Rotator Cuff Repair: The Compression SpeedBridge Technique

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Background: While rotator cuff repair has generally produced good to excellent outcomes, re-tear rates remain variable, with rates ranging from 20% to 50%. The ideal rotator cuff repair includes 3 main components: restoration of the humeral footprint contact area, appropriate compression of the tendon to the humeral footprint, and minimal motion at the bone-tendon interface until bone-tendon healing is completed. This video takes a well-established knotless double-row technique for rotator cuff repair and augments it with a modification to promote additional compression of the medial row tendon to the humeral footprint.

Indications: This compression SpeedBridge technique is indicated for repair of T-type rotator cuff tears involving the supraspinatus and infraspinatus tendons in patients that have failed conservative management, including physical therapy, activity modification, and corticosteroid injections. This technique can also be applied to U-shaped or L-shaped tears by removing the initial step, which involves side-to-side repair of the ''T'' portion of the T-type tear. Of note, findings such as advanced muscle atrophy (Goutalier III/IV) and advanced glenohumeral arthritis are concerning for irreparable tears and may be contraindications for surgical repair.

Technique Description: With the patient in the lateral decubitus position, a diagnostic arthroscopy is performed, the rotator cuff tear is debrided, and the footprint prepared. Two side-to-side stitches are placed to repair the ''T'' portion of the tear. The medial row anchors are then sequentially placed, and the pre-loaded sutures are passed through the tendon in 4 sequential locations in specific fashion. After placement of looped sutures in the anterior and posterior rotator cables, the passed sutures are then incorporated into the lateral row anchors. The medial row compression is provided by shuttling previously placed compression stitches through the knotless mechanism in the medial row anchors and terminally tensioned.

Results: This technique provides additional medial row compression to an already-established knotless double-row rotator cuff repair technique to facilitate improved bone-tendon healing and construct strength.

Discussion/Conclusion: The compression SpeedBridge technique is a unique method to apply additional medial row compression to a double-row rotator cuff repair.

Patient Consent Disclosure Statement: The author(s) attests that consent has been obtained from any patient(s) appearing in this publication. If the individual may be identifiable, the author(s) has included a statement of release or other written form of approval from the patient(s) with this submission for publication.

Keywords: rotator cuff tear; supraspinatus; infraspinatus; double row; arthroscopic; SpeedBridge

VIDEO TRANSCRIPT

Hi, my name is Steve Marcaccio, and together with Dr Brian Godshaw, Dr Justin Arner, and Dr James Bradley, we would like to share our technique to repair a T-type rotator cuff tear using the compression SpeedBridge technique. These are our disclosures.

Recent data have shown that the number of rotator cuff repairs has increased steadily over recent decades, with overall good to excellent outcomes; however, elevated re-tear rates remain a clinical concern.[1,3,5,9] The ideal rotator cuff repair includes 3 main components: restoration of the humeral footprint contact area, appropriate compression of the tendon to the humeral footprint to facilitate healing of the bone-tendon interface, and minimal motion at the

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Submitted October 8, 2023; accepted January 10, 2024.

One or more of the authors has declared the following potential conflict of interest or source of funding: J.A. receives financial support for research and educational content from Arthrex, whose implants were used in this surgical technique video. J.B. receives royalties from Arthrex, whose implants were used in this surgical technique video. 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.

Video Journal of Sports Medicine (VJSM®), 4(3), 26350254241229100
DOI: 10.1177/26350254241229100

bone-tendon interface until bone-tendon healing is completed.[1,9] This requires an adequate initial fixation construct to build a foundation for healing, as well as an appropriate postoperative rehabilitation protocol that balances initial motion restriction to facilitate healing with appropriate range-of-motion exercises to prevent postoperative stiffness. This video will present our technique, which takes a well-established knotless double-row technique for rotator cuff repair and augments it to promote additional compression of the medial row tendon to the humeral footprint.

The case we will be presenting today is a 64-year-old, right-hand-dominant male weightlifter with several years of left shoulder pain. This has acutely worsened over the past several weeks prior to his appointment and is associated with activities such as weightlifting, overhead activities, cross-body motion, or getting dressed.

On examination, he had a range of motion of 120° of forward flexion and abduction and 80° of external rotation, and he was able to internally rotate to the iliac crest. His strength was 4/5 in isolated testing of the supraspinatus, infraspinatus, and subscapularis.

His magnetic resonance imaging (MRI) demonstrated a near-full-thickness rotator cuff tear of the supraspinatus. Upon further evaluation, you can note that there is longitudinal/medial extension of the tear up the supraspinatus tendon.

The technique we will be demonstrating today is a compression SpeedBridge (Arthrex, Inc.). This technique turns our rotator cuff tear into a repaired tear in a standard SpeedBridge repair fashion. To make this repair technique unique, we first repaired the longitudinal split with side-to-side sutures as demonstrated by the orange bars. We then provide compression of the medial row, demonstrated by the black bars, using a knotless mechanism in the knotless SwiveLock anchors (Arthrex, Inc.). The green bars on the side represent repair of the rotator cuff cable using FiberLink sutures (Arthrex, Inc.) in a synch-type fashion.

The first step in this technique is the same as that in any other rotator cuff repair technique. First, you must define the tear. Here, we see the tear of the supraspinatus over the footprint, with a longitudinal split extending into the tendon of the supraspinatus.

We begin the repair by repairing the longitudinal split in the tendon. This is done by placing two side-to-side sutures of #2 FiberWire (Arthrex, Inc.) and tying them in standard arthroscopic fashion.

Here you can see the longitudinal split in the tendon. We began by passing the FiberWire using a scorpion through the anterior aspect of the tear. This is then repeated through the posterior aspect of the tear. Once both suture limbs are retrieved through the lateral cannula, they are tied in standard fashion using an arthroscopic sliding locking knot. This is repeated with a second suture. Here, you can see the finished product of the side-to-side repair of the longitudinal split.

The next step is placing the two medial row anchors. First, we place an anterior anchor, represented by the anterior black arrow, and then we place a posterior anchor, represented by the posterior black arrow. These are placed right at the articular margin, after the rotator cuff footprint is adequately prepared.

Here you can see the already prepared rotator cuff footprint, and we begin by placing our anterior medial row anchor. Once the hole is drilled and tapped, the anchor is placed until the top of the anchor is just below the surface of the bone. These are 4.75-mm knotless SwiveLock anchors loaded with fibertape for our SpeedBridge repair. Once the anterior anchor is placed, we repeat this process with the posterior anchor until both the anterior and posterior medial row anchors are placed with good purchase at the articular margin.

Once the medial row anchors are placed, it is time to pass the sutures. These are done in four sequential steps from anterior to posterior. First, we start in the anterior aspect of the rotator cuff. First, a FiberLink is used and passed through the rotator cuff. Through the looped end of the FiberLink, we place one of the fibertapes, demonstrated by the red line, and all 3 suture limbs from the knotless mechanism of the anterior anchor. These are shuttled through the pass on the anterior aspect of the rotator cuff tear. Next, we proceed with pass number 2. Pass number 2 is the second tape from the anterior anchor. This is placed posterior to the first pass, and it is also placed more medially. This process is then repeated for the posterior medial-row anchor. Pass number 3 is a single tape from the posterior medial row anchor and is passed at the same depth as pass number 2. The final pass, pass number 4, is done using the same technique as pass number 1. A FiberLink is passed through the posterior aspect of the rotator cuff tear. Through the loop, the final tape from the posterior anchor as well as the 3 sutures from the knotless mechanism are shuttled through the rotator cuff.

Here, we see a FiberLink suture being passed through the rotator cuff tear. Once this is passed, one of the tapes, as well as the 3 sutures from the knotless mechanism are grasped and retrieved through the lateral portal and shuttled through this pass. We then pass pass number 2 using just the tape with a scorpion device. This process is continued in a symmetric fashion for passes 3 and 4. Again, it is important to know that pass number 2 and pass number 3 are passed more medial than the peripheral passes. This is important when it comes to the final step of this technique to provide the appropriate compression of the medial row.

The next step is placing the lateral row. There are 2 anchors placed in the lateral row. Both are 5.5-mm SwiveLock anchors. The sutures placed in both the anterior and posterior lateral row anchors are similar to the standard SpeedBridge construct. First, the anterior anchor is placed. Prior to placing this anchor, we use a FiberLink suture that is passed at the edge of the rotator cuff tear in the most anterior aspect. This is placed at the area of the rotator cuff cable to repair the rotator cable. This is placed in a -synch-type fashion, represented by the green line. This FiberLink is retrieved through the lateral cannula, as well as the fibertape from pass number 1 and pass number 3. These are all loaded into the anterior lateral row anchor. This process is then repeated with the posterior lateral row anchor. A second FiberLink is placed in a synch-type fashion in the most posterior aspect of the tear near the

periphery to repair the posterior rotator cable. Then the fibertapes from pass number 2 and pass number 4 are retrieved out of the lateral row and are loaded into the posterior lateral row anchor, which is then placed. This creates our standard SpeedBridge construct with the addition of the rotator cable repair.

First, we will see the FiberLink suture being passed in the most-anterior aspect of the rotator cuff tear in the rotator cable. This is done in a synch-type fashion, and this is synched down. Once this is passed, the fibertapes from pass number 1 and pass number 3 are retrieved out of the lateral cannula and loaded into the anchor, and the position is obtained by checking the appropriate tension. A punch is used, and once our pilot hole is made, the anchor is placed. Each of the 3 limbs of suture passed through here are tensioned appropriately. The anchor is then advanced down to the bone and then screwed in in a standard fashion. The limbs from these sutures are then cut. This process is then repeated posteriorly. A second synched FiberLink suture is then passed in the posterior rotator cuff tear and retrieved out of the lateral cannula with the fibertape from pass number 2 and pass number 4. These are loaded into the lateral row anchor posteriorly and are placed in similar fashion as was done with the anterior lateral row anchor.

The final step of this repair is providing compression of the medial row. This is done using the knotless mechanism of each of the anterior and posterior knotless SwiveLock anchors, which are those used for our medial row anchors. In this diagram, the repair sutures of each of the knotless mechanisms are represented by the black sutures. First, we take the repair suture from the anterior medial row anchor and the looped end of the shuttling suture from the posterior medial row anchor out of the lateral portal. We use this to shuttle the repair suture from the anterior medial row anchor through the knotless mechanism of the posterior medial-row anchor. This process is then repeated in the opposite direction. The repair suture from the posterior medial row anchor and the looped end of the shuttling suture from the anterior medial row anchor are retrieved out of the lateral cannula, and then the repair suture from the posterior medial row anchor is shuttled through the anterior anchor's knotless mechanism.

Here, you can see the medial stay suture being shuttled through the anchor. For this posterior stay suture, you can see us retrieving the stay suture and the looped end through the lateral cannula. Once this is complete, the stay suture is then passed through the looped end and shuttled through the knotless mechanism. Once both repair sutures are tensioned, a knot pusher is placed along the tail of each one to ensure appropriate tensioning. Here is the final image. You can note that the medial compression is provided on top of the SpeedBridge repair. This ensures that there is no sawing mechanism of the rotator cuff to damage the tendon. This technique provides compression of the medial row to the rotator cuff footprint to enhance rotator cuff repair healing.

This slide highlights some important technical pearls to consider from the senior author, including optimal placement of medial-row anchors, using additional tools, such as a percutaneous probe, to lift the cuff to visualize the articular margin, medial placement of suture tapes 2 and 3 to ensure that the compression sutures rest on top of the tapes rather than directly on the rotator cuff tendon, using a 5.5-mm anchor in the lateral row for augmented fixation in especially poor bone quality, using independent looped sutures for additional fixation in the anterior and posterior rotator cables, and using a knot pusher for terminal tensioning of the compression sutures.

The postoperative protocol consists of using a sling for 6 weeks. A self-directed passive range-of-motion protocol begins at 24 hours. The patient then starts physical therapy at 4 weeks, in which isometrics and active range of motion are started. At 6 to 8 weeks, the sling is removed, and the strengthening begins. At 2 to 3 months, eccentric exercises and gentle polymetrics are started. At 4 months, progressive polymetrics and a total body conditioning program are started. At 5 months, the patient will begin work in sports-specific activities. At 6 months, clearance for sports or work depends on patient-specific shoulder demands.

There has been an increasing amount of literature regarding how to best manage large to massive repairable rotator cuff tears, particularly regarding single-row versus double-row repairs. In our practice, we prefer double-row repairs. Studies looking at biomechanical outcomes comparing double-row versus single-row repairs have shown that double-row repairs have increased load to failure, improved contact areas and pressures, and decreased gap formations.[2,4] Double-row repairs also consistently reproduce the original supraspinatus footprint approximately 100% of the time versus only 46% of the time for single-row repairs.[4,7]

Regarding clinical outcomes for single-row versus double-row repairs, studies have shown that patients who undergo double-row repairs for tears measuring more than 3 cm have improved constant, University of California Los Angeles (UCLA), American Shoulder and Elbow Surgeons (ASES) scores, as well as improved strength and decreased re-tear rates compared to patients who undergo single-row repairs.[6,8] Of note, when it comes to smaller tears, several studies have found no clinical improvement in outcomes scores for double-row versus single-row repairs despite single-row repairs having higher rates of image-proven re-tears.

Thank you very much for your attention, and we hope that you found our technique description to be useful.

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