

Comparison of 1- and 3-Week Immobilization Following Arthroscopic Shoulder Stabilization: Results of a Prospective Study

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ABSTRACT

Purpose: We investigated the effects of 1 week and 3 weeks of absolute immobilization duration on pain, range of motion (ROM), shoulder function, and recurrence rate on shoulder arthroscopic anterior capsulolabral repair (AACR) patients. **Method:** Fifty shoulder AACR patients' pain intensity, shoulder ROM, and function were evaluated 4, 8, and 12 weeks after surgery (1-week group: 26; 3-week group: 24 patients). Function was assessed with American Shoulder and Elbow Surgeons (ASES) score at post-operative 12 weeks and final follow-up (average of post-operative 30 months). Whether there was a re-dislocation after surgery was also questioned at final follow-up. **Results:** Similar ROM were observed on both groups at the post-operative 4, 8, and 12 weeks ($p > 0.05$). Pain intensities at rest ($p = 0.40$), night ($p = 0.22$), and during the activity ($p = 0.49$) were also similar on both groups. Also, no difference was observed for function between the two groups ($p = 0.99$). Only one re-dislocation was in the 3-week immobilization group. **Conclusions:** Both 1 week and 3 weeks of absolute immobilization demonstrated similar results in terms of shoulder ROM, pain, function, and recurrence rate after the shoulder AACR. Furthermore, earlier mobilization led to higher shoulder flexion at 4 weeks postoperatively. Either of the rehabilitation approaches can be adopted based on the patient's situation.

Key Words: Bankart lesions; immobilization; rehabilitation; shoulder; shoulder injuries.

RÉSUMÉ

Objectif : exploration des effets d'une immobilisation absolue de une ou trois semaines sur la durée de la douleur, l'amplitude de mouvements (AdM), la fonction de l'épaule et le taux de récurrence chez les patients ayant subi une réinsertion capsulolabrale antérieure par arthroscopie (RCAA) de l'épaule. **Méthodologie :** les chercheurs ont évalué l'intensité de la douleur, l'AdM de l'épaule et la fonction de 50 patients ayant subi une RCAA de l'épaule quatre, huit et 12 semaines après l'opération (groupe immobilisé une semaine : 26 patients; groupe immobilisé trois semaines : 24 patients). Ils ont évalué la fonction à l'aide du score de l'*American Shoulder and Elbow Surgeons* (ASES) 12 semaines après l'opération, puis au dernier suivi (en moyenne 30 semaines après l'opération). Lors du dernier suivi, ils ont également demandé aux patients s'ils avaient subi une nouvelle luxation après l'opération. **Résultats :** les chercheurs ont observé une AdM semblable dans les deux groupes quatre, huit et 12 semaines après l'opération ($p > 0,05$). L'intensité de la douleur au repos ($p = 0,40$), la nuit ($p = 0,22$) et pendant l'activité ($p = 0,49$) était également semblable dans les deux groupes. Les chercheurs n'ont observé aucune différence de fonction entre les deux groupes ($p = 0,99$). Une seule nouvelle luxation a été observée, et ce, dans le groupe immobilisé pendant trois semaines. **Conclusions :** l'immobilisation absolue pendant une ou trois semaines donnait des résultats semblables sur le plan de l'AdM, de la douleur, de la fonction et du taux de récurrence après une RCAA de l'épaule. De plus, une immobilisation plus rapide assurait une meilleure flexion de l'épaule quatre semaines après l'opération. Il est possible d'adopter les deux démarches de réadaptation en fonction de la situation du patient.

Mots-clés : blessures à l'épaule; épaule; immobilisation; lésion de Bankart; réadaptation.

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Surgical interventions are recommended in the treatment of traumatic anterior shoulder dislocations. They provide successful results in terms of motion, neuromuscular control, and return to daily life and sport. An appropriate post-operative rehabilitation programme is one of the most important factors increasing the success of the surgery.^{1,2} However, there are differences between the studies regarding the post-operative rehabilitation programme. Especially, the absolute immobilization duration and starting time of the post-operative rehabilitation are discussed issues.^{1,3,4}

Several studies have provided post-operative rehabilitation programmes on patients with shoulder arthroscopic anterior capsulolabral repair (AACR).^{1,3,5-12} Some suggest an absolute immobilization for 3 weeks,^{1,5,12} while some suggest a controlled-rehabilitation programme beginning from the post-operative day 2.^{3,10,11} American Society Shoulder and Elbow Therapists (ASSET) guideline¹ proposes an absolute immobilization for up to 4 weeks after the AACR surgery. Damkjaer and colleagues⁷ compared the standard protocol, which allowed passive shoulder range of motion (ROM) based on patients' toleration, with the ASSET guideline and found no difference in terms of shoulder function between the two protocols. Likely, Kim and colleagues¹³ started ROM and strengthening exercises on the first post-operative day and stated that there was no recurrence rate difference between the two groups after 31-weeks of follow-up. Moreover, they also reported earlier returning to daily activities in the accelerated protocol.

Both 1 week^{14,15} and 3 weeks^{1,6,12} of absolute immobilization periods are practised in the clinics. However, there is little information on whether there are differences between the effects of the two approaches. Therefore, we aimed to investigate the effects of 1 week and 3 weeks of absolute immobilization on the shoulder ROM, function, and recurrence rate. We hypothesized that there would be no differences between the 1 week and 3 weeks of absolute immobilization in terms of ROM, shoulder function, and recurrence rate.

METHODS

This was a prospective, single-blind, comparative study. Patients were selected among those who had undergone shoulder AACR and consulted at our physical therapy clinic between December 2016 and March 2021. The same surgical procedure was performed by three different surgeons who has at least 15 years of experience on shoulder surgeries. The inclusion criteria were; being at the age of 18-45 years, being either a professional or recreational athlete, having no injury on the non-operated side, and taking the post-operative rehabilitation programme at our clinic. Patients with previous surgery, glenoid rim defect higher than 20%, any systemic problems and patients who were operated by any other surgeon were

excluded from the study. After the assessments, 50 patients with AACR were included in the study. Patients were assigned to either 1 week ($n = 26$) or 3 weeks ($n = 24$) of absolute immobilization group due to on the surgeon's decision which was based on their own clinical experience.

The study was approved by the Ethical Committee of the Hacettepe University. All patients signed an informed consent form after surgery. Patients were reassured that the quality of care would not be compromised if they would not consent. They were informed that the post-operative rehabilitation programme would be identical not only in terms of the number of sessions but also in terms of content.

Surgical procedures were conducted in the beach chair position and under general anesthesia. An anteroinferior portal was opened for the imaging of the joint. Subsequently, posterior and anterosuperior portals were opened. The labral repair was performed with two suture anchors (Osteoraptor 2.9 mm, Smith & Nephew, Memphis, TN) using two strings loaded close to the adhesion point of the glenoid anteroinferior of the inferior glenohumeral ligament. One patient had an off-track Hill-Sachs lesion (in the 3-week group) and six patients (3 patients in the 1-week group; 3 patients in 3-week group) had type-5 superior labrum anterior-posterior (SLAP) lesion. A remplissage procedure was performed on one patient who had off-track Hill-Sachs lesion. The SLAP lesion was repaired with one anchor in five patients (2 patients in the 1-week and 3 patients in 3-week groups) and debrided in one patient (in the 1-week group).

Absolute immobilization was performed in both groups until the beginning of the supervised rehabilitation. Similar rehabilitation programmes were applied in both groups except for the immobilization time. All patients used a sling for 4 weeks after the surgery. Passive ROM exercises were started following absolute immobilization, based on patient's toleration according to the ASSET guideline, without any extra restriction about passive ROM ranges. Active assistive exercises were started at the post-operative 3rd week, and active ROM exercises were initiated at week 4. Scapular retraction exercises were started at post-operative 3rd week and rotator cuff strengthening exercises were initiated at the 6th week starting from 0° shoulder abduction and with minimum resistance. Full shoulder ROM was achieved at the end of the post-operative 12th week. Minimal to zero pain was aimed during the early rehabilitation period and aggressive stretching was avoided. Plyometric exercises were initiated after the post-operative 12th week. The rehabilitation programme gradually increased to sport-specific exercises.

All patients visited our clinic once a week until the post-operative 12th week. Clinical assessments were performed, and the progression of the rehabilitation pro-

Table 1 Exercise Protocol for Groups

Exercise protocol	1-wk immobilization	3-wk immobilization	Frequency
Standing passive flexion-scapion near the table	1st wk	3rd wk	10 reps × 4 times/d
Passive external rotation with stick	1st wk	3rd wk	10 reps × 4 times/d
Scapular retraction exercises with TB	3rd wk	5th wk	10 reps × 4 times/d
AAROM exercises with stick during flexion-abduction-scapion	3rd wk	5th wk	10 reps × 4 times/d
AROM exercises during flexion-abduction-scapion	4th wk	6th wk	10 reps × 4 times/d
IR with TB at 0° abduction	5th wk	7th wk	10 reps × 4 times/d
ER with TB at 0° abduction	6th wk	8th wk	10 reps × 4 times/d
Elevation in sagittal-frontal-scapular plane with TB during	6th wk	8th wk	10 reps × 4 times/d
Progressive scapula stabilization exercises (wall slide, etc.)	8th wk	10th wk	10 reps × 4 times/d
Progressive plyometric, proprioceptive, and stability exercises	12th wk	14th wk	10 reps × 4 times/d

AAROM = active assistive range of motion; ER = external rotation; IR = internal rotation; TB = theraband.

gramme was determined at weekly visits. The patients received also a specific home exercise programme during the rehabilitation period. The rehabilitation programme is presented in [Table 1](#).

The primary outcome for this study was ROM, while shoulder pain, function and recurrence rate were secondary outcomes. Demographics of the patients (gender, age, height, body weight, and the number of dislocations) were recorded prior to the study. Shoulder pain and ROM were assessed at the post-operative 4th, 8th, and 12th week, while shoulder function was assessed at the post-operative 12th week and the final follow-up (average of post-operative 30 months, ranging between 8 and 47 months). Whether there was a recurrence of the injury (re-dislocation or subluxation) was also questioned at the final follow-up. The recurrence of the dislocation was determined based on radiographic assessment, and subluxation was based on patient's sense of re-dislocation with a positive anterior apprehension.¹⁶

Visual Analogue Scale (VAS) was used to evaluate the shoulder pain at the post-operative 4th, 8th, and 12th week. Patients were asked to mark the "pain they feel" on a 10 cm chart where 0 indicated no pain and 10 indicated worst pain. Pain at rest, during night, and during activity were measured separately.^{6,9}

Shoulder ROM was assessed at the post-operative 4th, 8th, and 12th week using a universal goniometer in supine position. Shoulder internal and external rotation were measured at 90° of shoulder abduction.¹⁷ The physiotherapist who conducted the post-operative ROM measurements was blinded to allocation groups as an effort to minimize the potential bias for measurements.

American Shoulder and Elbow Surgeons (ASES) score (ICC = 0.94) was used to evaluate the functional activity level of the shoulder at the post-operative 3rd month and final follow up (30th month).¹⁸ The ASES score is a highly valid and reliable tool to evaluate shoulder function of patients following AACR, with an establish minimal clinically important difference of 8.5.¹⁹ Total ASES score ranges from 0 to 100 in which higher score indicates lower disability.²⁰

Primarily, we conducted a pilot study to calculate the potential sample size of the study with 10 patients (5 patients in each group). It was calculated based on the changes in the shoulder elevation from post-operative 4th to 12th weeks. In the pilot study, the 1-week immobilization group demonstrated 166.1 (SD 18.4) and the 3-week immobilization group demonstrated 177.7 (SD 14.2) shoulder elevation degrees at the post-operative 3 months. Based on these data, to observe a significant difference in shoulder elevation between the groups with a 0.80 power and alpha level of 0.05 error margin, 44 patients were required. Considering the potential drop-out rate, we included 50 patients to the study.

All statistical analyses were performed using IBM SPSS (version 21.0. Armonk, NY: IBM Corp). Descriptive analyses were presented using means and standard deviations. The *t*-test was used for comparison of patients' demographics. A 3 × 2 repeated measures analyses of variance (ANOVA) with one within-subject factor (time; post-operative 4th, 8th, and 12th week) and one between-subject factor (treatment groups; 1- and 3-week immobilization groups) were performed to investigate potential group and time interactions for pain, and ROM measurements. The shoulder function was analyzed using 2 × 2 repeated measures ANOVA design where the time (3rd and 30th months) was determined as with-in subject factor and group (1- and 3-week immobilization) determined as between-subject factor. Greenhouse–Geisser correction was used when the sphericity was not assumed. When a significant interaction was observed pairwise comparisons were performed. The significance level was set at $p = 0.05$ for all measurements.

RESULTS

Three patients in the 1-week immobilization group and three patients in the 3-week immobilization group did not complete the study. In addition, two of our patients did not comply the measurements and their data removed as well. In the end, outcome measurements were conducted in a total of 42 patients ([Figure 1](#)). The demographic characteristics of the patients were summarized in [Table 2](#).

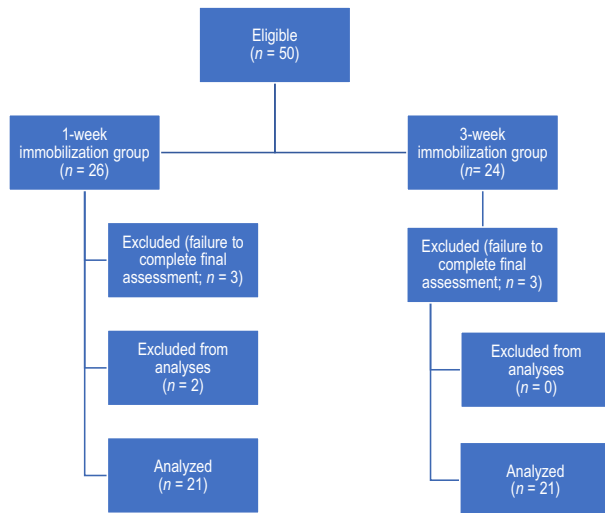


Figure 1 Patient flow diagram.

There were no significant differences in gender, age, or body mass index and the number of dislocations between the 1- and 3-week immobilization groups ($p > 0.05$). The dominant shoulder was involved in nine patients (39.1%) in the 1-week group and 10 patients (47.6%) in the 3-week group.

There was no group difference for pain at rest ($F_{2,80} = 0.93$, $p = 0.40$), night ($F_{2,80} = 1.52$, $p = 0.22$), and activity ($F_{2,80} = 0.71$, $p = 0.49$). In contrast, the main effect of time was significant for the pain at rest, night, and during activity ($p < 0.05$). The pain level significantly decreased in both groups throughout the rehabilitation period. There was a significant between-group difference for shoulder flexion ($F_{2,80} = 4.27$, $p = 0.02$). Post-hoc analyses revealed higher shoulder flexion in the 1-week group compared to the 3-week group at the 4th week after surgery ($p = 0.02$). Yet, it was similar in both groups at the post-operative 8th and 12th week ($p > 0.05$). No significant group difference was observed for shoulder abduction ($F_{2,80} = 1.72$, $p = 0.19$), external rotation ($F_{2,80} = 0.001$, $p = 0.99$), and internal rotation ($F_{2,80} = 0.13$, $p = 0.88$). The main effect of time was significant for the shoulder flexion, abduction, internal, and external rotations ($p < 0.001$). Shoulder ROM measurements gradually increased in both groups during the rehabilitation period. Pain levels and ROM measurements were presented in Figures 2 and 3.

Functional scores and recurrence numbers are shown in Table 3 for each group. Changes in the shoulder function was similar between the groups ($F_{1,40} = 0.001$, $p = 0.98$), yet the main effect of time was significant ($F_{1,40} = 30.04$, $p < 0.001$). The shoulder function significantly increased in both groups during the follow-up (from post-operative 3rd to a 30th months). Only one patient had re-dislocation in the 3-week group due to an epileptic seizure. There was no recurrence in the 1-week immobilization group.

DISCUSSION

With the exception of shoulder flexion, the results of the current study supported our hypothesis in that there were no differences in the shoulder ROM, pain, and function between 1 week and 3 weeks of absolute immobilization on patients with shoulder AACR. Only earlier mobilization led to higher shoulder flexion at 4 weeks postoperatively. Either of the absolute immobilization periods can be adopted after the surgery. No recurrence was observed in the 1-week immobilization group whereas one patient had a recurrence in the 3-week immobilization group due to an epileptic seizure. The similar results of the groups in terms of gender, age, or body mass index and number of dislocations between the 1- and 3-week immobilization groups provided a homogeneous group.

The optimal time to initiate rehabilitation after AACR is one of the issues discussed in the literature.^{1,7,13} The ASSET guideline recommends up to 4 weeks of absolute immobilization to avoid the potential negative effects of early mobilization on the repaired tissue.¹ Damkajer and colleagues⁷ compared the ASSET guideline with the standard procedures, which allow passive shoulder motions within the pain-free range, and found no difference between the two procedures in terms of shoulder function and quality of life. Likewise, Kim and colleagues¹³ started passive shoulder motion on the post-operative 3rd day in their accelerated protocol. Similarly, they reported no negative effects of early initiation of the rehabilitation programme on shoulder function. We also observed no differences in the functional activity levels at the post-operative 12th week and the 30 months between the two groups. Although the 3-week immobilization group initiates the exercise programme with 2 weeks of delay, it had

Table 2 Demographic Characteristics of the Participants

Characteristic	1-wk immobilization (n = 21)	3-wk immobilization (n = 21)	p-value
Gender, no.	21 male, 2 female	19 male, 2 female	1.00
Age, mean (SD)	23.6 (5.3)	22.1 (6.7)	0.42
Body mass index, kg/m ² , mean (SD)	22.7 (2.8)	21.3 (2.9)	0.11
No. of dislocations until the surgery, mean (SD)	7.0 (7.9)	4.5 (4.0)	0.30
Concomitant surgery	2 SLAP repairs, 1 biceps debridement	3 SLAP repairs	–

SLAP = superior labrum anterior posterior.

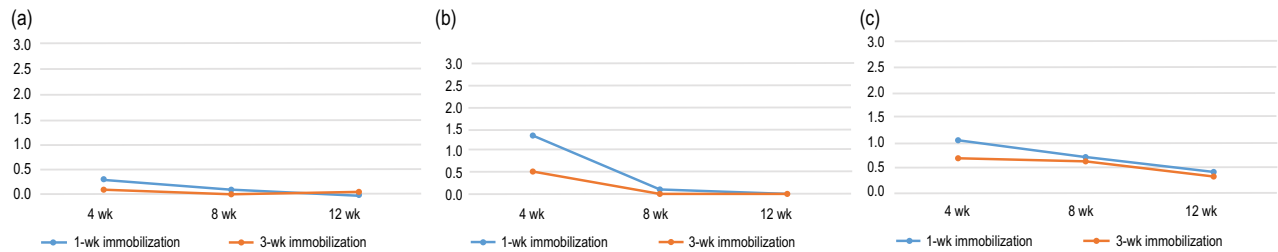


Figure 2 Pain levels of the groups through the rehabilitation period in mean (SD): (a) pain at rest, (b) pain at night, and (c) pain at activity.

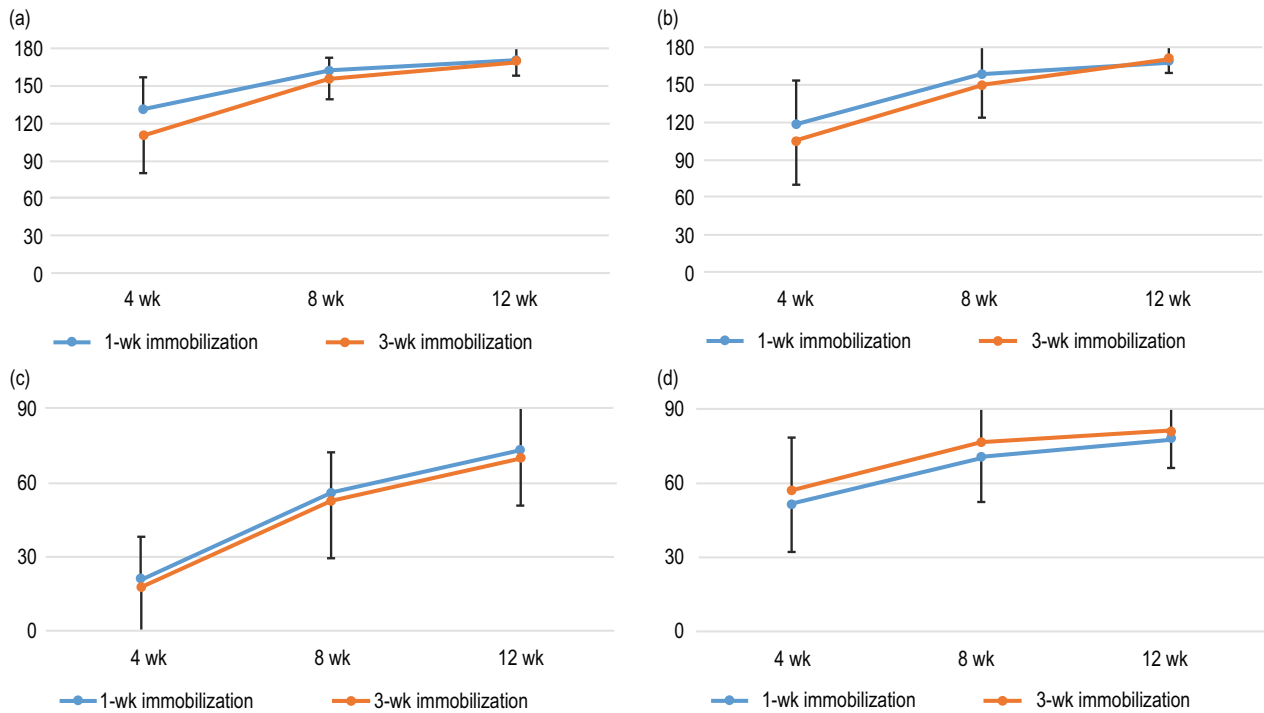


Figure 3 Shoulder range of motions of the groups through the rehabilitation period in mean (SD): (a) flexion, (b) abduction, (c) external rotation, and (d) internal rotation.

no negative effects on the shoulder function during daily activities.

Absolute immobilization is important for the proper healing of the repaired tissue.²¹ Early shoulder movement is thought to induce an abnormal loading on the joint capsule and negatively affect the healing tissue.¹ However, recent studies have indicated that a shorter absolute immobilization period which is followed by controlled

mobilization, will both stimulate the tissue healing and accelerate the recovery of the shoulder function.^{3,7} Therefore, some rehabilitation protocols allow passive motion on the post-operative second day.^{3,10,11} However, histological studies indicate that phagocytic activity initially takes place in the surgical area. Afterwards, a skeleton-like structure called fibrin clot is constituted for the angiogenesis and fibroblastic activity.²² During this pe-

Table 3 Functional Scores and Recurrence Numbers

Type	Mean (SD)		p-value
	1-wk immobilization (n = 21)	3-wk immobilization (n = 21)	
ASES score at 12th wk	87.6 (10.7)	86.2 (13.8)	0.79
ASES score at average 30 mo follow-up	95.1 (6.0)	94.0 (7.5)	0.62
Recurrence	0	1	–

ASES = American shoulder and elbow surgeons shoulder score.

riod the shoulder joint and the newly constituted tissues are highly susceptible to the injury resulting from the abnormal movements. This process usually takes 7–10 days.²² Therefore, we preferred to start the passive ROM exercise in the post-operative first week. Moreover, based on our clinical experience, shoulder pain is greater within the first week after surgery causing discomfort to the patients. It also prevents performing the exercise effectively due to the muscle spasm caused by excessive pain. Therefore, it might be better to immobilize the joint until the angiogenesis occurs.

The recurrence of shoulder instability is another indicator of the failure of treatment.¹² Only one patient had a re-dislocation in the 3-week immobilization group due to an epileptic seizure. Our results indicated that controlled-passive motion in the early periods after the surgery had no negative effects on joint stability. Previous studies also reported similar outcomes in that early initiation of the post-operative rehabilitation does not increase the risk of re-dislocation.^{3,8,13}

The current study revealed that the shoulder flexion was greater in the 4th week in the 1-week group compared to the 3-week immobilization group. Early initiation of the rehabilitation programme after the surgery might have positive effects on the shoulder flexion. However, this difference was only observed in the post-operative 4th week. Full shoulder ROM was achieved at the post-operative 12th week in both groups as recommended in the literature.^{1,8,10,21,23}

The current study also revealed that the duration of the absolute immobilization period had no effect on pain intensity after the AACR. The pain intensity was below 1.5 points in both groups at the post-operative 4 week. Compared to the previous studies, our patients displayed favorable pain intensity in early periods after the surgery. Kim and colleagues¹³ reported a pain score of 4.4 points in the standard rehabilitation group while 2.1 points in the accelerated rehabilitation group at the post-operative 6th week in patients with AACR. The 20 years between the studies might be the reason for lower pain levels in the current study. The innovations in arthroscopic surgery and differences in the rehabilitation approaches might provide decreased pain intensity after the surgery.

Home-based rehabilitation programmes became popular in recent years due to their cost-effectiveness. The current study also revealed effective results of a home-based rehabilitation programme in terms of shoulder function in patients with AACR. Similarly, Ismail and Shorgaby²⁴ showed no difference in the shoulder ROM and function between the patients followed by home-based exercise and supervised physiotherapy programme. A controlled home exercise programme is thought to be an effective method to improve shoulder function which is also a cost-effective approach. However,

patients must be compatible with the exercise programme to have positive outcomes.

The current study has some limitations. First, only verbal feedback was received from the patients in the last follow-up without using clinical tests. Second, since routine clinical practices of the surgeons determined the grouping, randomization could not be performed. Third, all of our patients returned to sport at different levels. Therefore, we could not present the return to sport participation rate in the groups.

CONCLUSION

This study provides the clinical results of 1- or 3-week absolute immobilization periods which are frequently used in clinical practice after the shoulder AACR. The duration of absolute immobilization did not affect the pain intensity, shoulder ROM, functional activity level, and recurrence rate. Therefore, both rehabilitation regimes can be adopted based on surgery and the patient's condition.

KEY MESSAGES

What is already known on this topic

The literature investigating absolute immobilization duration after arthroscopic anterior capsulolabral repair, but there is still no consensus.

What this study adds

This study revealed that 1-week and 3-week absolute immobilization periods after arthroscopic anterior shoulder stabilization surgery showed similar functional results.

According to our results, both rehabilitation approaches can be adapted based on the patient's situation. These results provide a clear knowledge about one of the discussed issues in the literature.

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