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Research Paper

Does Conservative Rehabilitation Program Lead to Long-Term Stiffness after Arthroscopic Rotator Cuff Repair?
關節鏡修復肩袖後，保守康復方案會導致長期僵硬嗎?

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ABSTRACT

Background: Evidence on the ideal rehabilitation program for arthroscopic rotator cuff repair is lacking. Most data and results are conflicting with no consensus made. This study aims to compare between an early aggressive program with immediate postoperative range-of-motion (ROM) exercises and a more conservative program with early restriction of motion in Hong Kong Chinese population.
Materials and methods: We retrospectively evaluated 37 arthroscopic rotator cuff repair cases who underwent a standardized delayed rehabilitation protocol of immobilization for 4 weeks to 6 weeks before formal passive ROM exercises. Patients were evaluated at 3 months, 6 months, and 12 months after the surgery, for which they would be tested on passive forward flexion (FF). They were categorized as "stiff" if FF was less than 100°. Constant score, Disability of Arm, Shoulder and Hand (DASH) score, Visual Analog Scale (VAS) score, and isometric abduction power deficit percentage were parameters to assess the functional outcome, and they were obtained in all of the patients' last follow-up assessments.
Results: Two cases (5.4%) are considered "stiff" 6 months after the surgery. At 1 year, the stiffness in both cases resolved, resulting in 0% rate of stiffness. The mean FF at 1 year was 153.33 ± 20.15, which is comparable to the literature. Two cases (5.4%) of clinical retear occurred. Mean Constant score at the latest follow-up was 62.4 ± 13.2. Mean VAS score was 1.1 ± 1.8 at rest and 2.8 ± 2.0 on exertion. Mean DASH score was 25.3 ± 21.9. Mean isometric abduction power deficit was 42.7% ± 0.2%.
Discussion: Historically, due to concerns on long-term stiffness, an early aggressive postoperative rehabilitation protocol was used. We found that an early restriction of ROM with 4 weeks to 6 weeks of immobilization did not lead to long-term stiffness and functional disadvantage. This includes patients with stiffness even before the operations.
Conclusions: Immobilization for 4 weeks to 6 weeks after arthroscopic rotator cuff repair does not result in long-term stiffness and may even be beneficial to cuff tendon healing.

中 文 摘 要

背景: 關於關節鏡修復肩袖的理想康復方案缺乏證據，大多數數據和結果是矛盾而沒有達成共識。本研究目的是以香港中國人，以積極方案即時術後可動範圍運動和較保守的早期運動限制方案作比較.
材料與方法: 我們回顧性評估了關節鏡修復肩袖37例，採用標準化的延遲康復方案，避免術後4至6周內的可動範圍被動活動。手術後3個月、6 個月、12 個月對患者進行評估，並測試向前屈曲，若向前屈曲 少於100度，就被歸類為僵硬。評估能力結果的參數是Constant 評分、上臂肩手功能殘疾 (DASH) 評分、視覺模擬量表 (VAS) 和等距外展力量不足百分比，都在所有患者的最後隨訪中獲得.
結果: 手術6 個月後，2例 (5.4%) 被認為"僵硬"。1年時，2例僵硬均可解決，僵硬的比率為0%。1年時，平均向前屈曲為153.33°+/-20.5°，與文獻類同。2例 (5.4%) 出現臨床再撕裂。最後隨訪中，平均Constant評分為62.4+/-13.2。平均視覺模擬量表在休息時為1.1+/-1.8，運動時為2.8+/-2.0。平均上臂肩手功能殘疾 (DASH) 評分為25.3+/-21.9。 平均等距外展力量不足百分比是42.7%+/-0.2%.

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討論: 從歷史上看，由於對長期僵硬的擔憂，使用了早期積極術後康復方案。我們發現在4至6周早期限制可動範圍運動並不會導致長期僵硬和功能缺陷。這包括了即使在手術前有僵硬的患者.
結論: 關節鏡修復肩袖後4至6周的不動不會導致長期僵硬，甚或有利於肩袖筋腱癒合.

Introduction

Arthroscopic rotator cuff repair has become the preferred method of treatment of rotator cuff pathology due to its rapid advancement over the past decade. Other than good surgical techniques, the postoperative rehabilitation program plays a major role in the success of the surgical treatment for rotator cuff injury. However, a rehabilitation program that best allows tendon-to-bone healing while preventing shoulder stiffness has not been established. Historically, concerns about postoperative stiffness have led surgeons to choose a more aggressive rehabilitation protocol that allows earlier passive motion. However, recent studies in animal models have shown that a period of immobilization could result in better microscopic tendon structure and better mechanical properties.[1] Immediate postoperative motion could actually cause more postoperative stiffness due to gapping in the repair site with scar formation and adhesion in the subacromial space.[2] Furthermore, multiple studies have demonstrated a significant rate of retear in arthroscopically treated rotator cuff tears.[3] Therefore, the idea of a more conservative rehabilitation protocol has been proposed to reduce the stress at the repair site. Our study investigated on the functional outcome and long-term stiffness of a conservative protocol that included 4 weeks to 6 weeks of immobilization in Hong Kong Chinese population.

Table 1
Demographic and clinical data

Variables	Data
Age, yr	58.08 (37–80)
Sex	13 males, 24 females
Side of involvement, *n* (%)	
Dominant	22 (59.5)
Nondominant	15 (40.5)
Occupation, *n* (%)	
Nil	14 (37.8)
Sedentary	5 (13.5)
Light duty	13 (35.1)
Heavy duty	5 (13.5)
Smoker/Ex-smoker, *n* (%)	
Yes	8 (21.6)
No	29 (78.4)
History of injury, *n* (%)	
Yes	21 (56.8)
No	16 (43.2)
Tear size, *n* (%)	
Partial	7 (18.9)
One tendon	19 (51.4)
Two tendons	6 (16.2)
Three or more tendons	5 (13.5)
Repair technique, *n* (%)	
Single row	10 (27.0)
Double row	27 (73.0)
Repair completeness, *n* (%)	
Complete	35 (94.6)
Partial	2 (5.4)
Acromioplasty, *n* (%)	
Yes	28 (75.7)
No	9 (24.3)
Biceps procedure, *n* (%)	
Nil	17 (46.0)
Tenodesis	14 (37.8)
Ruptured	5 (13.5)
Released	1 (2.7)
Immobilization period, *n* (%)	
6 wk	32 (86.5)
4 wk	5 (13.5)
Orthosis, *n* (%)	
Sling	31 (83.8)
Abduction brace	6 (16.2)
Symptom duration, mo	10.6 ± 25.3

Materials and methods

This is a retrospective study conducted in a Hong Kong regional hospital. We identified 36 patients who underwent arthroscopic rotator cuff repair operations between July 2012 and March 2014. One of the patients underwent bilateral rotator cuffs repair, resulting in a total of 37 cases. One case of rotator cuff repair revision was excluded from this study. The minimal follow-up period was 6 months and the average follow-up period was 15 months (range, 6–26 months). All operations were performed by a single surgeon.

The demographic and clinical data of the patients are presented in Table 1. The mean age was 58 years with a female-to-male ratio of 1.8; 22% of patients were smokers and 57% of tears were injury related. The average duration of symptoms before surgery was 11 months. As much as 51% of cases were single tendon tears and 14% had three or more tendons torn. We performed double-row repairs in 73% of cases. Additional procedures include acromioplasty (76%), biceps tenodesis (38%), and biceps release (3%).

All patients were enrolled into our standardized rehabilitation protocol involving 4 weeks to 6 weeks of immobilization after surgery. During this period, patients were encouraged to have elbow and wrist active mobilization exercises and pendulum exercises of shoulder three times/day. Five cases were assigned to undergo 4 weeks of immobilization period, whereas 32 cases were assigned a period of 6 weeks, which was followed by 4 weeks of passive range-of-motion (ROM) exercises. At 10 weeks, active ROM exercises would be started. Resisted strengthening exercises would be started at 3 months to 4 months.

The surgeon evaluated the shoulders' ROM at 3 months, 6 months, and 12 months. Stiffness was defined as passive forward flexion (FF) less than 100 degrees. At the latest follow-up, therapists would assess the Visual Analog Scale (VAS) score, Constant score, Disability of Arm, Shoulder and Hand (DASH) score, and the isometric abduction power deficit percentage.

Results

Figure 1 shows the mean passive FF at preoperative, 3 months, 6 months, and 12 months evaluations. It shows that although there is a significant drop in the FF at 3 months [122.57 ± 36.77 (preoperative) vs. 108.51 ± 32.89 (3 months)] after surgery, the FF values at 6 months (144.06 ± 18.92) and 12 months (153.33 ± 20.15) show a significant improvement in FF when compared with the preoperative stage ($p < 0.05$). The FF at 12 months also shows a significant improvement compared with that at 6 months ($p < 0.05$).

Nine patients (24.3%) met the criteria for being stiff before the surgery (Figure 2). At 3 months after the surgery, 14 (37.8%) were