Rotator Cuff Tears

ize and address associated glenohumeral lesions. A more extensive surgical dissection must be performed, which potentially will increase postoperative pain and the risk of infection.

Mini-open repair involves repairing the rotator cuff tear through a smaller incision than the open technique (Figure 28). Arthroscopy is used to visualize the tear and treat additional lesions within the glenohumeral joint or subacromial space, such as evaluating and treating degenerative labral tears or biceps tendon tears or performing a subacromial decompression. This technique avoids the need to detach the deltoid. Results of the mini-open repair have been equal to those of an open repair at 1 and 2 years after surgery.

With the development of new technology and improved surgical skill, an all-arthroscopic rotator cuff repair now is commonly performed. The theoretical advantages of the repair, which is performed through small portal incisions, include decreased immediate postoperative pain, decreased surgical insult to the deltoid, and decreased postoperative stiffness. This could result in increased patient satisfaction. Single-row and double-row repair constructs are used, and the technique chosen depends on the surgeon (Figure 29). Some researchers have shown that a double-row repair with medial and lateral sutures improves biomechanical strength. The improved biomechanical properties of a double-row repair over a single-row repair include decreased strain over the footprint area, increased stiffness, and increased ultimate load to failure. Mazzocca et al did not show a difference in load to failure, cyclic displacement, and gap formation but found that a double-row repair consistently restored a larger footprint than the single-row repair did. A single row of anchors restores only 67% of the original footprint, whereas adding the second row increases the contact area by 60%, which restores more normal footprint anatomy. Brady et al found that, after isolated lateral row repair, 52.7% of the rotator cuff footprint was left uncovered. On average, the double-row repair offered more than twice the footprint coverage yielded by a single-row repair. The double-row repair is more technically demanding than the single-row repair and might not necessarily improve patient satisfaction or functional outcome.

For patients with partial-thickness rotator cuff tears that have not improved with nonoperative treatment, surgery is recommended. Operative treatment includes both debriding and repairing the partial-thickness tear. Park et al used debridement to treat a tear comprising less than 50% of the thickness of the tendon and subacromial decompression in 37 patients; 24 patients had an articular-sided tear, and 13 had a bursal-sided tear. At 6 months after surgery, pain and function had improved in patients with bursal-sided tears, but they found no difference in pain and function at 1- and 2-year follow-up. Cordasco et al used debridement and subacromial decompression to treat 105 patients who had partial-thickness tears comprising less than 50% of the thickness of the tendon. They reported patients with articular-sided tears had a 3% failure rate, whereas bursal-sided tears had a 29% failure rate. Weber used debridement or repair to treat 65 patients who had grade 3A or 3B tears.
Figure 29A. Arthroscopic rotator cuff repair using a single-row construct.

Figure 29B. Arthroscopic rotator cuff repair using a double-row construct.
and found repair resulted in significantly improved outcomes. The difference was greater with the bursal-sided tear subgroup. He concluded that bursal-sided tears were not treated adequately with debridement alone.48

Mazzocca et al49 created articular-sided, partial-thickness tears comprising 25%, 50%, and 75% of the thickness of the supraspinatus tendon of cadavers; measured strain at glenohumeral angles of 45°, 60°, and 90°; repaired the tears; and measured strain again. They found an increase in rotator cuff strain between the intact rotator cuff tendon and partial-thickness tears comprising 50% and 75% of the thickness of the tendon. After repair, the strain returned to that with the intact state. The effect of the tear on strain increased as the abduction angle increased. The authors suggested that a biomechanical basis exists for repairing a partial-thickness tear greater than 50% of the footprint.49

Multiple techniques for repairing partial-thickness rotator cuff tears have been described. Lo and Burkhart50 described a transtendon technique using suture anchors to repair partial-thickness, articular-sided rotator cuff tears, which also are known as partial articular supraspinatus tendon avulsion lesions (Figure 30). Conway51 described a transcutaneous mattress suture repair. Wolff et al52 illustrated a technique for repairing bursal-sided tears in which the articular side is left intact. They explained that 3 goals are achieved with this repair: the intact articular fibers act as an internal splint to protect the bursal-sided repair; a wide, anatomic footprint is recreated; and the length-tension mismatch is minimized because the tissue is not lateralized excessively. At 24 months, the 15 patients treated with this technique had excellent results.52 The other treatment option involves converting a partial-thickness tear to a full-thickness tear and performing a standard repair of the rotator cuff.
For partial-thickness tears involving the subscapularis, treatment involves not only repairing the partial-thickness tear with suture anchors and recreating an anatomic footprint, but also addressing the potential cause of the defect within the tendon. A coracoplasty is performed in patients whose plain films and MRIs show decreased distance between the tendon defect and the coracoid (Figure 31A and B).

A partial-thickness tear in the overhead athlete is unique, and the appropriate treatment has been debated. The overhead athlete usually develops a partial articular tear with intratendinous extension lesion due to posterosuperior impingement. Failure occurs on the undersurface of the posterior portion of the supraspinatus and anterior portion of the infraspinatus with intratendinous delamination. This is best visualized on the abduction-external rotation view. In their study of 67 professional pitchers treated with debridement alone, Reynolds et al\(^54\) found 76% returned to competitive pitching, but only 55% returned to the same level or higher of competition. Lo and Burkhart\(^50\) described a new technique for arthroscopic intratendinous repair for a delaminated, articular-sided rotator cuff tear. The normal anatomy of the articular side of the rotator cuff is restored, and the delamination component also is repaired, preventing overconstraint of the shoulder. Results are promising, but only 5 months of follow-up have been reported.

Many investigators have compared the different repair techniques available for partial rotator cuff tears. In their biomechanical study, Gonzalez-Lomas et al\(^55\) compared a transtendon repair and a tear completion followed by repair. The transtendon repair showed less gapping and also had a higher mean ultimate failure strength. Park et al\(^56\) compared the transtendon repair with 2 isolated mattress configurations. Gap formation in the anterior tendon was lower in the isolated mattress configuration but did not exceed 0.5 mm. The authors found no difference in linear stiffness, yield, ultimate load, or energy absorbed to failure. They concluded that the interimplant mattress cuff repair for articular-sided, partial-thickness tears involving 50% of the footprint has biomechanical characteristics similar to those of a repair using 2 isolated mattress sutures.

Using an ovine model, Peters et al\(^57\) compared no repair; transtendon repair; completion of the tear with tension-band, single-row repair; and completion of the tear with double-row repair for articular-sided, partial-thickness tears. They measured the footprint contact pressure and the ultimate load to failure and found footprint contact pressures were 3 times greater for the transtendon and double-row repairs than the single-row and no repairs. Ultimate load to failure was more