved at 3 months postoperatively and showed an increase in the mean ER from 62°

preoperatively to 72° postoperatively at the mean follow-up. The authors reported a recurrence rate of 3%. As a limitation, they mentioned the lack of a control group of patients with internal immobilization to make a statement regarding the effectiveness of two different immobilization positions and to make a recommendation for the future.³¹

Our study compares the influence of postoperative immobilization in internal vs. ER with respect to the range of motion, stability, and shoulder-specific function scores. The results of our study could not prove a significant influence of the selected immobilization on the postoperative long-term results after arthroscopic anterior shoulder stabilization. There was no significant difference in recurrence rate and shoulder function scores comparing the immobilization in internal vs. ER. A suspected advantage of better ER due to postoperative immobilization in ER, while reported restriction with immobilization in IR, could not be detected.^{24,34} Although a significantly better ER in the group of immobilization in ER appeared in the early postoperative period (up to the sixth postoperative week), the results nullified over time, so that there was no significant difference in terms of ER at the time of long-term follow-up.

As a limitation of our study, the small patient population must be mentioned. In addition, the loss to the long-term follow-up of 20% must be considered. Further studies with greater patient population are needed to prove and underline the results of our study.

Conclusion

According to the mid- to long-term results of this study, it can be concluded that postoperative immobilization in internal or ER after arthroscopic anteroinferior shoulder stabilization does not make any significant difference in terms of postoperative range of motion, clinical and subjective shoulder stability, or functional shoulder scores.

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Conflicts of interest: Dr. Scheibel received consultant payments from Arthrex Company, which is not related to this work. The other authors, their immediate families, and any research foundation with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

References

- Bacilla P, Field LD, Savoie FH 3rd. Arthroscopic Bankart repair in a high demand patient population. *Arthroscopy* 1997;13:51-60.
- Braun C, McRobert CJ. Conservative management following closed reduction of traumatic anterior dislocation of the shoulder. *Cochrane Database Syst Rev* 2019;5:Cd004962. <https://doi.org/10.1002/14651858.CD004962.pub4>.
- Cole BJ, L'Insalata J, Irgang J, Warner JJ. Comparison of arthroscopic and open anterior shoulder stabilization. A two to six-year follow-up study. *J Bone Joint Surg Am* 2000;82-A:1108-14.
- Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. *Clin Orthop Relat Res* 1987;160-4.
- Finestone A, Milgrom C, Radeva-Petrova DR, Rath E, Barchilon V, Beyth S, et al. Bracing in external rotation for traumatic anterior dislocation of the shoulder. *J Bone Joint Surg Br* 2009;91:918-21. <https://doi.org/10.1302/0301-620x.91b7.22263>.
- Gartsman GM, Roddey TS, Hammerman SM. Arthroscopic treatment of anterior-inferior glenohumeral instability. Two to five-year follow-up. *J Bone Joint Surg Am* 2000;82-A:991-1003.
- Gerber C, Nyffeler RW. Classification of glenohumeral joint instability. *Clin Orthop Relat Res* 2002;65-76. <https://doi.org/10.1097/00003086-200207000-00009>.
- Gilbart MK, Gerber C. Comparison of the subjective shoulder value and the Constant score. *J Shoulder Elbow Surg* 2007;16:717-21. <https://doi.org/10.1016/j.jse.2007.02.123>.
- Grana WA, Buckley PD, Yates CK. Arthroscopic Bankart suture repair. *Am J Sports Med* 1993;21:348-53.
- Green MR, Christensen KP. Arthroscopic versus open Bankart procedures: a comparison of early morbidity and complications. *Arthroscopy* 1993;9:371-4.
- Itoi E, Hatakeyama Y, Kido T, Sato T, Minagawa H, Wakabayashi I, et al. A new method of immobilization after traumatic anterior dislocation of the shoulder: a preliminary study. *J Shoulder Elbow Surg* 2003;12:413-5. [https://doi.org/10.1016/s1058-2746\(03\)00171-x](https://doi.org/10.1016/s1058-2746(03)00171-x).
- Itoi E, Hatakeyama Y, Sato T, Kido T, Minagawa H, Yamamoto N, et al. Immobilization in external rotation after traumatic anterior dislocation reduces the risk of recurrence. A randomized controlled trial. *J Bone Joint Surg Am* 2007;89:2124-31. <https://doi.org/10.2106/jbjs.f.00654>.
- Kandziora F, Jager A, Bischof F, Herresthal J, Starker M, Mittlmeier T. Arthroscopic labrum refixation for post-traumatic anterior shoulder instability: suture anchor versus transglenoid fixation technique. *Arthroscopy* 2000;16:359-66.
- Kang RW, Frank RM, Nho SJ, Ghodadra NS, Verma NN, Romeo AA, et al. Complications associated with anterior shoulder instability repair. *Arthroscopy* 2009;25:909-20. <https://doi.org/10.1016/j.arthro.2009.03.009>.
- Karlsson J, Magnusson L, Ejerhed L, Hultenheim I, Lundin O, Kartus J. Comparison of open and arthroscopic stabilization for recurrent shoulder dislocation in patients with a Bankart lesion. *Am J Sports Med* 2001;29:538-42.
- Kim SH, Yoo JC, Ahn JM. Arthroscopically repaired Bankart lesions and the effect of two different arm positions on immediate postoperative evaluation with magnetic resonance arthrography. *Arthroscopy* 2005;21:867-74. <https://doi.org/10.1016/j.arthro.2005.04.109>.
- Kirkley A, Griffin S, McLintock H, Ng L. The development and evaluation of a disease-specific quality of life measurement tool for shoulder instability. The Western Ontario Shoulder Instability Index (WOSI). *Am J Sports Med* 1998;26:764-72.
- Krueger D, Kraus N, Pauly S, Chen J, Scheibel M. Subjective and objective outcome after revision arthroscopic stabilization for recurrent anterior instability versus initial shoulder stabilization. *Am J Sports Med* 2011;39:71-7. <https://doi.org/10.1177/0363546510379336>.
- Liavaag S, Brox JJ, Pripp AH, Enger M, Soldal LA, Svenningsen S. Immobilization in external rotation after primary shoulder dislocation did not reduce the risk of recurrence: a randomized controlled trial. *J Bone Joint Surg Am* 2011;93:897-904. <https://doi.org/10.2106/jbjs.j.00416>.
- Malhotra A, Freudmann MS, Hay SM. Management of traumatic anterior shoulder dislocation in the 17- to 25-year age group: a dramatic evolution of practice. *J Shoulder Elbow Surg* 2012;21:545-53. <https://doi.org/10.1016/j.jse.2011.01.006>.
- Mologne TS, Lapointe JM, Morin WD, Zilberfarb J, O'Brien TJ. Arthroscopic anterior labral reconstruction using a transglenoid suture technique. Results in active-duty military patients. *Am J Sports Med* 1996;24:268-74.
- Morgan CD, Bodenstab AB. Arthroscopic Bankart suture repair: technique and early results. *Arthroscopy* 1987;3:111-22.
- Owens BD, Harrast JJ, Hurwitz SR, Thompson TL, Wolf JM. Surgical trends in Bankart repair: an analysis of data from the American Board of Orthopaedic Surgery certification examination. *Am J Sports Med* 2011;39:1865-9. <https://doi.org/10.1177/0363546511406869>.
- Rahme H, Vikerfors O, Ludvigsson L, Elven M, Michaelsson K. Loss of external rotation after open Bankart repair: an important prognostic factor for patient satisfaction. *Knee Surg Sports Traumatol Arthrosc* 2010;18:404-8. <https://doi.org/10.1007/s00167-009-0987-6>.
- Regan WD Jr, Webster-Bogaert S, Hawkins RJ, Fowler PJ. Comparative functional analysis of the Bristow, Magnuson-Stack, and Putti-Platt procedures for recurrent dislocation of the shoulder. *Am J Sports Med* 1989;17:42-8.
- Rosenberg BN, Richmond JC, Levine WN. Long-term followup of Bankart reconstruction. Incidence of late degenerative glenohumeral arthrosis. *Am J Sports Med* 1995;23:538-44.
- Rowe CR, Patel D, Southmayd WW. The Bankart procedure: a long-term end-result study. *J Bone Joint Surg Am* 1978;60:1-16.
- Scheibel M, Tsynman A, Magosch P, Schroeder RJ, Habermeyer P. Postoperative subscapularis muscle insufficiency after primary and revision open shoulder stabilization. *Am J Sports Med* 2006;34:1586-93. <https://doi.org/10.1177/0363546506288852>.
- Taskoparan H, Kilincoglu V, Tunay S, Bilgic S, Yurttas Y, Komurcu M. Immobilization of the shoulder in external rotation for prevention of recurrence in

- acute anterior dislocation. *Acta Orthop Traumatol Turc* 2010;44:278-84. <https://doi.org/10.3944/aott.2010.2274>.
30. Tauro JC. Arthroscopic inferior capsular split and advancement for anterior and inferior shoulder instability: technique and results at 2- to 5-year follow-up. *Arthroscopy* 2000;16:451-6.
 31. Walch G. Directions for the use of the quotation of anterior instabilities of the shoulder. In: Abstracts of the First Open Congress of the European Society of Surgery of the Shoulder and Elbow, Paris; 1987. p. 51-5.
 32. Watson L, Story I, Dalziel R, Hoy G, Shimmin A, Woods D. A new clinical outcome measure of glenohumeral joint instability: the MISS questionnaire. *J Shoulder Elbow Surg* 2005;14:22-30. <https://doi.org/10.1016/j.jse.2004.05.002>.
 33. Whelan DB, Kletke SN, Schemitsch G, Chahal J. Immobilization in external rotation versus internal rotation after primary anterior shoulder dislocation: a meta-analysis of randomized controlled Trials. *Am J Sports Med* 2016;44:521-32. <https://doi.org/10.1177/0363546515585119>.
 34. Yin B, Levy D, Meadows M, Moen T, Gorroochurn P, Cadet ER, et al. How does external rotation bracing influence motion and functional scores after arthroscopic shoulder stabilization? *Clin Orthop Relat Res* 2013. <https://doi.org/10.1007/s11999-013-3343-6>.