Full-Thickness Massive Rotator Cuff Repair With a Dermal Allograft Using CuffMend Augmentation Technique

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Background: Rotator cuff repair using graft augmentation for large-to-massive, full-thickness rotator cuff tears has been reported to have improved clinical outcomes relative to other therapeutic interventions. Although an effective and promising technique, graft augmentation can be technically challenging, particularly with deployment and positioning of the graft. CuffMend is a user-friendly rotator cuff augmentation technique that combines a decellularized dermal allograft with a novel graft deployment device, tendon anchor, and set of lateral knotless, tension-able anchors to allow for a reliable and stable implantation of the graft.

Indications: Graft augmentation using CuffMend is indicated for tears with a high risk of retear or incomplete healing. This includes revision tears, poor-quality degenerative tissue, and massive full-thickness rotator cuff tears. Severe glenohumeral osteoarthritic change is the primary contraindication to this technique.

Technique Description: The rotator cuff is reduced medially and secured using 3 anchors with sutures passed in a mattress configuration. Graft augmentation is then performed using the CuffMend graft spreader that facilitates placement and attachment of the graft onto the repaired tendon.

Results: The patient is recovering as expected and started physical therapy 1 month postoperatively. He is able to perform light activities of daily living and reach the top of his head for daily self-care without pain. He will begin strengthening at 12 weeks postoperatively.

Discussion/Conclusion: CuffMend is a new graft augmentation technique that uses a novel graft deployment device for consistent and precise deployment of a decellularized dermal allograft. This facilitates an expedited repair using the graft augmentation technique for optimal clinical and biomechanical outcomes in patients with rotator cuff tears with high risk of retear.

Keywords: graft augmentation; dermal allograft; irreparable rotator cuff tear; CuffMend; ArthroFLEX

VIDEO TRANSCRIPT

This is Dr. Nikhil Verma, Director of the Sports Medicine and Shoulder service at Midwest Orthopaedics at Rush and Rush University Medical Center in Chicago, Illinois.

I'd like to present to you our techique for full-thickness rotator cuff repair using the CuffMend (Arthrex, Inc, Naples,FL) augmentation device.

My coauthors are listed.

Disclosures are available thorugh the academy's online disclosure program and are listed here.

Massive rotator cuff tears are defined as full-thickness tears involving 2 or more tendons or tears measuring over 5 cm in the coronal plane.[3] A larger rotator cuff tear size is associated with a poorer prognostic value. More specifically, it is associated with a higher rate of retear after surgical intervention with a recent systematic review reporting a healing rate of 28% and a retear rate of 78% following repair.[3] Biomechanical studies have also reported reduced mechanical strength in repaired tendons compared with native tendon tissue.[4] Despite these findings, conclusions drawn from the literature suggest that a primary attempt at surgical repair should be the first-line treatment in most clinical presentations of large-to-massive rotator cuff tears.[3]

Maintaining the integrity of a repaired massive rotator cuff tear is vital to reduce the risk of developing glenohumeral osteoarthritis or rotator cuff tear arthropathy.[1] In addition, studies have reported improved functional outcomes, pain scores, and strength in patients with intact rotator cuff repairs postoperatively.[2] Consequently, the use of various biological and synthetic grafts to augment massive rotator cuff repairs has gained increasing popularity among shoulder surgeons.

There are a variety of graft options available, including human dermis, porcine dermis, porcine intestinal

Video Journal of Sports Medicine (VJSM®), 2(2), 26350254211058738
DOI: 10.1177/26350254211058738

submucosa, freeze-dried cadaveric rotator cuff, synthetic grafts, and autograft (such as biceps tendon, fascia lata, patellar tendon, Achilles tendon, and quadriceps tendon).[2] In addition to providing structural support to the repair, most biological grafts induce collagen growth and can aid native tendon remodeling, allowing for a more robust native tendon and an improved tendon-bone interface.[7] The use of graft augmentation also offers a major biomechanical benefit compared with other treatment modalities such as superior capsule reconstruction by providing an anatomical repair with increased strength at the repair site.[6]

A recent systematic review by Ferguson et al analyzed 10 studies that investigated the use of graft augmentation of primary repairs compared with isolated primary repairs in large-to-massive rotator cuff tears.[2] The authors reported superior structural integrity of repairs in patients with allograft augmentation. About 85% of patients with augmented repairs remained intact compared with 40% for subjects who underwent primary repair alone. The authors concluded that functional outcomes were also improved in patients undergoing allograft augmentation versus primary repair, supporting the use of allograft augmentation in the setting of large-to-massive rotator cuff tears.

While anatomic reconstruction reinforced with graft augmentation has demonstrated biomechanical and clinical superiority for the treatment of massive rotator cuff tears, there exist technical challenges with deploying the graft into the desired location, which has limited widespread applicability.[8] Furthermore, positioning the graft into place, managing sutures, controlling graft rotation, and final fixation have all been reported as complexities associated with this technique.[8] The CuffMend augmentation system is a new augmentation technique that combines a decellularized allograft with a novel graft deployment device, tendon anchor, and lateral knotless anchor fixation. The CuffMend system allows for a consistent and expedited graft deployment to facilitate augmentation following anatomic rotator cuff repair.

In the case that we have today, the patient is a 56-year-old man who presented to our clinic 2 months after a motor vehicle incident. Since the injury, the patient has reported right shoulder pain and weakness and has undergone a conservative course with physical therapy, ibuprofen, and failure to improve after 6 weeks of conservative treatment. No injections were provided.

On physical examination, the patient had no atrophy or deformity. He had no pain in his acromioclavicular (AC) joint but reported moderate pain over the anterolateral shoulder. On range of motion, he had forward flexion to 160° and external rotation to the side at 60°. He has pain at terminal elevation and a positive impingement sign. He reports significant pain with resisted elevation or rotation. He also had weakness and was 3/5 with abduction in the scapular plane and 4/5 with external rotation at the side. An magnetic resonance imaging (MRI) demonstrated full-thickness tears of the supraspinatus and infraspinatus with tendon retraction to the glenoid. The muscle quality was generally maintained with minimal atrophy and was stage I with fatty streaks using the Fuchs modification of the Goutallier classification.

On the day of surgery, the patient was placed in a modified beach chair position after induction with general anesthesia. An examination under anesthesia showed a preserved range of motion without instability. After sterile draping, a posterior portal was established followed by an anterior portal in the rotator interval. A diagnostic arthroscopy revealed that the biceps had been previously ruptured, and a stump of the biceps was debrided. The subscapularis was found to have an upper border tear requiring repair, and full-thickness tears of the supraspinatus and infraspinatus were confirmed. The articular cartilage was generally maintained.

A lateral portal was then established, and attention was turned to the subacromial space. Initially, an acromioplasty was performed using a cutting block technique to establish a type I morphology. Afterward, the greater tuberosity was prepared with light decortication, followed by preparation of the lesser tuberosity *to facilitate anatomic reconstruction of the massive rotator cuff tear.* In addition, the biceps groove is open to allow for double-row fixation of the subscapularis. Next, we identified the upper border of the subscapularis and the coracohumeral ligament. A single double-loaded suture anchor is placed in the lesser tuberosity. Sutures are passed in a mattress

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Submitted August 11, 2021; accepted October 21, 2021.

One or more of the authors has declared the following potential conflict of interest or source of funding: B.J.C. received research support from Aesculap/B. Braun, Arthrex, Inc, National Institutes of Health (National Institute of Arthritis and Musculoskeletal and Skin Diseases [NIAMS] & Eunice Kennedy Shriver National Institute of Child Health and Human Development [NICHD]), and Regentis; is a paid consultant of Arthrex, Inc, and Samumed; received royalties from Arthrex, Inc, Elsevier Publishing, and Operative Techniques in Sports Medicine; is a board or committee member for *American Journal of Orthopedics*, *American Journal of Sports Medicine*, Arthroscopy Association of North America, Cartilage, International Cartilage Repair Society, Elsevier Publishing, *Journal of Shoulder and Elbow Surgery*, and *Journal of the American Academy of Orthopaedic Surgeons*; received other financial or material support from JRF Ortho, Smith & Nephew, and Athletico; received stock or stock options from BandGrip Inc, OSSIO, and Regentis; and received financial or material support from Athletico, JRF Ortho, Operative Techniques in Sports Medicine, Smith & Nephew. N.N.V. is a paid consultant for Minivasive, OrthoSpace, Smith & Nephew; is a board member or committee appointment for American Orthopaedic Society for Sports Medicine, American Shoulder and Elbow Surgeons, Arthroscopy Association Learning Center Committee, and SLACK Incorporated; received stock or stock options in CyMedica, Minivasive, and Omeros; received research support for Arthrex, Arthrosurface, DJ Orthopedics, Ossur, Smith & Nephew, Athletico, ConMed Linvatec, Miomed, and Mitek; received royalties from Arthroscopy, Smith & Nephew, and Vindico Medical-Orthopedics Hyperguide; received financial or material support from Arthroscopy and Vindico Medical-Orthopedics Hyperguide. AOSSM checks author disclosures against the Open Payments Database (OPD). AOSSM has not conducted an independent investigation on the OPD and disclaims any liability or responsibility relating thereto.

configuration through the subscapularis, tied, brought over the top, and secured laterally, using 2 lateral row anchors to create a transosseous repair of the subscapularis.

Next, attention was turned to the supraspinatus and infraspinatus. A large U-shaped tear is identified with relatively poor-quality tissue. The repair is conducted using anchors placed in the midportion of the greater tuberosity. Pilot holes are prepared, and the anchors are inserted using a percutaneous portal off the edge of the acromion. Note how care has been taken to properly prepare the greater tuberosity with light decortication to create a bleeding bed for healing. Once the anchors are appropriately deployed, suture passage is carried in a standard fashion using a combination of penetrating devices and a spectrum device.

Here, you can see the sutures being passed through the torn rotator cuff, just lateral to the musculotendinous junction. In this case, triple-loaded anchors were selected to maximize tendon-to-bone fixation. A second more anterior anchor is then placed allowing for repair of the anterior leaf or supraspinatus portion of the rotator cuff tear. Again, a triple-loaded anchor is selected, and once all sutures are passed, sutures are tied using a standard knot tying configuration, and here you can see the final repaired construct. Once the repair is completed, we then prepared the graft on the back table.

A 20-by-25 mm graft of approximately 1 to 1.5 mm in thickness was prepared on the back table by placing 2 separate luggage tag sutures at the lateral aspect of the graft and simple sutures in the medial aspect of the graft. Two ends of the graft were loaded into the CuffMend graft spreader. The loaded suture ends were wrapped around the inner contralateral groove on the handle; the unloaded suture ends were wrapped around the outer ipsilateral groove on the handle. The loaded CuffMend graft spreader is tested prior to insertion into the joint space.

Next, the graft was then inserted into the subacromial space and was aligned to cover the repaired rotator cuff tissue. The CuffMend technique recommends the surgeon create an auxiliary inferior anterolateral portal to introduce the graft spreader into the subacromial space for optimal graft placement. It was then secured medially at the level of the musculotendinous junction using polyethylene staples using a tissue-tak stapling device that is included with the CuffMend graft augmentation kit. The stapler is inserted via a portal placed just off the edge of the acromion to allow for the appropriate angulation for placement of the staples. A total of 6 staples, 3 placed medially and 3 placed along the lateral edges of the graft, both anteriorly and posteriorly, were used to secure the graft in the optimal position. Next, we prepare a second row of fixation along the lateral margin of the tuberosity to perform lateral row fixation.

Two PushLock anchors (Arthrex, Inc) were then used to secure the construct laterally, allowing for a complete coverage of the anatomic repair, excellent tension of the graft, and excellent stability through range of motion. Regardless of single- or double-row construct, separate lateral anchors will be used to fixate the graft. Specifically, 3.5-mm PushLock anchors are the recommended anchors for lateral fixation. *Here, we are securing the anterolateral PushLock anchor. Here we are securing the posterolateral PushLock anchor*. Finally, the correct placement of the graft is visualized completely overlying the repaired rotator cuff and demonstrating adequate stability through range of motion.

Irrigation was then completed, and the arm was taken through rotation to confirm the repair was adequate. Instrumentation was removed, and portal sites were closed with 3-0 prolene. Afterward, a sterile dressing was applied, and the patient was placed in an abduction sling. The patient will remain braced for a total of 6 weeks.

Postoperative rehabilitation includes strict immobilization for a total of 6 weeks. Passive range of motion is initiated at approximately 6 weeks with the goal of achieving full passive and active range of motion at 12 weeks. At 12 to 14 weeks, strengthening is initiated, and we anticipate the patient returning to normal activities between 8 and 12 months following surgery.

The aim of rotator cuff surgery is to repair the tendon to the anatomic footprint in a tension-free fashion while restoring as much function as possible.[5] In our opinion, the CuffMend technique allows for augmentation of an anatomic repair in a reproducible fashion when treating patients with massive rotator cuff tear. Due to the chronicity of the tear, degree of retraction, and poor tissue quality, there was a concern for an increased risk of a retear with subsequent poor clinical outcomes using an anatomic repair alone. Graft augmentation is one potential solution to provide increased structural support to reinforce the primary repair. In addition, graft augmentation has been shown to have superior clinical outcomes relative to other surgical constructs for primary massive rotator cuff tears.[2] In this case, the CuffMend system facilitated rapid and reliable deployment of the graft in the desired location, angle, and orientation to successfully supplement an anatomic repair.

Thank you very much for your attention.

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