Abstract. [Purpose] The effect of early rehabilitation protocols after arthroscopic rotator cuff repair is currently unknown. We examined short-term effects of early rehabilitation on functional outcomes and activities of daily living after arthroscopic rotator cuff repair. [Subject and Methods] An 82-year-old male fell during a walk, resulting in a supraspinatus tear. Arthroscopic rotator cuff repair was performed using a single-row technique. He wore an abduction brace for 6 weeks after surgery. [Results] From day 1 after surgery, passive range of motion exercises, including forward flexion and internal and external rotation were performed twice per day. Starting at 6 weeks after surgery, active range of motion exercises and muscle strengthening exercises were introduced gradually. At 6 weeks after surgery, his active forward flexion was 150°, UCLA shoulder rating scale score was 34 points, and Quick Disabilities of the Arm, Shoulder, and Hand questionnaire disability/symptom score was 36 points. At 20 weeks after surgery, his active forward flexion was 120°, UCLA shoulder rating scale score was 34 points, and Quick Disabilities of the Arm, Shoulder, and Hand questionnaire disability/symptom score was 0 points. [Conclusion] These protocols are recommended to physical therapists during rehabilitation for arthroscopic rotator cuff repair to support rapid reintegration into activities of daily living.

Key words: Arthroscopic rotator cuff repair, Early rehabilitation, Daily-living activities

INTRODUCTION

Rotator cuff tear is a frequent cause of shoulder pain and can result in weakness, alterations in glenohumeral kinematics, and shoulder instability1). Surgery can be performed using either an open or arthroscopic approach2, 3). Arthroscopic surgery is a less-invasive approach to treatment of rotator cuff tears3). Classical teaching has advocated for passive range of motion exercises in the early postoperative period in an effort to minimize adhesions and stiffness. Mobilization of the joint during the early period of recovery helps to prevent adhesions and reduces the frequency of complications. Recent retrospective studies have shown that patients who received no formal physical therapy or limited physical therapy regained their range of motion and demonstrated no significant restrictions at 1 year after surgery. However, no studies have yet evaluated functional outcomes and daily-living activities within the first six months following surgery5–9). This study evaluated short-term patient outcomes after arthroscopic rotator cuff repair multiple times at 1 week intervals using a postoperative rehabilitation protocol with early passive motion.
SUBJECT AND METHODS

An 82-year-old male fell during a walk, resulting in an inability to raise his right upper limb and pain in his right shoulder. He was subsequently diagnosed with a supraspinatus tear with fatty infiltration of the muscle belly by magnetic resonance imaging (Fig. 1). Arthroscopic rotator cuff repair was successfully applied using a single-row technique. The patient had no history of neurological problems, cervical spine disc herniation, or psychological problems and was amenable to therapy. He was instructed to wear an abduction brace for the first 6 weeks after surgery. From day 1 after surgery, gradually increasing passive range of motion (ROM) exercises including forward flexion and internal and external rotation were performed twice a day with the support of a therapist (Fig. 2). Active assisted ROM exercises were introduced at 6 weeks after surgery. Finally at 12 weeks after surgery, gradually increasing muscle strengthening exercises were introduced. The patient was discharged at 10 weeks after surgery. After discharge, the patient continued this rehabilitation program 2–3 times per week until 20 weeks after surgery. The patient was examined using several standardized ROM assessments such as forward flexion and abduction every week until 20 weeks after surgery, and the results were recorded.

Active ROM (forward flexion, extension, internal and external rotation and abduction), the UCLA shoulder rating scale (UCLA scale), and the Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) questionnaire assessments were performed and recorded every week after surgery except for weeks 13, 15, and 16, due to patient scheduling variables. The UCLA scale has been used to describe the outcome of interventions for many shoulder conditions, including rotator cuff tears. Activities of daily living (ADL) were assessed with the QuickDASH [10, 11]. The QuickDASH questionnaire is a self-reported questionnaire that reflects the functional state and symptoms from the patient’s perspective. Furthermore, the QuickDASH evaluates disability due to upper extremity injury (QuickDASH disability/symptom) as well as the limitations of work-related activities (QuickDASH work) and leisure (QuickDASH sports/music). The subject provided written informed consent to take part in the study prior to its commencement, and the study conformed to the principles of the Declaration of Helsinki. This study was conducted with the approval of the Research Ethics Committee of Health Science University (approval number: 30).

RESULTS

Until 6 weeks after surgery, the primary goals were to decrease pain, improve healing, and restore normal joint motion (Fig. 2, Phase I). From 6 weeks after surgery, the rehabilitation goals included weaning off the abduction brace and increasing active ROM. Rehabilitation criteria included adequate passive ROM for advancement, minimal substitution patterns with passive ROM exercises, and minimal pain with passive ROM (Fig. 2, Phase II). At 6 weeks after surgery, pain had nearly disappeared. Active forward flexion, internal rotation, and external rotation were 150°, 70°, and 60°, respectively (Fig. 3). The

| Phase I. Immediate postoperative period  (weeks 0-6) |
|-----------------------------------------------|
| Maintain integrity of the repair |
| **Exercises** |
| 1. Active Finger, wrist, and elbow ROM exercises |
| 2. Gradually, begin passive shoulder ROM exercises to tolerance should be reasonably pain free |
| 1) Flexion scapular plane 2) External or internal rotation |
| 3. Abduction brace |
| Continue full-time until end of week 5 |

| Phase II. Protection and active motion  (weeks 6-12) |
|-----------------------------------------------|
| Do not overstress healing tissue |
| **Exercises** |
| 1. Begin active-assisted or active shoulder ROM exercises |
| 1) Forward flexion 2) External/Internal rotation 3) Abduction |

| Phase III. Strengthening  (weeks 12-20) |
|-----------------------------------------------|
| Gradual restoration of shoulder strength, power, and endurance |
| Gradual return to activities |
| **Exercises** |
| 1. Continue stretching and active and passive ROM exercises, as needed |
| 2. Initiate strengthening program |
| 1) External or internal rotation with exercise bands |
| 2) External rotation side-lying 3) Lateral raises |
| 3. Initiate interval sports program |

Fig. 1. Magnetic resonance imaging on the left demonstrates the supraspinatus muscle tear where it attaches to the humerus (white arrow in a) On the right, the same muscle is torn (white arrow in b)
UCLA scale score and QuickDASH Disability/symptom score were 34 and 36 points, respectively (Fig 4). At 10 weeks after surgery, the patient was discharged and able to resume work and sports (QuickDASH work and sports/music scores of 44 and 31 points, respectively). Subsequently, ROM and QuickDASH scores regressed (active forward flexion, 120°; QuickDASH disability/symptom score, 25 points) compared with at 7–10 weeks after surgery (Fig 3 and 4). From 20 weeks after surgery, the advanced strengthening phase can typically be initiated (Fig. 2, Phase III). At 20 weeks after surgery, active ROM values were higher compared with at 10 weeks after surgery, and active internal rotation, external rotation, and abduction were 80°, 80°, and 160°, respectively (Fig. 3). The UCLA scale score was 34 points. The QuickDASH disability/symptom and sport/music scores were both 0 points. Furthermore, his disability related to “difficult housework” improved, so all disability parts of the QuickDASH became 0 points (Fig. 4). ROM and ADL were maintained at home.

DISCUSSION

Rehabilitation is an important component in the postoperative recovery of patients after rotator cuff repair. Although patient age, activity level, and tear size influence surgical decision-making, nonsurgical management is frequently the preferred method of initial treatment after a rotator cuff tear[2]. Recently, rehabilitation protocols have varied considerably among providers with respect to both timing of progression and application of therapeutic exercise[13]. Parsons et al. conducted a retrospective review of 43 patients in which no formal physical therapy was started until 6 weeks after surgery. In an examination at 6 weeks after surgery, they noted that 23% of their patients had residual stiffness; however, at 1 year after surgery, the patients had regained their range of motion, with no significant restrictions at the final follow-up assessment[14]. In a prospective randomized study, Cuff et al. determined that both early and delayed range of motion groups had similar clinical outcomes at 1 year after arthroscopic repair of a full-thickness supraspinatus tear. The early range of motion group regained a greater average forward elevation (172°) compared with the delayed group (165°; p<0.0001) at 6 months. However, their values had equalized by 1 year, and ROM tests revealed similarly improved results in both groups. Forward elevation was 174° in the early group and 173° in the delayed group. External rotation was 46° in the early group and 45° in the delayed group, with no statistical differences between the two groups[15].

This study evaluated short-term patient outcomes after arthroscopic rotator cuff repair using a postoperative rehabilitation protocol with early passive ROM exercises. At 6 weeks after surgery, pain almost disappeared and ROM was high. Active forward flexion, internal rotation, and external rotation were 150°, 70°, and 60°, respectively. Particularly after arthroscopic rotator cuff repair, an early rehabilitation protocol must be carefully administered until 6 weeks after surgery because the first 6 weeks after surgery represent an important period for ingrowth of the tendon to the bone surface[16]. This phase typically lasts for 4–8 weeks after surgery, but may be delayed, depending on the age of the patient and quality and size of the repair. Cellular proliferation and matrix deposition during this phase are thought to be regulated by several growth factors and initially yield primarily type III collagen[17].

The patient was discharged at 10 weeks after surgery, and his ROM and QuickDASH scores regressed (active forward flexion, 120°; QuickDASH disability/symptom score, 25 points) compared with at 7–10 weeks after surgery (Figs. 2 and 3). At discharge, the ADL of this patient greatly changed, as he resumed work and leisure[18]. It is imperative that the therapist watch for increases in ADLs and modify the home exercise program at the time of discharge to account for increases in stress on the shoulder. Return to work should occur only after the patient has been cleared by the therapist, has achieved symmetric motion and strength and a normalized scapulohumeral rhythm, and has no complaints of pain at rest or during activities[19].

This study demonstrates that there may be advantages to prescribing formal physical therapy that includes early passive
Range of motion exercise for patients undergoing arthroscopic repair for a full-thickness supraspinatus tear. Early rehabilitation protocols are recommended to physical therapists during rehabilitation for arthroscopic rotator cuff repair to support rapid reintegration into daily-living activities. Early rehabilitation after rotator cuff repair resulted in greater recovery in a shorter time span, which in turn is related to ADL and convenience for the patient. We suggest that early rehabilitation after arthroscopic rotator cuff repair should be mandatory. However, there are several limitations of the current study. This study was only one case, and comparisons with gentle rehabilitation have not been done. In the future, further studies are needed that compare the effectiveness of early rehabilitation compared with conventional rehabilitation for short-term outcomes after arthroscopic rotator cuff repair.

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