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A new method of immobilization after traumatic anterior dislocation of the shoulder: a preliminary study

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Abstract

This preliminary prospective study was conducted to determine whether immobilization with the arm in external rotation would decrease the rate of recurrence after initial traumatic anterior dislocation of the shoulder. Forty patients with initial shoulder dislocations were assigned to (1) conventional immobilization in internal rotation (IR group, N = 20) or (2) a new method of immobilization in external rotation (ER group, N = 20). The recurrence rate was 30% in the IR group and 0% in the ER group at a mean 15.5 months. The difference in recurrence rate was even greater among those who were aged less than 30 years (45% in the IR group and 0% in the ER group). Immobilization with the arm in external rotation is effective in reducing the rate of recurrence after initial dislocation of the shoulder.

Shoulder dislocation, the most common dislocation in the human body, is well known for its high rate of recurrence. For over 2000 years, since the era of Hippocrates, physicians have immobilized the arm to the trunk, hoping to prevent further recurrence. A previous study using magnetic resonance imaging has shown that the detached soft tissue from the glenoid, known as a Bankart lesion, is better coapted to the bone with the arm in external rotation than in internal rotation. On the basis of this observation, we hypothesized that immobilization of the shoulder in external rotation would decrease the recurrence rate. We performed the following study to test this hypothesis.

Materials and methods

From January 2000, 42 patients with an initial anterior dislocation of the shoulder were referred to our institutions. Of these, 14 had undergone reduction and were referred to us, whereas the remaining 28 visited us directly with their shoulders dislocated. After routine radiographic examination of the anteroposterior view, the shoulders were reduced manually. Radiographic examination revealed a fracture of the greater

tuberosity in 9 cases and a fracture of the glenoid in 1 case. The greater tuberosity remained displaced in 2 cases after reduction. These cases were treated surgically and thus excluded from this study. The remaining 40 patients were enrolled in this study. There were 29 male and 11 female patients with a mean age of 39 years (range, 17-84 years).

They were assigned to two groups with informed consent: immobilization in internal rotation (IR group) or immobilization in external rotation (ER group). The first 10 cases were alternatively assigned, and the remaining 30 were randomly assigned. There were 20 patients in the IR group (mean age, 38 years; range, 17-81 years) and 20 patients in the ER group (mean age, 40 years; range, 17-84 years). The demographics of these patients are summarized in Table 1.

Table 1. Background of patients

	Internal rotation group	External rotation group	P value
No. of patients	20	20	1.0*
Age (y) [mean (range)]	38 (17–81)	40 (17-84)	.82†
Male/female	14/6	15/5	.72*
Right/left	12/8	9/11	.34*
Already reduced at initial visit	6 cases	8 cases	.51*
Sports injuries	12 cases	11 cases	.75*
Combined fracture	3 greater tuberosities; 1 glenoid	4 greater tuberosities	1.0*

Immobilization in internal rotation was performed with a sling and swathe. Immobilization in external rotation was performed with a wire-mesh splint covered with a sponge. This splint was bent so that the curved portion fit to the trunk and the straight portion fit to the forearm of the affected arm (Figure 1). After the splint was bent, it was inserted into a large stockinette (No. 5 or greater). Two holes were made in the stockinette covering the lateral surface of the straight portion such that the patient's forearm on the affected side could be passed through the stockinette (Figure 2,*A*). The stockinette was wrapped around the trunk, fixed at the elbow of the affected arm, passed behind the neck, and then tied with the stockinette on the other side of the trunk (Figure 2,*B*).

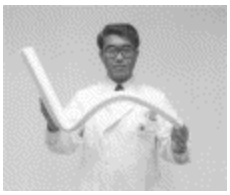

Figure 1.

External rotation (ER) immobilizer. A wire-mesh splint covered with a sponge was bent so that the curved portion fit to the trunk whereas the straight portion fit to the forearm.

(A) *(B)*

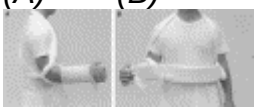

Figure 2.

ER immobilizer in place. **A**, The forearm was passed through the holes created on the stockinette covering the lateral surface of the straight portion. **B**, One end of the stockinette was tied at the tip of the straight portion. The other end was wrapped around the back of the patient, fixed at the elbow of the affected arm, passed behind the neck, and tied with the stockinette on the unaffected side. Immobilization in 10° of external rotation is achieved with use of this immobilizer.

In both groups, immobilization was continued for 3 weeks except when patients showered, followed by unrestricted motion of the arm. To assess the compliance of the immobilizer, we asked them for how many hours a day and for how long they put it on. At follow-up, we asked them whether they had had any further dislocations after immobilization and whether they had returned to preinjury sports. We also evaluated the anterior apprehension test (a physical test used to assess anterior shoulder instability) to detect any residual instability of the shoulder. The mean follow-up period was 15.5 months: 16.9 months for the IR group and 14.7 months for the ER group.

Compliance was assessed in both groups. The recurrence rate of dislocation, the rate of positive anterior apprehension test, and the rate of sports return were compared between the groups by χ^2 tests. Statistical significance was set at 5% level.

Results

Five patients in the IR group (twenty-five percent) and four patients in the ER group (twenty percent) took off the immobilizer in less than a week despite our instructions. All others immobilized the shoulder for 3 weeks as instructed. There was no significant difference in compliance ($P = .70$). The recurrence rate was 6 of 20 in the IR group (30%) and 0 of 20 in the ER group (0%) ($P = .008$). Among those who were aged younger than 30 years, the recurrence rate was 5 of 11 in the IR group (45%) and 0 of 11 in the ER group (0%) ($P = .011$). Among those who strictly immobilized the shoulder for 3 weeks, the recurrence rate was 4 of 15 in the IR group (27%) and 0 of 16 in the ER group (0%) ($P = .027$). The anterior apprehension test was positive in 2 of 14 in the IR group (14%) without recurrence and 2 of 20 in the ER group (10%) ($P = .70$). A return to preinjury sports was found in 7 of 12 cases in the IR group (58%) and 9 of 11 cases in the ER group (82%) ($P = .22$).

Discussion

Immobilization in internal rotation after shoulder dislocation has been performed for over 2000 years, since the era of Hippocrates. Surprisingly, there has been no evidence that this position is optimum for healing of the Bankart lesion. The shoulder never redislocates in 52% of patients after an initial dislocation, and recurrent dislocations spontaneously cease in 20% of patients with recurrent dislocations. This information

suggests that the Bankart lesion has the ability to heal. However, the recurrence rate does not depend on how long the shoulder is immobilized or how securely it is immobilized. It is likely that these poor outcomes after shoulder dislocation are because the position of shoulder immobilization has been inappropriate. A previous study by Itoi et al confirmed that the Bankart lesion observed on magnetic resonance imaging was better coapted when the arm was in external rotation than in internal rotation. Our current study has clearly demonstrated that immobilization in external rotation is better than conventional immobilization in internal rotation.

In a pilot study we attempted to immobilize the shoulder in 30° of external rotation. However, we found that external rotation close to the maximum was not well tolerated by the patient. Therefore, we decreased the angle of external rotation arbitrarily down to 10°. The patients felt comfortable with this amount of external rotation. Recently, Hatrick et al measured the contact force between the Bankart lesion and the glenoid with the arm in 60° of internal rotation, neutral rotation, and 45° of external rotation in a human cadaver model. They showed that there was no contact force with the arm in internal rotation but that the contact force increased as the arm passed through neutral and reached a maximum at 45° of external rotation. According to their study, there is a positive contact force with the arm in 10° of external rotation. It is likely that the higher the contact force, the higher the healing rate. However, from the patient's point of view, the less the external rotation, the more comfortable it is. Thus, we need to determine the least effective external rotation in order to improve patient compliance. Less external rotation, such as 5° or even closer to neutral rotation, still produces positive contact force and thus may be effective. Further studies are needed to determine which angle is best.

Similarly, the appropriate length of immobilization also needs to be determined. In this preliminary study we immobilized the shoulder for 3 weeks according to the conventional recommendation. Rowe compared 6 groups of patients immobilized for 1 week up to 6 weeks with a 1-week increment. Although the recurrences were equally distributed among the groups, the lowest incidence of recurrence was observed in patients treated by 4 weeks in a sling, by 3 weeks in a sling and swathe, and by 3 weeks of strapping. From this study, he stated that perhaps 3 weeks of immobilization might be sufficient time for healing to occur. In the healing process of the soft tissue, granulation tissue, which fills the gap and unites the soft tissues by 7 to 10 days, increases its tensile strength by 3 weeks. Three weeks of immobilization in external rotation may be an appropriate length for healing of a Bankart lesion, but an even shorter period may be acceptable. Once we determine the best position, we need to determine the best period of immobilization as the next step.

The number of patients in our study was small. The follow-up period was also short. According to Rowe, 70.5% of all recurrences occurred within the first 2 years, and 18.7% recurred from 2 to 5 years. In our series 2 of 20 patients in the ER group showed a positive anterior apprehension test at the time of follow-up. These patients may have recurrent dislocations in the future. Therefore, a long-term observation of a larger number of patients is under way.

In conclusion, immobilization in external rotation after shoulder dislocation is better than conventional immobilization in a sling in internal rotation in terms of reducing recurrent dislocations.

References

1. A.S.B. Bankart, Recurrent or habitual dislocation of the shoulder-joint. *BMJ* **2** (1923), pp. 1132–1133.

2. J.A. Buckwalter, J.A. Maynard and A.C. Vailas, Skeletal fibrous tissues: tendon, joint capsule, and ligament. In: J.A. Albright and R.A. Brand, Editors, *The scientific basis of orthopaedics*, Appleton & Lange, Norwalk (1987), pp. 387–405.

3. C. Hatrick, S. O'Leary, B. Miller *et al.*, Should acute anterior dislocation of the shoulder be treated in external rotation. *Trans Orthop Res Soc* **27** (2002), p. 830.

4. Hippocrates. On the articulations. The genuine works of Hippocrates. Clin Orthop 2002;400:19-25

5. L. Hovelius, B.G. Augustini, H. Fredin *et al.*, Primary anterior dislocation of the shoulder in young patients: a ten-year prospective study. *J Bone Joint Surg Am* **78** (1996), pp. 1677–1684.

6. E. Itoi, R. Sashi, H. Minagawa *et al.*, Position of immobilization after dislocation of the glenohumeral joint: a study with use of magnetic resonance imaging. *J Bone Joint Surg Am* **83** (2001), pp. 661–667.

7. B. Kazar and E. Relovszky, Prognosis of primary dislocation of the shoulder. *Acta Orthop Scand* **40** (1969), pp. 216–224.

8. C.R. Rowe, Prognosis in dislocations of the shoulder. *J Bone Joint Surg Am* **38** (1956), pp. 957–977.

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