



Immobilization of the shoulder in external rotation for prevention of recurrence in acute anterior dislocation

Hüseyin TAŞKOPARAN, Servet TUNAY, Volkan KILINÇOĞLU, Serkan BİLGİÇ,
Yüksel YURTTAŞ, Mahmut KÖMÜRCÜ

Gülhane Military Faculty of Medicine, Department of Orthopedics and Traumatology, Ankara

Objectives: We aimed to compare the functional and stability outcomes of the patients with acute anterior shoulder dislocation, who were stabilized at external versus internal rotation.

Methods: A total of 33 patients (31 males and 2 females) with the diagnosis of acute primary traumatic anterior shoulder dislocation were immobilized at internal (n=17) or external rotation (n=16). The mean follow-up period was 20.85 months (range 6-41 months). Patients received rehabilitation program immediately after splinting. We assessed functionality by Constant-Murlay score and stability by Rowe scoring system in 6th month. Control examinations were performed in 12th and 24th months.

Results: There were no statistically significant differences between internal rotation and external rotation groups in terms of Constant-Murlay and Rowe scores. Recurrent dislocation rate was 6.3% (1/16) in external rotation group and 29.4% (5/17) in internal rotation group (p>0.05). In the subgroup of patients aged between 21-30 years, while no recurrent dislocation was seen in external rotation group, 5 patients developed recurrent dislocation in internal rotation group (p=0.035).

Conclusion: Immobilization of the shoulder in external rotation is an effective preferred for prevention of recurrent dislocations in acute anterior shoulder dislocation and should be preferred to traditional splinting in internal rotation in clinical practice.

Key words: Conservative treatment; external rotation in shoulder splinting; shoulder dislocation.

Although shoulder joint has the widest range of motion in the body, it is the most prone joint to instability. Thus, the incidence of traumatic shoulder dislocation is high. Half of the joint dislocations is of shoulder, and 97% of shoulder dislocations is to anterior. Due to its high incidence, there are different opinions for the treatment of shoulder dislocations.

Until last 10 years, the traditional approach was stabilization at adduction and internal rotation position after reduction of primary anterior traumatic

shoulder dislocation.^[1] In this technique, soft tissue healing would prevent recurrence of dislocation. However, the studies in the last 10 years completely changed our traditional knowledge and treatment approach. Clinical and cadaveric studies proved that instead of traditional internal rotation after reduction, stabilization at external rotation should be applied.^[2-4]

Biomechanical studies^[5] found that, in glenolabral tears, there is no glenolabral surface contact at

internal rotation, minimal contact at neutral position, and maximum contact at 45° of external rotation.

More studies on stabilization at external rotation in primary anterior shoulder dislocation would provide more evidence for clinical treatment protocols on fixation at external rotation. In this study, we aimed to compare the functional and stability outcomes of the patients with acute anterior shoulder dislocation, who were stabilised at external versus internal rotation.

Patients and methods

A total of 33 patients (31 males and 2 females) with the diagnosis of acute primary traumatic anterior shoulder dislocation were included in the study between 2004–2008. Study patients had primary dislocation, admission at the first day of reduction after dislocation, and no hyperlaxity findings. One patient was below 20 years old, 21 patients (63.6%) were between 21–30 years old; 4 patients (12.12%) were between 31–40 years old, and 7 patients (21.21%) were over 40 years old.

Patients with odd emergency department administration numbers received stabilization at internal rotation [$n=17$, mean age 28.94 years (range 15–68 years)], and patients with even numbers received stabilization at external rotation [$n=16$, mean age 34.94 years (range 21–75 years)].

The etiology of dislocation was forcing sportive activity for 7 patients (43.8%) and trauma for 9 patients (56.3%) in the external rotation group; forcing sportive activity for 9 patients (52.9%) and trauma for 8 patients (47.1%) in the internal rotation group. Dislocation was at the dominant side in the 20 patients (60.6%)—12 patients in the internal rotation group and 8 patients in the external rotation group.

For reduction, Hippocrates maneuver was used for 20 patients, Kocher maneuver for 12 patients, and Stimson maneuver for 1 patient (Table 1). All patients were evaluated with anteroposterior shoulder radiography and magnetic resonance imaging (MRI) (Fig. 1) before and at 6th, 12th, and 24th months after reduction. Additionally, Rowe scoring

system and Constant-Murlay functional scoring system were applied at 6th months. Mean follow-up period was 20.85 months (range 6 to 41 months).

Fixation methods

Patients in internal rotation and adduction group were fixated at first day with valpaeu bandaging; and the next day, they switched to waist-assisted sling. In the first day after reduction, specific splint fixated in 10° external rotation and adduction was applied in 16 patients. During three weeks, patients in both groups removed the fixation materials only during the shower. The body of the external rotation fixation splint was made from hard polyethylene (vitraton), also known as “the tire sector” among people, which is forming supporting point by giving special form on the iliac wing applied to the waist. The part of the splint extending to the body did not completely surround the waist, it was outstretching up to umbilicus in the front and up to spinose process in the back, while the remaining parts fixed by velcro were providing a good stabilization. On the other hand, arm fixation consists of a part made of thermoplastic, which is suitable for the placement of forearm attached to the body with two metallic bars (Fig. 2).

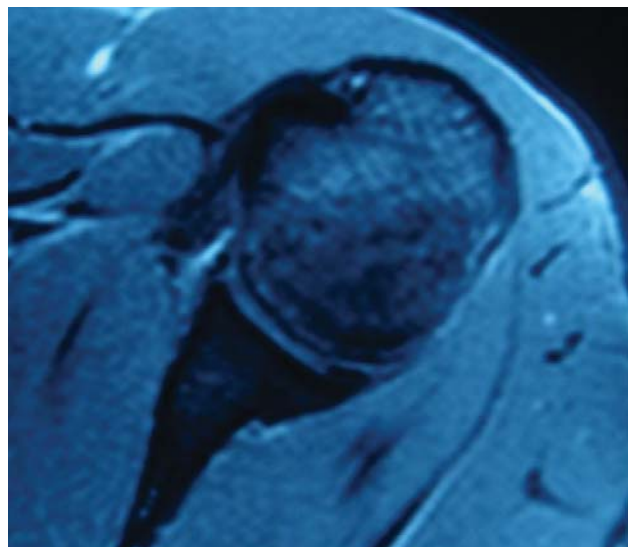


Fig. 1. Bankart lesion in shoulder MRI of 32-year-old patient after dislocation.

Table 1
Demographics and basic clinical characteristics of patients

No	Sex	Age	Group	Const.	Rowe	Appr.	Recurrence	Follow-up (months)	Reduction side	Rowe score	Dom. arm	Red. method	Tra. type
1	M	21	ER	98	100	-	-	20	Right	Excellent	-	H	S
2	M	34	ER	96	70	+	-	27	Right	Fair	+	H	S
3	M	24	ER	100	100	-	-	6	Right	Excellent	+	H	F
4	M	26	ER	100	100	-	-	10	Right	Excellent	+	Ko	F
5	M	30	ER	98	95	-	-	17	Left	Excellent	-	H	F
6	M	21	ER	100	100	-	-	24	Left	Excellent	-	Ko	F
7	M	34	ER	82	40	+	+	36	Left	Poor	-	H	S
8	M	30	ER	98	95	-	-	22	Left	Excellent	-	H	S
9	M	21	ER	100	100	-	-	22	Right	Excellent	+	H	S
10	M	22	ER	98	100	-	-	9	Left	Excellent	+	H	S
11	M	21	IR	94	45	+	+	23	Right	Poor	+	Ko	S
12	M	21	IR	84	25	+	+	18	Left	Poor	-	H	F
13	M	23	IR	85	25	+	+	9	Left	Poor	-	Ko	S
14	M	22	IR	83	40	+	+	29	Right	Poor	-	Ko	S
15	M	24	IR	100	95	-	-	10	Right	Excellent	+	H	S
16	M	35	IR	100	70	+	-	10	Left	Fair	+	Ko	S
17	M	21	IR	100	100	-	-	26	Right	Excellent	+	H	F
18	M	21	IR	92	45	+	+	41	Left	Poor	-	H	S
19	M	21	IR	100	100	-	-	27	Left	Excellent	-	Ko	F
20	M	15	IR	100	100	-	-	32	Right	Excellent	+	H	S
21	M	22	IR	91	95	-	-	17	Right	Excellent	+	Ko	S
22	M	21	IR	100	100	-	-	26	Right	Excellent	+	Ko	S
23	M	21	IR	100	100	-	-	6	Left	Excellent	+	H	F
24	M	35	IR	100	100	-	-	6	Left	Excellent	-	H	F
25	F	60	IR	87	90	-	-	17	Right	Excellent	+	H	F
26	M	41	IR	97	100	-	-	38	Right	Excellent	+	St	F
27	F	68	IR	71	90	-	-	29	Left	Excellent	+	H	F
28	M	22	ER	100	100	-	-	24	Right	Excellent	-	H	S
29	M	65	ER	100	100	-	-	21	Left	Excellent	-	Ko	F
30	M	75	ER	86	95	-	-	21	Right	Excellent	+	H	F
31	M	56	ER	99	95	-	-	24	Left	Excellent	+	Ko	F
32	M	57	ER	97	90	-	-	9	Right	Excellent	+	Ko	F
33	M	21	ER	98	95	-	-	32	Right	Excellent	+	H	F

M: Male, F: Female, ER: Stabilization at external rotation, IR: Stabilization at internal rotation, H: Hippocrates, Ko: Kocher, St: Stimson, S: Sports, F: Falling, Appr: Apprehension test, Const: Constant, Red: Reduction, Tra: Trauma, Dom: Dominant.



Fig. 2. (a-d) Application of external rotation shoulder splinting.

Rehabilitation and follow-up

After the end of a three-week period of fixation, isometric exercises providing immediate movement width and pendulum exercises ensuring the muscle power were started under the control of a physiotherapist. When isometric exercises were performed painlessly, patients were switched to isotonic exercises. It has been proposed not to begin sporting activities for three months.

Statistical analysis

In the data analysis, SPSS 15.0 statistical package program was used. Data were summarized with number, percentage, mean, and minimum-maximum values. For the comparison between groups, chi-square and Fisher's exact tests were used for the discrete variables, and Student-t test was used for the continuous variables. The level of statistical significance was defined as $p < 0.05$.

Results

From the 35 patients admitted with traumatic anterior dislocation of the shoulder, one patient was

excluded from the study for brachial plexus lesion and one patient for hyperlaxity findings. Totally 33 patients were included in the study. All of the patients were adapted quite well to the fixation methods, and fixation was performed for three weeks. Both groups were similar in basic clinical parameters. Between the two groups, there were no statistically significant differences in terms of age, follow-up period, and etiology of trauma and dislocation of the shoulder ($p > 0.05$). For the patients in the external rotation group, mean Constant score was 96.88 (range 82-100). Rowe score was poor in one patient, fair in one patient and excellent in 14 patients. On the other hand, for the patients in the internal rotation group, mean Constant score was 93.16 (range 71-100) and Rowe score distribution was bad in 5 patients, average in one patient and perfect in 11 patients. There were no statistically significant differences between the two groups in terms of Constant-Murlay score and Rowe score. There was no severe functional limitation in any patient during

follow-up except one patient in the internal rotation group with 30° limitation in abduction and 10° in internal rotation in the 6th and 12th months. This patient was 75 years old and had additional rotator cuff problems.

Constant-Murlay and Rowe scores were significantly different between the two groups in patients aged between 21-30 years ($p=0.035$). Two patients (12.5%) in the external rotation group and 6 patients (35.3%) in the internal rotation group had positive intimidation test. Intimidation test results were not statistically different between groups. However, in the subgroup of patients aged 21-30 years, while no patient had positive intimidation test in external rotation group, 5 patients had positive test in internal rotation group ($p=0.035$).

One patient (6.3%) in external rotation group and 5 patients (29.4%) in internal rotation group had recurrent dislocation ($p>0.05$). In the subgroup of patients aged between 21-30 years, while no recurrent dislocation was seen in external rotation group, 5 patients developed recurrent dislocation in internal rotation group ($p=0.035$) (Table 2). All the patients experienced first recurrence within 2 years. Recurrent dislocation was detected in the second year for one patient in external rotation group; in the first year for 2 patients and in the second year for 3 patients in internal rotation group.

Discussion

Internal rotation fixation has been applied approximately for 2000 years for shoulder dislocation.^[1] The

purpose of this fixation is to avoid external rotation of shoulder providing sufficient improvement of the front section of the capsule.^[6] However, as highlighted by the studies on internal rotation fixation, optimum improvement is not seen with internal rotation fixation in Bankart lesion. Itoi et al.^[7-9] reported that external rotation fixation make an anatomical improvement in Bankart lesion, decrease dislocation development risk and is more for the useful to the traditional methods. Robinson et al.^[10] studied functional outcome of the shoulder dislocation in 252 patients between the ages of 15-35 years who were divided into those develop or did not develop instability after 4 weeks in the sling in internal rotation. Of the patients, 55.7% and 66.8% had instability after 2 and 5 years of dislocation, respectively. For the young and active people, the risk level is proportional to the risk of activity, but inversely proportional to the quality of the static stabilizers, and condition and power of the dynamic stabilizers.^[4,11] Thus, patients with bad condition of the rotator cuff muscles or with congenital capsular laxity, especially above the head in sports are at risk in terms of glenohumeral instability.^[12,13] On the other hand, patients with ligaments in good quality and condition can have shoulder dislocation with a sudden trauma. The previous studies reported that the most important risk factors for recurrent shoulder dislocation are age and sex.^[14-18] The younger age for the first dislocation is associated with the high recurrence risk; the risk of recurrence in men is also more than 6 times of the risk in women.^[19] Hovelius et al.^[14] found that the risk of recurrence was around

Table 2
Recurrence rates according to age groups [n/total (%)]

Age groups (years)	Internal rotation group	External rotation group	p value
<20	0/1	0/0	>0.05
21-30	5/11	0/10	0.035
31-40	0/2	1/2	>0.05
≥41	0/3	0/4	>0.05
Total	5/17 (35.3%)	1/16 (6.3%)	>0.05

30% in patients under 30 years and 10% in patients aged 30-40 years in 10-year follow-up. The vast majority of recurrent dislocation was seen in two years following the first dislocation.^[20-24] Rowe et al.^[25] reported that 70.5% of the recurrent dislocation occurs in the 2 years, 18.7% in the 5 years after dislocation.

In our series, 2 of the 6 patients with recurrence had the relapse in the first year and the other 4 in the second year. The anteroinferior part of the labrum was inverted and move medially after the relapse of anterior shoulder dislocation. Anterior soft tissues loosen and let the labrum to split. These findings become evident with the release of capsule in internal rotation. In external rotation, anterior joint space diminishes, and subscapularis muscle is seen stretched and more slim. With the compression of anterior capsule and subscapularis muscle, glenolabral separation is prevented in this region.^[2,8] MRI studies investigated the position of Bankart lesion while the shoulder is in internal and external rotation after the dislocation of the shoulder.^[8] MRI following intraarticular injection showed that the separation of labrum is significantly less in external rotation than internal rotation. Itoi et al.^[9] found that 94 of 198 patients diagnosed as the first time shoulder dislocation had the internally rotated separation of labrum, and 104 patients had a 10° externally rotated separation of labrum. The recurrence rate of internally rotated group was 33% (31/94) and of externally rotated group was 10.5% and the difference was statistically significant. In the present study, the recurrence rates of dislocations in the age groups were compared. We found that dislocation was mostly seen in the age group of 21-30 years, and externally rotated immobilization was more effective to prevent recurrence of dislocation than internally rotated immobilization in all age groups. There was no statistically meaningful difference between externally and internally rotated immobilization in terms of recurrence results, but patients aged 21-30 years had higher recurrence rate. In Miller's biomechanical study on cadaver, glenolabral contact force was investigated when the shoulder was 60° internally rotated and 45° externally

rotated.^[5] There was no contact when the shoulder was internally rotated, however contact was constituted in neutral position and the contact surface became much wider when the shoulder was 45° externally rotated.^[5] They found that the contact force significantly increased in Bankart lesion supporting externally rotated immobilization for anatomically healing. The external rotation increases the contact force, and we think that it is difficult for the patients to cooperate to 45° externally rotated immobilization. For this reason we used 10° externally rotated immobilization for easy to perform and to increase the cooperation rate. The most important problem of external rotated immobilization is the cooperation of patient in his daily life. The major difficulties are passing through a door, the risk to have a trauma in crowded places, and discomfort of patient. However, considering the decreased recurrence rates of dislocation by externally rotated immobilization in particularly young patients, it is a worth to apply externally rotated immobilization rather than conventional methods. If the importance of the splint usage is explained to the patient, the patient's cooperation may increase. Currently, the angle of externally rotated immobilization need to be defined.^[9]

As a conclusion, our study showed the importance of externally rotated immobilization especially in 21-30 years old patients that has higher risk for recurrence. Externally rotated immobilization would be more commonly included in treatment protocols with increasing clinical studies.

References

1. Hippocrates. On the articulations. The genuine works of Hippocrates. *Clin Orthop Relat Res* 2002;(400):19-25.
2. Bonutti PM, Norfray JF, Friedman RJ, Genez BM. Kinematic MRI of the shoulder. *J Comput Assist Tomogr* 1993;17:666-9.
3. Perugia D, Gumina S, Postacchini F. Immobilization after primary dislocation of the shoulder. *J Shoulder Elbow Surg* 1996;5(2 Pt 1):S80.
4. Itoi E, Hatakeyama Y, Urayama M, Pradhan RL, Kido T, Sato K. Position of immobilization after dislocation of the shoulder. A cadaveric study. *J Bone Joint Surg Am* 1999; 81:385-90.

5. Miller BS, Sonnabend DH, Hatrick C, O'leary S, Goldberg J, Harper W, et al. Should acute anterior dislocations of the shoulder be immobilized in external rotation? A cadaveric study. *J Shoulder Elbow Surg* 2004;13:589-92.
6. Kesmezacar H. The evaluation and treatment of acute anterior shoulder dislocation. [Article in Turkish] *Acta Orthop Traumatol Turc* 2005;39:40-7.
7. 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.
8. Itoi E, Sashi R, Minagawa H, Shimizu T, Wakabayashi I, Sato K. Position of immobilization after dislocation of the glenohumeral joint. A study with use of magnetic resonance imaging. *J Bone Joint Surg Am* 2001;83-A:661-7.
9. Itoi E, Hatakeyama Y, Sato T, Kido T, Minagawa H, Yamamoto N, et al. Immobilization in external rotation after shoulder dislocation reduces the risk of recurrence. A randomized controlled trial. *J Bone Joint Surg Am* 2007; 89:2124-31.
10. Robinson CM, Howes J, Murdoch H, Will E, Graham C. Functional outcome and risk of recurrent instability after primary traumatic anterior shoulder dislocation in young patients. *J Bone Joint Surg Am* 2006;88:2326-36.
11. Rowe CR, Patel D, Southmayd WW. The Bankart procedure: a long-term end-result study. *J Bone Joint Surg Am* 1978;60:1-16.
12. Bigliani LU, Pollock RG, Soslowsky LJ, Flatow EL, Pawluk RJ, Mow VC. Tensile properties of the inferior glenohumeral ligament. *J Orthop Res* 1992;10:187-97.
13. Özkan H. The Bankart procedure in anterior shoulder instabilities. [Thesis in Turkish] PhD Thesis. Ankara, 2003.
14. Hovelius L, Augustini BG, Fredin H, Johansson O, Norlin R, Thorling J. Primary anterior dislocation of the shoulder in young patients. A ten-year prospective study. *J Bone Joint Surg Am* 1996;78:1677-84.
15. te Slaa RL, Wijffels MP, Brand R, Marti RK. The prognosis following acute primary glenohumeral dislocation. *J Bone Joint Surg Br* 2004;86:58-64.
16. Simonet WT, Cofield RH. Prognosis in anterior shoulder dislocation. *Am J Sports Med* 1984;12:19-24.
17. Kralinger FS, Golser K, Wischatta R, Wambacher M, Sperner G. Predicting recurrence after primary anterior shoulder dislocation. *Am J Sports Med* 2002;30:116-20.
18. Kirkley A, Griffin S, Richards C, Miniaci A, Mohtadi N. Prospective randomized clinical trial comparing the effectiveness of immediate arthroscopic stabilization versus immobilization and rehabilitation in first traumatic anterior dislocations of the shoulder. *Arthroscopy* 1999;15:507-14.
19. Moseley HF. Recurrent dislocation of the shoulder. Montreal: McGill University Press; 1961.
20. Bankart ASB. The pathology and treatment of recurrent dislocation of the shoulder joint. *Br J Surg* 1938;26:23-9.
21. DePalma AF. Surgery of the shoulder. 2nd ed. Philadelphia: J. B. Lippincott; 1973.
22. Adams JC. Recurrent dislocation of the shoulder. *J Bone Joint Surg Br* 1948;30B:26-38.
23. Eyre-Brook AL. The morbid anatomy of a case of recurrent dislocation of the shoulder. *Br J Surg* 1942;30:32-7.
24. McLaughlin HL, Cavallaro WU. Primary anterior dislocation of the shoulder. *Am J Surg* 1950;80:615-21.
25. Salmon JM, Bell SN. Arthroscopic stabilization of the shoulder for acute primary dislocations using a transglenoid suture technique. *Arthroscopy* 1998;14:143-7.