

**Case Report**

# The Effects of Exercise Rehabilitation on Shoulder Range of Motion, ASES Score and VAS After Rotator Cuff Repair

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**Abstract:** The purpose of the present study was to report the effect of exercise rehabilitation after rotator cuff repair. This case is a woman (54 years of age) who had been operated on for rotator cuff repair in 2017 and passed six weeks after surgery. Her job is a shop assistant in market. It showed that the ROM of shoulder flexion was deficit 70° from the non-involved side, abduction deficit 135°, internal rotation deficit 60°, external rotation deficit 80° at six weeks after surgery. She had rehabilitation exercise over eight weeks in a specific rehabilitation center. The ROM of shoulder was rapidly improved after two weeks a rehabilitation exercise. And after four weeks a rehabilitation, The ROM of shoulder and Shoulder instability score (ASES) were restored to nearly normal and VAS was well controlled. Shoulder ROM and ASES and VAS remained normal during the eight week rehabilitation exercise after rotator cuff repair. It was very effective to have rehabilitation exercise three times a week after rotator cuff repair. The shoulder range of motion (flexion, abduction, internal rotation and external rotation), ASES and VAS were consistently improved and restored to normal during the eight week rehabilitation after rotator cuff repair.

**Keywords:** Rotator Cuff, Shoulder Repair, Exercise Rehabilitation, ROM, ASES

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## 1. Introduction

Rotator cuff tear is caused by collision syndrome under the acromion. The etiology of rotator cuff disease is likely multifactorial, including age-related degeneration and microtrauma. Smoking, hypercholesterolemia, and genetics have all been shown to influence the development of rotator cuff tearing [1]. However these observations apply primarily to athlete using shoulder. The main cause of rotator cuff injuries were reported to be the overuse syndrome, slack of glenohumeral joint, the construction of soft tissue, and dyskinetic movement in scapular [2]. After the injury of the rotator cuff, Most of doctors are worried about whether to perform surgical or non-surgical treatment. Various treatments are applied for non-surgical treatment [3, 4]. Although non-surgical therapy is mainly used with shock

wave therapy, medication and physical therapy. But surgical treatment is often used because it is difficult to expect a functional improvement eventually [5, 6]. The main goals of rehabilitation exercise after rotator cuff repair are return to daily activities, control of pain and inflammation, healing of tendons, movement of subacromial structures and flexibility of the complex including joint ligaments [7]. However, most of the patients who had repaired rotator cuff come to the exercise rehabilitation center over six weeks after the surgery. The reason for starting exercise rehabilitation at six week after surgery is for maximum protection of the surgical site. Therefore, many doctors encourage patients to exercise themselves or exercise under the supervision of a physician. However, it is recommended to refrain from routine activities after arthroscopic rotator cuff repair. Because there is no case report of postoperative rehabilitation exercise by exercise

specialist, most patients and medical doctors are afraid of evoking any side effects during exercise for fear of inflammation on the surgical site.

The purpose of this study was to present a rehabilitation exercise program through a case report on rehabilitation exercise in patients with rotator cuff repair, and to investigate the shoulder range of motion, ASES and VAS.

## 2. CASE Presentation

### 2.1. CASE History

She is a 54 year old female. On March 10th, 2017, she underwent arthroscopic rotator cuff 2cm repair of the right shoulder, SLAP type II marginal resection and cartilage repair, and decompression of the protruded bone under the acromion. She visited our sports rehabilitation center at six weeks post-operation. The mechanism of injury was considered to be due to the repeated work of displaying and transporting merchandise at a large market. On May 12th, at the time of admission, she reported that she could not sleep because of the pain, she was unable to rest due to limitations

in her range of motion. In recent years, lateral epicondyle of humerus have also been associated with pain. She had been treated manual therapy from a physical therapist 15 times in total until six weeks post-operation, and her pain decreased a lot. But she still complained that she could not sleep because of the pain. Brace fixation was performed at three weeks after the operation. From the forth week, the home exercise program, which could be done by herself, was prescribed, but it was rarely performed due to pain and difficulty in exercise. Finally, she visited a specialized sports rehabilitation center at the sixth postoperative week. And she performed specialized rehabilitation exercises for eight weeks, three days a week. In pre-rehabilitation exercise, there was a limited range of motion of the shoulder joint. The range of motion was limited to 110° in shoulder flexion, 45° in shoulder abduction, 30° in internal rotation, 10° in external rotation at 0° AbTP posture. There was no backward movement posture within the limitations of her range of motion. She complained of pain at night so she wasn't able to have a good night's sleep. The specific characteristics of the study subjects are presented in Table 1.

*Table 1. Characteristic of subject.*

Age (yrs)	Sex	ht (cm)	wt (kg)	Job	injury type	Exercise day	brace period	Physical therapy
54	Female	158	62	shop assistant	work	24 times/8 weeks	4weeks	6 weeks post op.

### 2.2. Shoulder Range of Motion Test

The active range of motion was measured using a goniometer Model 7514 (Sammons prestonrolyan, Inc, USA). The subject was allowed to stand, and then the upper arm was flexed as much as possible with the elbows held in position. The axis was aligned with the center of the lateral side of the concave sagittal joint, the fixed arm was aligned with the direction of gravity, the working arm was aligned with the upper arm, and the angle was read. The angle of shoulder abduction was maximally extended to the lateral side of the torso, and then the center of the posterior glenohumeral joint was aligned with the axis of the goniometer at the back of the subject and the fixed arm was perpendicular to the ground. The first and second measurements were made with the arm attached to the body in internal and external rotation angles. But from the second week of rehabilitation exercise, the range of motion of internal and external rotations were performed at 90° abduction test position (AbTP). In other words, the axis of the goniometer was placed in the center of the elbow head (olecranon process), the fixed arm was level with the ground, and the working arm was placed in the ulna. At this time, the upper arm was passively moved to measure the maximum internal and external rotation range of motion. Measurements were performed two times by a specialist after static and dynamic stretching of the shoulder joint lightly for two minutes and better values were selected.

### 2.3. ASES Questionnaire

Instability score of shoulder was used by the ASES Shoulder Assessment Questionnaire, that was recorded through self assessments during daily activities. Questionnaire items can be done through dressing, sleeping on the surgery site, taking a shower performance, using the toilet, brushing hair, reaching high places, raising 10 pounds overhead, throwing balls, doing daily work and the daily sports activities. If unable to perform, it is scored as a zero point, very difficult one point, slightly difficult two points, not difficult three points, and 30 points is perfect score. Using the questionnaire, the total score was recorded every two weeks of rehabilitation exercise.

### 2.4. Visual Analog Score

Pain scores were calculated using the VAS index. Of the random numbers from zero to ten, zero means no pain and ten means deathly severe pain to die. At this time, the score of the usual pain was recorded by subject

### 2.5. Rehabilitation Exercise Program

Table 2 shows the results of the rehabilitation exercise program consisting of stretching, strength training, and manual therapy to restore the range of motion. The first step of the rehabilitation program is manual technique for relaxation of the muscles around the scapular, myofascial release of injured site through the JooKuk®, Isometric and isotonic strengthening exercise within 0 to 45° of shoulder

abduction. In the second stage, the goal was to set normal range of motion flexion and abduction, and internal/external rotation. The program was involved in manual technique, JooKuk technique, PNF stretching, dynamic strengthen exercise and proprioceptive exercise. During the sports

rehabilitation program, it was recommended to reduce the calorie intake with a 30 minute walking exercise to prevent weight gain. VAS was within 3 during rehabilitation exercise program. Total exercise time was 60min.

*Table 2. Rehabilitation exercise program.*

Periods	Type	Exercise Types	Exercise Methods	VAS
Phase 1 (0~4weeks)	Warm-up ROM PNF Strengthening	Bicycle		
		Manual Technique		
		Jookuk Technique	50rpm. 50watt, 5min	
		AbTP 0~45° Shoulder Flex/Ext, Abd/Add	Myofacial release: 30min (sacrum~humerus)	0
		Isometric and theraband exercise	5min, site: surgery, GH joint, stiffness muscle	3
		-Shoulder IR/ER at 0° AbTP	As possible as strong with talk to stimulus and response, 3~6sec hold and relax	3
		-Triceps curl	3~6sec hold, 3times	3
		-Rawing 0° AbTP		
		-Protraction/Retraction	Theraband (green) 8reps, 2times	
		-Horizontal Abd/Add		
Phase 1 (5~8weeks)	Warm-up ROM PNF Strengthening Proprioception	Bicycle		
		Manual Technique		
		Jookuk Technique		
		AbTP 90° Shoulder Flex/Ext, Abd/Add, IR/ER, D1/D2	50rpm. 50watt, 10min	
		Dynamic exercise	Myofacial release: 30min (sacrum~humerus)	0
		-Shoulder IR/ER at 90° AbTP	5min: surgery, GH joint, stiffness muscle	3
		-Triceps curl	3~6sec hold, 3times	3
		-Rawing 90° AbTP	8reps, 2~3times, somewhat hard	3
		-Protraction/Retraction	Flexion/abduction, one/both hand	2
		-Horizontal Abd/Add		
-Lateral/Frontal raise	Hold as possible as long time per one trial			
-Modified push-up				
Bodyblade				
Modified push-up on balance board				

### 3. Results

In the case of the shoulder, the shoulder flexion range of motion was 110° before the rehabilitation exercise and was at a 70° deficit from the contralateral side. After two weeks of rehabilitation exercise, it increased to 160°, 20° from the contralateral side and recovered to 180° after four weeks of rehabilitation. The shoulder abduction range of motion was 45° before the rehabilitation exercise, 135° deficit from the contralateral side, but it increased to 160° after two weeks of rehabilitation. After four weeks of rehabilitation, he recovered to 180°. The internal rotation range of motion was 30° before rehabilitation, 60° deficit from the contralateral side, and 50° after two weeks of rehabilitation, 80° after four

weeks of rehabilitation, and 85° after six weeks of rehabilitation. The range of motion of shoulder external rotation was 10° after rotator cuff surgery before rehabilitation, 80° deficit from the contralateral side, 60° after two weeks of rehabilitation, 85° after four weeks of rehabilitation and 90° after six weeks of rehabilitation. In the case of shoulder instability evaluation index, there was one point before rehabilitation of six week. There was 12 points after rehabilitation of two weeks, 24 points after rehabilitation four weeks, 25 points after rehabilitation of six weeks, and after eight weeks of rehabilitation, 28 points out of 30 points was reported. Pain scores were seven points before rehabilitation, five points after two weeks of rehabilitation, three points after four weeks, one point after six weeks, and zero after eight weeks (Table 3).

*Table 3. Changes in test results between the two sides by times.*

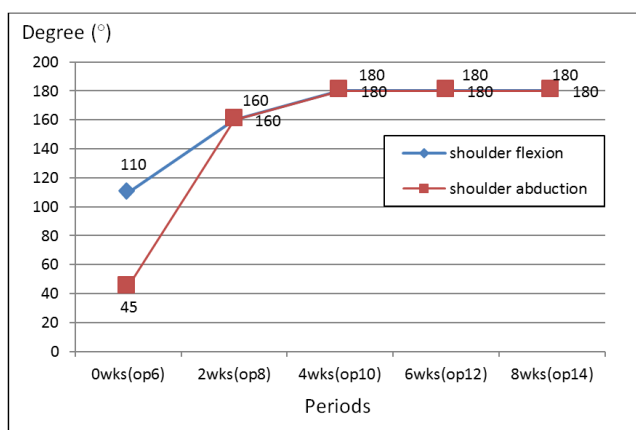
Times	Shoulder Flexion (°)			Shoulder Abduction (°)			Internal Rotation (°)			External Rotation (°)			ASES (point)	VAS (point)
	inv.	un-inv.	diff.	inv.	un-inv.	diff.	inv.	un-inv.	diff.	inv.	un-inv.	diff.		
0week	110	180	70	45	180	135	30	90	60	10	90	80	0	7
2week	160	180	20	160	180	20	50	90	40	60	90	30	12	5
4week	180	180	0	180	180	0	80	90	10	85	90	5	24	3
6week	180	180	0	180	180	0	85	90	5	90	90	0	25	1
8week	180	180	0	180	180	0	85	90	5	90	90	0	28	0

### 4. Discussion

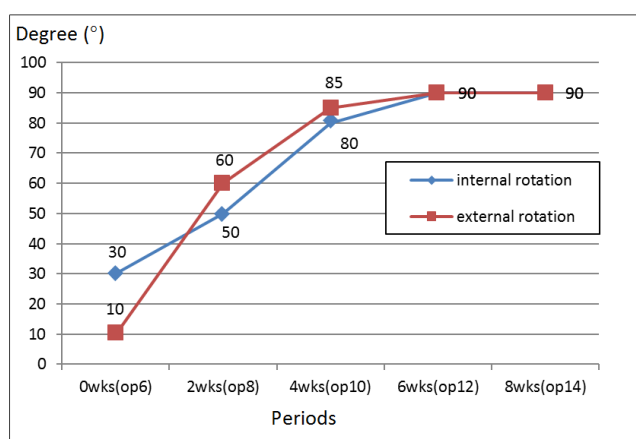
The initial exercise program after the repair of the rotator cuff allows unrestricted passive shoulder range of motion

within six to seven weeks after surgery, strengthening exercises were most commonly prescribed between six weeks to three months and unrestricted return to activities was commonly allowed at five to six months [8]. In the previous study [9], Early ROM exercise accelerated recovery from

postoperative stiffness for patients after arthroscopic rotator cuff repair but was likely to result in improper tendon healing in shoulders with large sized tears. Houck et al. was reported that early motion improves ROM after rotator cuff repair but increases the risk of rotator cuff retear [10]. This case study started CPM exercise and manual therapy at three exercise at six weeks after rotator cuff surgery. This case study was focused on variables with periods through rehabilitation exercise. CPM exercise five times per week evoked severe decrease of shoulder range of motion. Especially, shoulder abduction was just  $45^\circ$  and external rotation was  $10^\circ$ , internal rotation was  $30^\circ$ . And shoulder instability point was at one point (total 30 point). Immobilization for two weeks after rotator cuff surgery was to decrease shoulder range of motion and instability point, and to deteriorate pain scores. CPM and manual therapy starts at third week after surgery was not effective for patients of rotator cuff repair. However, the integrated exercise program at six weeks after surgery was so effective in shoulder range of motion, instability, and pain scale. The shoulder flexion and abduction range of motion returned to  $160^\circ$  after two weeks of rehabilitation and  $180^\circ$  from forth week of rehabilitation (Figure 1, Figure 2). This shows the range of motion of shoulder flexion recovered faster than that of the shoulder abduction. The reasoning is that flexion range of motion is smaller in intervening rotator cuff than abduction.



**Figure 1.** Change of shoulder ROM of flexion and abduction.



**Figure 2.** Change of shoulder ROM of IR and ER.

After four weeks of rehabilitation, the range of motion of shoulder internal rotation was approached to almost  $80^\circ$ . However, in the case of the external rotation, it was improved to  $85^\circ$  from the forth week after rehabilitation (Figure 3). In other words, in the rotation of the shoulder joint, the recovery speed of the internal rotation angle was slower than that of the external rotation angle, because the rotator cuff injury was caused by the collision of the acromion and the rotator cuffs when the shoulder joint was turned inward, it seems that recovery of the inherent sensory receptors for the inward swinging motion takes longer.

Raschhofer et al. reported that early isometric exercise group was more effective in improving shoulder function and reducing pain after manual rotation and early isometric exercise group after rotator cuff repair [11]. Nikolaidou et al. noted that early manual passive range of motion is helpful after repair, but muscle movement can damage on the surgical site [5]. Houck Da et al. found that the group that allowed early movement and the group that allowed early movement to move earlier showed better range of motion and shorter time to return than those who did not [10]. However, it is reported that close cooperation with the surgeon is important in rehabilitation exercise because of the high risk of re-tearing of the surgical site. Mollison et al. surveyed 70% of the surgeons preferring a sling and a shoulder slightly inwardly, cushioned on the inside of the elbow for shoulder fixation, and 35% of them recommend to secure the shoulder ROM exercise from six~seven weeks after surgery [8]. And 56% recommend muscle exercises from six weeks to three months postoperatively. The subjects of this study were sling fixed with daily living for six weeks after surgery. After six weeks of operation, muscle movements were performed with rehabilitation exercise to secure range of motion. We used a rehabilitation exercise program that included both passive and isometric exercises for muscular exercise. The range of motion of shoulder flexion and abduction were restored to normal after four weeks of rehabilitation (10 weeks after surgery). The range of motion of internal and external rotation were restored to normal after six weeks of rehabilitation (12 weeks after surgery). The pain index recovered to normal during the same period.

The shoulder instability evaluation index was one point at pre-rehabilitation (sixth week after surgery), but improved with time. That is, it was improved to 12 points at two weeks after rehabilitation (eighth week after surgery), 24 points at four weeks after rehabilitation (10th week after surgery), 25 points at six weeks after rehabilitation (12th week after surgery), and 28 points at eight weeks after rehabilitation (14th week after surgery). The pain index was seven points at the sixth week after surgery, five points after rehabilitation of two weeks, three points after rehabilitation of four weeks, one point after rehabilitation of six weeks, and zero point after rehabilitation of eight weeks. The shoulder instability evaluation index was 30 points, and it improved to 24 points after four weeks rehabilitation (10th week after surgery), and the pain score was 3/10 points. It means that after sling immobilization for six weeks after rotator cuff repair and

then rehabilitation exercise during four weeks was very effective for shoulder stability. The pain score was also decreased to three points. Mazuquin et al. suggested that early mobilization may be beneficial, particularly for small and medium tears, but more studies would be needed in case of repair with large tear [12]. In previous studies, there was no significant difference in shoulder range of motion, muscle strength, and function between early rehabilitation group and conservative rehabilitation group at 6 months after rotator cuff repair. However, the result of this case study showed that the shoulder instability index and pain index returned to normal with the shoulder range of motion at 14 weeks after surgery. Considering the quality of life of patients with rotator cuff tears, active rehabilitation at an earlier stage is considered to be effective in securing the range of motion of the shoulder, improving the instability index, and relieving pain. In other words, When It compared with other previous studies [3, 8-13]. There was a significant increase in movement and VAS and showed the nearly normal results in 14 weeks after rotator cuff repair. So, this rehabilitation exercise program is considered far more effective.

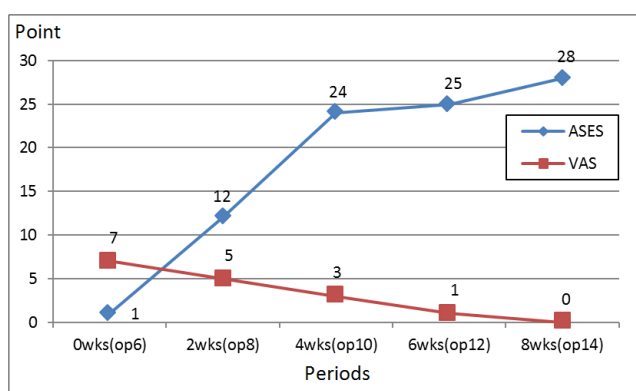


Figure 3. Change of ASES and VAS points.

## 5. Conclusion

When a patient with a rotator cuff repair starts rehabilitation after six weeks of immobilization, Two weeks of rehabilitation exercise rapidly improve the range of motion of the flexion, abduction, internal and external rotation in shoulder. Shoulder instability still existed and the pain score was high. But after rehabilitation exercise over four weeks, all the test items were almost normal. It showed that the indices approached normal data from five weeks to eight weeks. Rehabilitation exercise during the eighth week normalized shoulder ROM and stability, while the pain was eliminated.

In conclusion, it was found that if the patient had six weeks of immobilization after rotator cuff repair, it would be very effective to have a rehabilitation exercise program for at least eight weeks.

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