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ORIGINAL ARTICLE

The comparison of outcomes between delaminated and nondelaminated rotator cuff tear repair: is delamination a negative prognostic factor?

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Background: This study (1) compared clinical outcomes and tissue healing between delaminated and nondelaminated rotator tear after repair and (2) evaluated clinical results according to the degree of tissue healing.

Materials and methods: Ninety-five patients who underwent arthroscopic rotator cuff repair were divided into delaminated tear and nondelaminated tear groups. Tissue healing was evaluated using computed tomography arthrogram and classified into anatomic healing, partially healed defect, and retear. The American Shoulder and Elbow Surgeons Shoulder Assessment score and Constant score were evaluated to quantify the clinical results.

Results: The mean American Shoulder and Elbow Surgeons and Constant scores at final follow-up were 82 ± 10 and 77 ± 7 in the delaminated tear group and 83 ± 12 and 75 ± 9 in the nondelaminated tear group, respectively. There was no statistical difference ($P = .13$ and $P = .17$, respectively). Anatomic healing was most common in both groups. A partially healed defect was the second most common in the delaminated tear group (20 [40.8%]) and retear was the second most common in the nondelaminated tear group (11 [23.9%]; $P = .04$). Clinical scores showed a statistically significant difference according to tissue healing.

Conclusions: A delaminated tear showed no difference in the clinical outcome but a difference in tissue healing compared with a non-delaminated tear. Although clinical scores showed a difference according to tissue healing, a higher partially healing defect and lower retear compared with a nondelaminated tear may imply that a delaminated tear may not be a poor prognostic factor after repair.

Level of evidence: Level II; Retrospective Design; Prognosis Study

Keywords: delaminated rotator cuff tear; non-delaminated rotator cuff tear; tissue healing; clinical outcomes; rotator cuff repair; partially healed defect; suture bridge repair

Delamination is commonly observed at the time of rotator cuff repair.[1,4,20,21,24,29] As knowledge of delaminated rotator cuff tears has increased and arthroscopic techniques are advanced, the incidence of such tears has increased, ranging from 38% to even 92%.[1,5,10,20,21,29,30] Despite the high incidence of

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delaminated rotator cuff tears, few clinical studies of arthroscopic delaminated rotator cuff repair have been published to date. Several reports suggested that the presence of delaminated tears was a negative prognostic factor in clinical and radiologic results after rotator cuff repair.[1,4,24] However, other reports suggested that the presence of delaminated tears had no effect on the clinical outcomes of rotator cuff repair when delaminated components were curetted at the time of surgery.[3,4,26]

Therefore, whether the presence of delamination affects tendon healing and clinical outcomes after arthroscopic rotator cuff repair is still controversial. Moreover, we wondered whether the degree of tendon healing affects clinical outcomes if delamination affects tendon healing. The purpose of this study was (1) to compare clinical outcome and tissue healing between delaminated and nondelaminated rotator tear after repair and (2) to evaluate clinical results according to the degree of tissue healing.

Materials and methods

Patient selection

Among patients with full-thickness rotator cuff tears who underwent preoperative magnetic resonance imaging (MRI) scans and arthroscopic rotator cuff repair at our institution between January 2012 and January 2014 and who were monitored for at least 2 years, those with only a single-tendon (supraspinatus tendon) tear were retrospectively reviewed. The study excluded patients with (1) an arthritic shoulder; (2) revision of the cuff repair; (3) irreparable rotator cuff tear; (4) combined stiffness that showed limitation of active and passive range of motion (ROM) in any direction, specifically, less than 50% of ROM compared with the motion of contralateral shoulder; (5) previous operative history around the shoulder area, including fracture; (6) combined cervical spine lesions; and (7) more than 2 tendon tears.

Arthroscopic video and preoperative MRI scans were reviewed for enrolled patients. We defined delamination as a horizontally retracted tear of both the articular and bursal surface of the tendon with a distinguishable gap between the articular and bursal surfaces and interstitial horizontal splitting (Fig. 1). The patients were divided into 2 groups according to the presence of delamination. When both arthroscopic and radiologic evaluation met the criteria, the patients were assigned to the delaminated tear group. When both arthroscopic and radiologic evaluation did not meet criteria, the patients were assigned to the nondelaminated tear group. If the radiologic and arthroscopic findings did not match, the patients were excluded.

Preoperative and postoperative clinical evaluation

All patients underwent a preoperative evaluation consisting of interviews, questionnaires, and physical examinations a day before the operation. The same questions were evaluated regularly at 3 weeks, 6 weeks, 3 months, 6 months, and 12 months after the operation and at the last follow-up. The preoperative results and the last follow-up results were analyzed. The subjective level of patients' pain was measured using a visual analog scale (VAS), with 0 indicating no pain and 10 indicating extremely severe pain.

ROM was measured with a full-circle manual goniometer made of flexible clear plastic for forward flexion, abduction, external rotation at the side, external rotation at 90°, and internal rotation. Abduction was measured with the patient sitting in a neutral position. Forward flexion, external rotation at the side, and external rotation at 90° were measured with the patient supine on the treatment table. In external rotation at 90°, the patient rotated his or her shoulder with the shoulder abducted 90° and the elbow at 90° of flexion. Internal rotation was assessed by an indirect method called posterior reach or hand behind back, where the hand was actively placed behind the back and the vertebral level reached by the tip of the extended thumb was recorded.

Muscle strength was measured using the handheld Nottingham Mecmesin Myometer (Mecmesin Co., Nottingham, UK). Abduction strength was measured with patients seated with their arm abducted at 90° in the scapular plane.

The American Shoulder and Elbow Surgeons (ASES) Standardized Shoulder Assessment score and the Constant score were also calculated to quantify the clinical results.

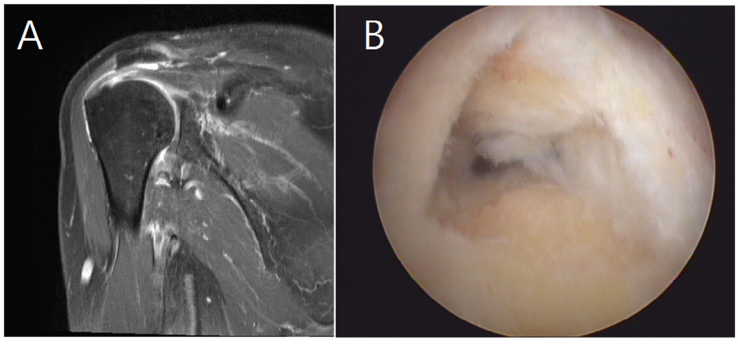

Figure 1 A delaminated rotator cuff tear is seen on **(A)** a magnetic resonance image and **(B)** an arthroscopic image. We defined delamination as a horizontally retracted tear of both the articular and bursal surface of the tendon with a distinguishable gap between the articular and bursal surfaces, and interstitial horizontal splitting.