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Position of Immobilization After First-Time Traumatic Anterior Glenohumeral Dislocation: A Literature Review

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Anterior glenohumeral dislocation affects about 2% of the general population during the lifetime. The incidence of traumatic glenohumeral dislocation ranges from 8.2 to 26.69 per 100 000 population per year. The most common complication is recurrent dislocation occurring in 17–96% of the patients. The majority of patients are treated conservatively by closed reduction and immobilization in internal rotation for 2–3 weeks. However, no clear conservative treatment protocol exists. Immobilization in external rotation can be considered an alternative. A range of external rotation braces are commercially available.

The purpose of this work was to review the current literature on conservative management of glenohumeral dislocation and to compare the results of immobilization in internal and external rotation.

A comprehensive literature search and review was performed using the keywords “glenohumeral dislocation”, “shoulder dislocation”, “immobilization”, “external rotation”, and “recurrent dislocation” in PubMed, MEDLINE, Cochrane Library, Scopus, and Google Scholar databases from their inceptions to May 2016.


Three cadaveric studies, 6 imaging studies, 10 clinical studies, and 4 meta-analyses were identified. The total number of 734 patients were included in the clinical studies.

Literature analysis revealed better coaptation of the labrum on the glenoid rim in external rotation in cadaveric and imaging studies. However, this tendency was not confirmed by lower redislocation rates or better quality of life in clinical studies.

On the basis of the available literature, we cannot confirm the superiority of immobilization in external rotation after glenohumeral dislocation when compared to internal rotation. A yet-to-be-determined group of patients with specific labroligamentous injury pattern may benefit from immobilization in external rotation. Further studies are needed to identify these patients.

MeSH Keywords: **Braces • Immobilization • Orthotic Devices • Shoulder Dislocation**

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Background

The glenohumeral joint permits the greatest range of motion out of all the joints in the human body [1,2]. Its anatomical structure favors mobility over stability [3,4]. As a result, glenohumeral dislocation (GHD) is a common problem, affecting around 2% of the general population during the lifetime, and it is the most frequent joint dislocation seen in Emergency Departments, accounting for approximately 45% of all dislocations [5–8]. The incidence of traumatic glenohumeral dislocation ranges greatly, from 8 to more than 26 per 100 000 persons per year, depending on the population studied [9–12]. A recent study by Szyluk et al., who investigated the entire Polish population for 5 years, found the mean incidence rate of first-time traumatic glenohumeral dislocation was as high as 26.69 per 100 000 persons per year, which reflects the large scale of the problem [13]. The main cause of GHD is trauma [14,15]. The 2 major groups of affected patients are young men, who sustain injury as a result of high-energy, sport-related trauma, and elderly women, in whom it is caused by a low-energy fall [13–17]. GHD is associated with significant rates of related injuries, causes absence from work, and may force change of occupation due to long-term compromise of shoulder function, creating a substantial health and economic problem [14,15].

Traditionally, the treatment of acute first-time GHD is conservative, with the arm immobilized in internal rotation (IR) in a sling and swathe or a splint. Despite its wide use, little evidence exists confirming validity of this treatment method in preventing redislocation. In a survey of British Trauma Society (BTS) members, 93% of respondents opted for immobilization in IR for first-time dislocators, but 87% admitted that no protocol regarding management of GHD existed at their institution [18].

The idea of immobilizing the shoulder after dislocation in adduction and IR was first called into question by Itoi et al. (1999), who reported better adjustment (coaptation) of the Bankart lesion to the glenoid rim in the position of external rotation (ER) compared to IR [19].

The purpose of this work was to review the current literature on conservative management of glenohumeral dislocation and to compare the results of immobilization in internal and external rotation.

We performed a review of studies dedicated to the management of first-time anterior GHD, and searched using the keywords “glenohumeral dislocation”, “shoulder dislocation”, “immobilization”, “external rotation”, and “recurrent dislocation” in PubMed, MEDLINE, Cochrane Library, Scopus, and Google Scholar databases from their inceptions to May 2016.

The inclusion criteria were:

- articles focusing on first-time traumatic glenohumeral dislocation;
- articles reporting the results of conservative treatment of glenohumeral dislocation with immobilization in external rotation;
- articles comparing the results of immobilization in external and internal rotation;
- follow-up period of at least 12 months for clinical studies;
- a minimum of 10 patients included in clinical studies;
- articles published in English or German language.

The exclusion criteria were:

- articles dealing with recurrent glenohumeral dislocation;
- articles focusing on glenohumeral joint instability;
- articles dealing with operative management of glenohumeral dislocation;
- abstracts;
- duplicates;
- case reports.

Three cadaveric studies (28 shoulders), 6 imaging studies (129 shoulders), 10 clinical studies (734 shoulders), and 4 meta-analyses comparing the outcomes of immobilization in IR and ER were analyzed.

Cadaveric Studies

Bankart lesion is the major factor responsible for recurrent dislocation and shoulder instability [3,20]. Therefore, the aim of treatment should be achieving approximation of the detached labrum to the glenoid rim and immobilizing it in such position for the time needed for ligamentous structures to heal [19]. Itoi et al. have suggested, on the basis of a cadaveric study conducted on 10 shoulders, that the best approximation of the Bankart lesion is achieved in the position of adduction and ER, or abduction and neutral rotation [19]. A possible weakness of this study may be the removal of all muscles surrounding the joint, except for rotator cuff muscles, which alters the normal biomechanical relations of the joint. The subscapularis tendon creates anterior tension, significantly contributing to apposition of the tissues [21]. The contact force between the labrum and the glenoid was measured by Miller et al. for 10 cadaveric shoulders and compared for 3 positions: 60° of IR (force not detectable), neutral rotation (force measurable), and 45° of ER (maximum force) [22]. In contrast, Limpisvasti et al. found no difference in contact pressure between subscapularis and anterior labrum in the position of IR and ER in 8 tested shoulders [23]. Cadaveric studies have number of limitations, including the fact that artificial creation of the Bankart lesion may inadequately simulate the conditions after dislocation due to lack of associated

Table 1. Summary of imaging studies comparing coaptation of the Bankart lesion in the position of the arm in internal rotation (IR) and external rotation (ER).

	Itoi et al. [25] 2001	Pennekamp et al. [30] 2006	Liavaag et al. [31] 2009	Siegler et al. [32] 2010	Chetouani et al. [29] 2010	Momenzadeh et al. [33] 2015		
No. of shoulders with first-time dislocation	6	10	55 (28-ER)	23	15	20 (9-ER)		
Mean patient age	23	30.4	27	32	28	26.4 (ER: 27.2)		
Mean ER (degrees)	52	10	15	37	30.6	10		
Mean time to MRI (days)	4	–	6 weeks (IR)*	7	54	3.8	8	3 weeks**
Separation ^a IR vs. ER	1.6 vs. 0.7	0.44± 0.27 vs. 0.01± 0.19	–0.1± 0.14	0.8 vs. 0.8	1.0 vs. 0.4	2.8 vs. 1.3	2.43±1.17 vs.1.16±1.11	
Displacement ^b IR vs. ER	3.8 vs. 1.0	0.45± 0.33 vs. –0.08± 0.28	–0.23 ±0.21	1.5 vs. 0.5	0.9 vs. 0.6	3.2 vs. 1.8 (in 6 cases)	No data available; qualitative assessment of separation and displacement	2.28±1.35 vs.1.73±1.64
Detached length ^c IR vs. ER	22.6 vs. 13.7	–	14.9 vs. 13.6	10.0 vs. 9.8	–	–	–	
Detached area ^d IR vs. ER	161.4 vs. 54.7	–	–	–	–	–	–	
Opening angle ^e IR vs. ER	31.5 vs. 11.0	–	–	–	–	–	27.86±14.74 vs.15.00±15.84	

^a Separation – distance (mm) between the inner margin of the labrum and the anterior aspect of the glenoid neck;

^b displacement – distance (mm) between the tip of the labrum and the tip of the glenoid rim (positive value when the labrum is displaced medially to the rim and negative when it is displaced laterally, towards the humeral head); ^c detached length – the length between the anterior glenoid rim and the anterior capsular attachment; ^d detached area – the area between the anterior part of the glenoid neck and the detached anterior capsule; ^e opening angle – the angle between the anterior capsule of the glenoid neck and the line tangential to the capsule at the glenoid insertion. * Investigation performed in IR 3 weeks after 3-week period of immobilisation in ER; ** MR arthrography performed after 3 weeks of immobilisation in ER or IR.

capsular injury and absence of dynamic influence on the capsulolabral complex [24].

Imaging Studies

The results of MRI studies comparing coaptation of the Bankart lesion in positions of IR and ER are presented in Table 1. In the study by Itoi et al. (2001), with the arm in IR, the joint cavity as seen on MRI was wide open and the labrum was displaced inferiorly to the glenoid rim, and the anterior capsule was lax and allowed the anterior aspect of the labrum to shift medially [25]. When changing the rotation into external, the anterior joint cavity closed and the labrum rested on the glenoid rim [25]. Joint hematoma, which is a common finding in dislocated shoulders for the first 3–7 weeks, thus the crucial period of soft-tissue healing has been identified as a factor impairing coaptation, because it interposes between anterior capsulolabral structures and the glenoid [4,15,26]. Arthroscopic

lavage removing joint effusion reduces the rate of recurrence [26,27]. Reduction of joint hematoma can also be achieved nonsurgically by placing the arm in ER, which pushes the hematoma away from the anterior aspect of the joint cavity [25]. Coaptation is further improved by the anterior band of IGHL, which in the position of abduction and ER supports the humeral head from the front [28,29]. In another study, initial MRI in ER and IR was performed and repeated after 3 weeks of immobilization in ER [30]. As indicated by separation and displacement, the position of the labroligamentous complex in relation to the glenoid was much better in ER in all of the patients. The authors concluded that immobilization in ER promotes a more anatomical healing of the Bankart lesion [30]. A 2009 study, in which 55 patients were randomized to immobilization either in IR or ER, further confirmed better coaptation of the Bankart lesion in ER [31]. The authors performed MRI within 7 days after the initial injury and repeated MR arthrography after 3 weeks of immobilization. Separation decreased to a larger extent in the ER group, but there was no significant difference

regarding displacement and detached capsule length. On initial MRI, the number of Bankart lesions in both groups was determined. After 3 weeks of immobilization, the Bankart lesion was still visible in less than 35% of the patients in the ER group compared to almost 80% of the patients immobilized in IR [31]. In a consecutive study, Siegler et al. confirmed that ER has more effect on separation (100%) than displacement (22%) [32]. In this study, the positive influence on reduction of anterior hematoma in ER was also confirmed for 75% of the patients [32]. In a recent study, Momenzadeh et al. confirmed in MR arthrography decreased separation in patients immobilized for 3 weeks in ER when compared to a group immobilized in IR, a difference that reached statistical significance [33]. Chetouani et al. achieved migration of hematoma towards the posterior pouch in all 15 shoulders immobilized in ER. Labral reduction, defined as normalization of separation and displacement (assessed qualitatively by the authors) was achieved in 40% of the patients [34]. Another study, in which MRI was performed on a group of 14 patients after immobilization in ER for 3 weeks, demonstrated coaptation of the Bankart lesion in 78.57% of the patients [35]. The constant finding in all of the above-mentioned studies was that immobilization in ER never caused worsening of the relations between the labrum and the glenoid rim. Hart and Kelly compared labral coaptation during arthroscopy in 25 first-time dislocators. In 92% of the patients, reduction of the detached labrum was improved in ER [36]. A recent study by Itoi et al. compared 4 shoulder positions – adduction-IR, adduction-ER, abduction-30° ER, and abduction-60° ER – with respect to separation, displacement, and opening angle values in 37 patients [37]. They found that while ER improved reduction of the anterior labrum when compared to IR, the position of abduction was associated with better inferior labrum reduction in comparison to the adducted position of the arm, with the optimal position for anatomic reduction being 30° of abduction and 60° of ER [37]. Scheibel et al. assessed the effect of prolonged duration of immobilization in ER. They compared separation and displacement in IR, neutral position, and ER after 3 days, 3 weeks, and 5 weeks of immobilization in 30° ER. Immobilization in ER allowed satisfactory coaptation of the Bankart lesion after 3 weeks. Prolonging immobilization by another 2 weeks did not result in improvement of outcome [38]. Another MRI study assessed the effectiveness of immobilization in ER depending on the type of labroligamentous lesion [39]. The authors classified the lesions as Perthes lesions (detachment of labrum and capsule from the glenoid rim without rupture of anterior scapular periosteum), Bankart lesions (detachment of labrum and capsule from the glenoid rim with discontinuity of anterior scapular periosteum), non-classifiable lesions (which did not meet the criteria for Perthes, Bankart, GLAD, or HAGL lesions), and into grades I-IV according to increasing degree of plastic deformation of the labroligamentous complex (IGHL and capsule) as indicated by signal intensity and level of edema in the subscapularis

tendon. Separation and displacement were assessed in IR and ER for all of the patients. The authors found that coaptation was improved in all patients in ER compared to IR, with the best effect in Perthes lesions and grade I plastic deformation. The authors emphasized that presence of a midsubstance tear of the subscapularis or its tendon, as well as excessive joint effusion, may decrease or even completely eliminate the effect of ER on improving coaptation [39]. Therefore, a subgroup of patients who would benefit most from immobilization in ER should be determined on the basis of imaging studies, preferably MRI.

Clinical Studies

Promising results of cadaveric and MRI studies promoted clinical trials necessary to finally evaluate the effect of immobilization in ER on redislocation rates and patient-evaluated shoulder function. Recurrence was chosen a primary outcome measure in all analyzed studies, and secondary outcome measures included quality of life (QOL) scores (4 studies), time to first recurrence (7 studies), positive apprehension test (1 study), return to sports activity (5 studies), and need for surgery (2 studies). Details of 10 clinical studies comparing long-term effects of immobilization in IR and ER are presented in Table 2.

A total number of 734 patients with the mean age of 30.76 years immobilized for a mean period of 3.2 weeks and followed-up for a mean of 25.12 months were included in the clinical studies. Compliance in the total of 294 patients immobilized in IR was 62.93%, while in the ER group of 323 patients it was 73.99% (3 studies in which compliance rates were not given were excluded from the analysis). Glenohumeral dislocation recurred in 100 out of the total number of 296 patients immobilized in IR (33.78%) and in 86 of 365 patients in the ER group (23.57%).

Itoi et al. and Taskoparan et al. found that the benefit in terms of recurrence rates as well as Constant and Rowe scores in the ER group was especially significant in the individuals aged 21–31 years [40, 41]. In another study, the most significant risk reduction of recurrent dislocation was observed in the 31–40 age group [28]. Itoi et al. noticed that recurrences were rarer in patients who began immobilization on the day of the dislocation [40]. They reported that 7% of patients complained of post-immobilization stiffness of the arm, which resolved within 1–2 months [40]. In another study, 5.8% of the patients complained of shoulder rigidity, which resolved within 24 months of follow-up [28]. Finestone et al., having compared the effect of immobilization in ER and IR on a group of 51 young, active males, 78% of whom were soldiers, were not able to confirm the superiority of immobilization in ER [42]. Tanaka et al., having followed a highly active group of military personnel treated

Table 2. Summary of clinical studies comparing long-term effects of immobilisation in internal rotation (IR) and external rotation (ER).

	Itoi et al. [56] 2003	Seybold et al. [57] 2006	Itoi et al. [40] 2007	Finestone et al. [42] 2009	Tanaka et al. [35] 2010	Taskoparan et al. [41] 2010	Venkatachalam et al. [58] 2010	Liavaag et al. [43] 2011	Heidari et al. [28] 2014	Whelan et al. [44] 2014
No. of patients in the study (IR: ER)	40 (20: 20)	10 (ER only)	198 (94: 104)	51 (24: 27)	16 (ER only)	33 (17: 16)	36 (ER only)	188 (95: 93)	102 (51: 51)	60 (29: 31)
Mean patient age (IR: ER)	39 (38: 40)	30.4	37: 35	20.3	21.3	32 (27: 35)	all <40	26.8	35.7	23
Period of immob. (weeks)	3	3	3	4	3	3	4	3	3	4
ER (degrees)	10	10–20	10	15–20	10	10	–	15	10	0–5
Follow-up period (months)	15.5 (16.9 IR: 14.7 ER)	12	25.6	33.4 (30.8 IR: 35.8 ER)	24	20.9	12	29.1 (28.9 IR: 29.5 ER)	24	25
Follow-up rate (IR: ER) (%)	100	100	79: 82	100	100	100	–	97.9: 97.8	100	83 (82.75: 83.87)
Compliance rate (%) (IR: ER)	75: 80	–	53: 72	100	100	–	–	47.4: 67.7	94.2: 80.4	85 (83: 87)
Recurrence (%) (IR: ER)	30: 0 (45: 0 for patients <30 years of age)	10	ITT 42: 26 PPA 38: 20	39.2 (41.7: 37)	43.75	29.4: 6.3	16	ITT 24.7: 30.8 PPA 13.6: 21.7	ITT 33.3: 3.9 PPA 33.3: 2.4	32: 22; 40: 37**
Time to 1st recur. (IR: ER) (months)	–	8	84%: 82% (within the 1 st year)	12.4: 13.8	14.5	All within 2 years	–	11.6: 10.5	Most within the 1 st year	–
WOSI	–	–	–	–	–	–	–	375: 238	230.92: 187.72	84: 87
ASES	–	–	–	–	–	–	–	–	–	89: 95
Rowe score (IR: ER)	–	91.5	–	–	–	77.65: 92.19	–	–	–	–
Constant score (IR: ER)	–	96.1	–	–	–	93.16: 96.88	–	–	–	–
Apprehension test (IR: ER)	14: 10	–	–	–	–	–	–	–	17.6: 8.1	–
Return to sports (IR: ER)	58: 82	100	63: 72 (20: 37)*	–	–	–	–	60.5: 61.4*	31.5: 83.8	–
Oper. stabilization (recur. IR: ER) (%)	–	–	29: 36	–	31.25	–	–	–	–	–

* Return to preinjury activity level (IR: ER) %; ** recurrent instability including frank recurrent dislocation and subluxations.

with immobilization in ER for 3 weeks, found that 31.25% required arthroscopic repair and 43.75% of the patients suffered recurrence within 2 years. They concluded that immobilization in ER may not be as effective as previously reported for highly active young men, and recurrence rates may not fully correlate with the findings on MRI [35]. A randomized trial by Liavaag et al. also confronted the findings of Itoi et al. [43]. The study comprised 188 patients randomly assigned to 2 homogeneous groups (IR and ER). The studied patients were more representative of the general population than those in the previously described studies [35,42,43]. All patients started immobilization within 24 h after reduction of the dislocation [40,43]. The authors studied the recurrence of dislocation, as well as WOSI score and return to previous level of physical activity. They found no statistically significant differences between the groups [43]. ER groups in the studies by Itoi and Liavaag showed better compliance than in the IR groups, although ER braces have been repeatedly reported to be more cumbersome than IR slings [40,43]. It is possible that the authors could have put greater emphasis on the importance of unbroken immobilization when explaining it to the ER group or the patients may have had greater confidence in the new method of treatment, therefore complied better with the protocol. A recent level I study found no difference between the participants immobilized in ER compared to IR in terms of recurrent instability (true dislocation and subluxations), as well as WOSI (no statistical significance) and ASES (borderline significance of unknown clinical importance) scores [44]. There was also no difference in the number of patients requiring surgery (6 in the ER group and 7 in the IR group) [44]. The mean time to immobilization was 4 days and the group of patients was homogeneous [43,44].

A number of ER braces are commercially available. Sullivan et al. compared 4 types of braces in terms of the amount of ER achieved and maintained, comfort of use, ease of application, and interference with activities of daily living [45]. None of the braces initially achieved the expected amount of ER. The results were even worse when braces were applied by lay persons rather than medical personnel. The degree of ER decreased further after performing activities of daily living and fell below 10° in soft cushion braces. Rigid orthoses were more effective in maintaining ER but were rated as less comfortable and thus likely to be associated with worse compliance [45]. A recent study by Hatta et al., comparing comfort of use and patient acceptability of 4 shoulder braces (Add-IR, Add-ER, 30°Abd-30°ER, and 30°Abd-60°ER), revealed that while the 30°Abd30°ER brace was still acceptable for the patients, 60° of ER was considered uncomfortable, which made it likely to be associated with lower compliance [46]. In another study comparing immobilizing performance, comfort, and user-friendliness of 4 braces (2 ER and 2 ER-Abd braces), the braces combining ER with abduction were found to be significantly less

comfortable for the patients [47]. The obvious drawback of these studies was the use of each brace for periods of only 15 min to a maximum of 24 h, while during treatment the patients are required to use orthosis with breaks only for showering for a mean period of 3 weeks, as well as enrollment of only healthy young men into the trials [40,41,44,46,47].

Meta-Analyses

Four meta-analyses comparing the effects of immobilization in ER and IR in large groups of patients in level I–IV studies were identified [48–51]. Out of these, 2 demonstrated no significant difference between the 2 methods of immobilization (Liu and Vavken), 1 found the results of immobilization in ER were significantly better (Longo), and 1 showed a tendency towards better results in patients immobilized in ER (but without statistical significance) (Paterson). Vavken et al. found the p values to be borderline and highlighted the influence of patient age [51]. The meta-analysis with the largest number of patients (663) included in 7 studies, demonstrated no superiority of immobilization in ER regardless of age, and in 2 groups stratified by age (≤ 30 ; > 30 years) [48]. The authors also analyzed QOL scores in 4 trials (Wang, Whelan, Taskoparan, and Liavaag) and found no statistically significant differences except for ASES score in the study by Whelan, in which p value was borderline [44,48]. The comparison of meta-analyses is presented in Table 3.

Discussion

Due to its high incidence, reaching 26.69 per 100 000 population per year in a recently published study [13], and frequently involving complications, optimization of treatment of traumatic GHD with a view to preventing recurrence and improving patient performance has received much research interest. Since the idea of immobilization in external rotation first came to light, many studies have been dedicated to confirming its effectiveness and comparing it with the traditional immobilization in adduction and internal rotation [19]. Unfortunately, the conclusions of these works are often contradictory and do not allow to make clear recommendations for practice. This prompted us to conduct a thorough literature review in an attempt to organize the available reports and explain the disparity between favorable results of cadaveric as well as imaging studies and clinical reports, in which ER did not prove significantly more effective than IR.

After performing a comprehensive review of the available literature, we found that populations studied by particular authors differed in terms of age, sex, and physical activity levels, and different outcome measures were used. While the primary

Table 3. Meta-analyses comparing the effects of immobilisation in internal rotation (IR) and external rotation (ER) on large groups of patients in level I–IV studies.

	Paterson et al. [50] 2010	Longo et al. [49] 2014	Vavken et al. [51] 2014	Liu et al. [48] 2014
Studies included (No. of studies)	Itoi et al. 2003 Itoi et al. 2007 Finestone et al. 2009 (3)	Itoi et al. 2003 Itoi et al. 2007 Finestone et al. 2009 Taskoparan et al. 2010 (4)	Itoi et al. 2003 Itoi et al. 2007 Finestone et al. 2009 Taskoparan et al. 2010 Liavaag et al. 2011 (5)	Itoi et al. 2003 Itoi et al. 2007 Finestone et al. 2009 Taskoparan et al. 2010 Liavaag et al. 2011 Whelan et al. 2014 Wang et al. 2011 (7)
ER: IR	ER=IR (ER>IR)*	ER>IR	ER=IR	ER=IR
Total no. of patients in the studies (IR: ER)	289 (138: 151)	322 (155: 167)	471 (230: 241)	663 (325: 338)
Level of evidence of included studies	I–II	I–III	I–III	Not specified

* Existing tendency towards better effect after immobilisation in ER did not reach significance.

end point was consistently redislocation, secondary end points were not always present and if so, different QOL scores or return to pre-injury activity level were chosen in different studies. Not all studies were properly randomized and some had less than the recommended 2 years of follow-up. Moreover, higher compliance rates in the ER group, despite the ER orthosis being less comfortable in some studies, may indicate the presence of bias [40,44]. There was also a substantial difference between the angle of ER, in which coaptation has been proven to be most effective and the greatest angle accepted by patients (45° or 60°, according to different studies versus 10–15°) [22,37,45–47]. Several studies confirmed that increasing the degree of external rotation is associated with worse patient discomfort, even when the brace was worn only for periods as short as minutes to hours [45–47]. Furthermore, the actual amount of ER achieved and maintained by orthoses was less than anticipated, especially when they are applied by lay persons [45]. The acceptability of the treatment by the patients needs to be studied further, with the compliance rates assessed after 2 to 3 weeks of continuous use.

Immobilization in ER and varying degrees of abduction is a new concept that has been studied recently [37,46,47]. Here as well, the disproportion between optimal degree of abduction required to achieve coaptation and the degree accepted by patients was found. Long-term results of immobilization in the position of ER and abduction are not yet available.

We find the use of external rotation braces especially questionable in elderly patients. Older patients are less likely to suffer recurrence after first-time traumatic GHD. The redislocation rates in those patients vary between 0% and 31% [52–54]. It

has been detected in a cadaveric model that in patients below 30 years of age, the attachment of the labrum is the site most susceptible to damage, while in the subjects over 30 years the anterior capsule and subscapularis tendon are weaker in comparison to the capsular attachment [55]. The disparity in complication rates between young and elderly patients can be partly explained by different tissue properties. Structure of collagen fibers (the main component of the capsule, ligaments, and tendons) changes with advancing age. In young subjects, elastic collagen type III predominates, while in older patients it is replaced by tougher collagen type I. Therefore, stretching of the capsule and ligaments promoting redislocation is more likely in the young, while in older people capsular disruption or rotator cuff tear is more common [3]. Taking into consideration that subscapularis tear is a confirmed factor decreasing the effectiveness of immobilization in ER [39] and the generally lower redislocation rates in elderly patients, immobilization in external rotation is less likely to be effective in these patients. Moreover, elderly patients are initially less physically capable and wearing a large, cumbersome brace may further limit their ability to perform ADLs (activities of daily living) and be associated with increased risk of a fall. The higher price of an external rotation brace may also affect some patients.

Immobilization in external rotation can be considered an alternative to traditional conservative treatment of traumatic GHD, with its main limitations being: disparity between the optimal and patient-acceptable external rotation angles, patient compliance, inability of some braces to maintain the required amount of ER, and possible reduced effectiveness of the method in the presence of certain accompanying injuries (e.g., subscapularis tear).

Conclusions

1. The current literature does not provide convincing evidence of the superiority of immobilization in external rotation in terms of prevention of recurrence and improvement of patient quality of life.
2. Further long-term studies are recommended, with the focus on the following aspects:
 - immobilization in the position of ER combined with abduction;
 - patient compliance and tolerability of the braces in long-term use;
 - determining a patient group most likely to benefit from immobilization in ER (depending on the labroligamentous injury pattern).
3. Immobilization in ER can be considered in highly-motivated individuals, who after having been informed about possible difficulties and discomfort connected with brace use, are willing to comply.

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