CASE REPORT

Use of a Hyaluronic Acid Scaffold to Augment Rotator Cuff Repair: A Case Report

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Abstract

A rotator cuff tear is one of the most common pathologies of the shoulder joint. In this case, we present a 67-year-old female with a right shoulder full-thickness tear of the leading edge of the supraspinatus. Once conservative treatment failed to yield improvement, the patient underwent a right shoulder arthroscopy and supraspinatus repair with augmentation utilizing a hyaluronic acid scaffold (Integrity implant).

Postoperatively, the patient remained non-weight bearing in a sling except for ADLs for a total of six weeks. At 12 weeks post-operatively, the patient reported no pain at rest, symmetric range of motion to the contralateral side, and full strength with testing of the rotator cuff. This case displays the successful use of a hyaluronic acid scaffold to augment and accelerate recovery after a rotator cuff repair. The Integrity implant offers a knitted scaffold with hyaluronic acid that may support tissue regeneration and that resorbs over time.

Introduction

Rotator cuff tears are a common cause of shoulder pain. Not all patients who experience a tear require surgery, but factors such as previous treatment, age, activity level, and functional deficits are considered when contemplating surgery as an option.[1] In this case, our patient was a 67-year-old female who had exhausted non-operative treatments including corticosteroid injections and physical therapy without improvement of pain. Surgical treatment was discussed and elected by the patient. Surgical management involved a double-row repair of the rotator cuff with augmentation of the supraspinatus tendon with the Integrity implant. The Integrity implant is composed of hyaluronic acid derivatives and may enhance healing by aiding in cellular infiltration and collagen organization.[2] This case report showcases the successful use of a hyaluronic acid-based scaffold (Integrity implant) in accelerating recovery in a 67-year-old female patient who presented with a full-thickness right rotator cuff tear.

Case Presentation

We present the case of a 67-year-old female with a chief complaint of right shoulder pain. The patient exhibited pain after a fall and reported difficulty sleeping. Past medical history was significant for obesity with a BMI of 36. On physical exam, the bicipital groove and lateral shoulder were tender to palpation. During rotator cuff testing, there was pain with Jobe's test, diminished supraspinatus strength, and positive impingement signs. An X-ray demonstrated significant osteopenia and minimal glenohumeral joint arthritis. An MRI demonstrated a 1.5cm full-thickness tear of the leading edge of the supraspinatus without associated atrophy, and long head biceps tenosynovitis. The findings from testing were discussed with the patient, along with both non-operative and operative treatments. After discussion with the patient, surgical intervention was elected. The postoperative plan followed the authors' standard cuff repair protocol, consisting of sling immobilization for 6 weeks with pendulum exercises, as well as non-weightbearing except for activities of daily living (ADLs).

Surgical Technique

The patient was transferred to the operating room where endotracheal general anesthesia was administered. The patient was placed in a beach chair position and the operative extremity was prepped and draped in the sterile fashion. Diagnostic arthroscopy was performed on the right shoulder by inserting a camera through a posterior portal. An anterior portal was created under needle localization through the rotator interval. The joint was inspected, and the full thickness supraspinatus tear confirmed (Figure 1). The long head of the biceps tendon was found to be torn, with a residual stump at the superior labrum. Coincidentally, a cranial subscapularis tendon tear was also found.

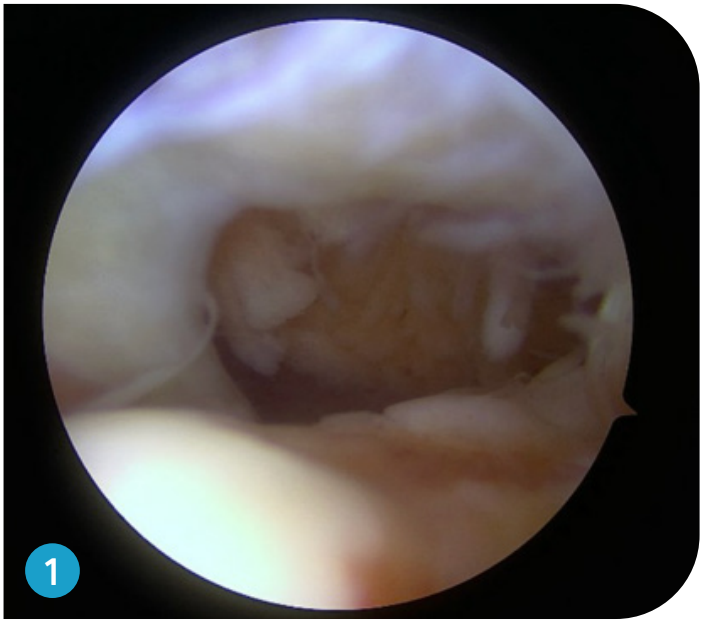

Figure 1. *Full thickness tear of the leading edge of the supraspinatus, as visualized from the posterior portal of the right shoulder intra-articularly*

A shaver was used to debride the lesser tuberosity to prepare the surface for repair. A traction suture was placed into the subscapularis tendon to aid in provisional reduction. A free suture tape was passed in an inverted horizontal mattress through the subscapularis and loaded onto a 4.75mm anchor. The anchor was then inserted into the upper aspect of the lesser tuberosity to repair the subscapularis. The residual long head of the biceps tendon stump was also debrided using a shaver and radio-frequency ablation device.

The camera was then inserted into the subacromial space. A lateral portal was established and a subacromial bursectomy was performed. The greater tuberosity footprint was prepared down to bleeding bone. A grasper was used in the lateral portal to determine suture placement for a tension-free repair. A percutaneous incision was created for inserting a double-loaded all-suture medial row 2.6mm anchor (Figure 2).

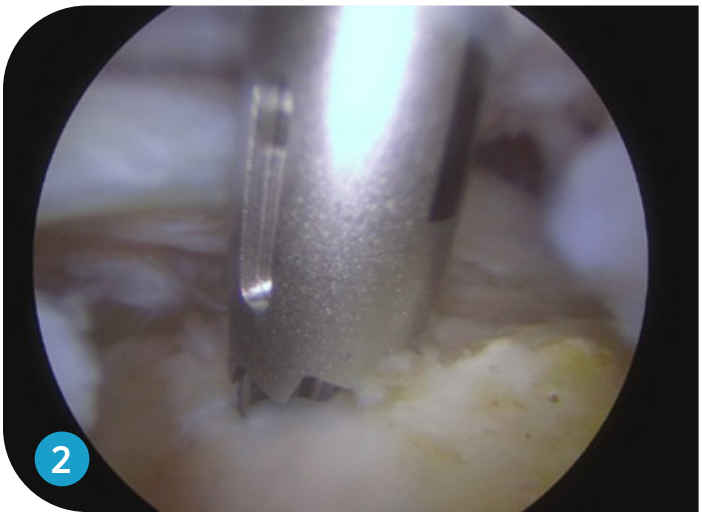

Figure 2. *Insertion of medial row anchor at the junction of the chondral surface and greater tuberosity, as viewed from the subacromial space*

The suture tapes from the anchor were then passed through the supraspinatus tendon using a suture passing device. These were then retrieved and loaded into a 4.75mm lateral row anchor. The anchor was inserted into the lateral aspect of the greater tuberosity, thus creating a standard double-row rotator cuff repair (Figure 3).

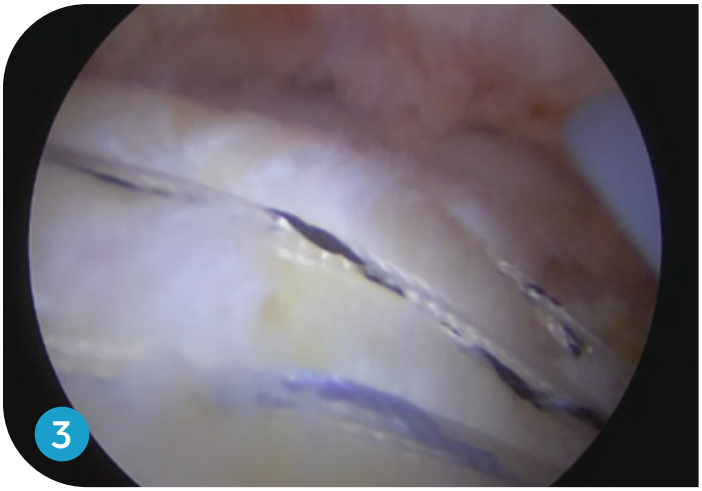

Figure 3. *Subacromial view of double-row rotator cuff repair, as viewed from the subacromial space*

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The Integrity implant was then introduced into the subacromial space using the lateral portal. It was positioned so that it would cover the underlying repair site. The implant was first fixed to the lateral aspect of the greater tuberosity with a bone staple. The implant was rolled out medially using the commercially available inserter (Figure 4). This was then secured to underlying tendon with several PLGA tacks (Figure 5).

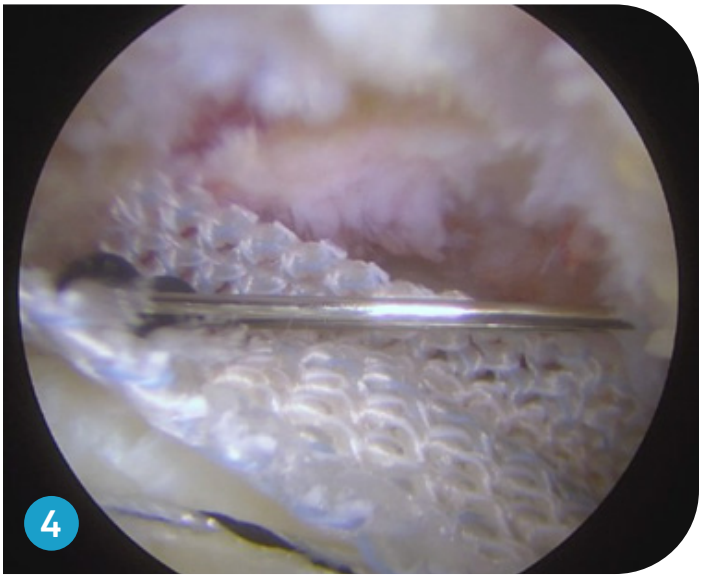

Figure 4. *The Integrity graft being introduced into the subacromial space using an inserter above the rotator cuff repair site, as viewed from the subacromial space*

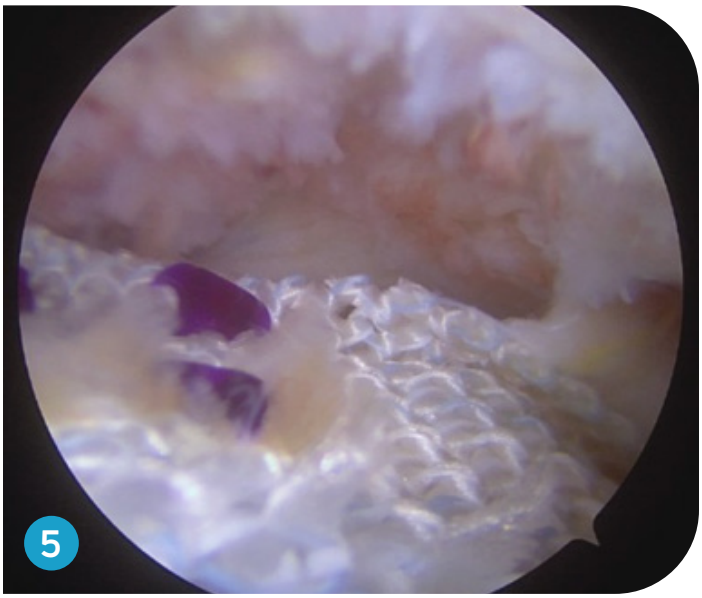

Figure 5. *The Integrity graft that has been secured to underlying rotator cuff tendon with several PLGA tacks and covering the repair site*

This provided completed coverage of the repair site, with the implant spanning from medial to the tear site to the lateral aspect of the greater tuberosity. The portals were then closed in a standard fashion and sterile dressings applied. The patient was placed in a sling and discharged home.

The patient's initial post-operative recovery was unremarkable for any acute issues. The sling was discontinued and formal physical therapy started at 6 weeks. The patient followed up at 3 months, reporting no pain. She had symmetric ROM compared to the contralateral side and 5/5 strength of the rotator cuff. The typical recovery for a cuff repair entails 6 months before normal function is regained, particularly with regards to strength.[3] In this case, our patient had a remarkably accelerated recovery by the 3-month post-operative timepoint, in terms of pain relief, range of motion, and strength.

Discussion

Our case highlights the successful use of a hyaluronic acid-based scaffold for augmentation of a double-row repair of a full thickness rotator cuff tear, that resulted in an accelerated post-operative recovery. Hyaluronic acid (HA) occurs naturally in the body and is crucial for many bodily functions, including providing lubrication and cushioning in synovial joints.[4] HA is a naturally occurring glycosaminoglycan. It is a key factor in the healing process by acting as a binding site for regenerative cytokines and chemokines that facilitate cellular migration, proliferation and differentiation, angiogenesis, and immunomodulation.[5]

The Integrity implant is used to support the natural repair process. With increasing age, there is an increased risk of re-tear after cuff repairs. In patients who are 50-59, 60-69, 70-79, and over 80 the re-tear rates are 10%, 15%, 25%, and 34%, respectively.[6] Other factors such as smoking status, nicotine use, diabetes, larger tear sizes, retracted cuff tears, atrophy of the cuff musculature, high activity level, and osteoporotic bone all contribute to higher re-tear rates.[7] Several techniques have been used to try to improve healing rates after cuff repairs - vented anchors, the "crimson duvet", medialized repairs, bone marrow aspirate concentrate (BMAC), Platelet Rich Plasma (PRP), dermal grafts, collagen-derived grafts, etc.

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However, re-tear rates remain high. Our case highlights that the addition of a synthetic HA-derived scaffold may be part of the solution, although further study is required. The modified Rotator Cuff Healing Index (RoHI) score is a useful tool to predict healing after cuff repair and can help surgeons identify patients who may benefit from augmentation.[8]

The Integrity implant is a composite of Hyaff and polyethylene terephthalate (PET). More specifically, the implant is 80% Hyaff-11 and 20% PET. Hyaff is a benzyl ester derivative of HA which exhibits superior stability and strength, as well as slower rate of degradation when compared to unmodified HA. Naturally occurring HA degrades rapidly in the body with a half-life of minutes to hours.[9] Hyaff-11 is used because of its ability to increase in-residence time in situ. The scaffold is a solid form that is water-insoluble which can be processed into different resorbable solid-form configurations. When Hyaff degrades, it releases native HA molecules creating an environment rich in HA, aiding in natural healing and tissue regeneration. Studies show that HA accelerates tendon-bone healing.[10] PET imparts mechanical stability, allowing for greater implant strength. When HA and PET are paired together, it creates a product with both mechanical and biological potency.

Our case demonstrates the potential benefits of augmenting rotator cuff repairs with the Integrity implant. The patient's subjective shoulder value increased from 60 preoperatively to 85 by only 12 weeks post-operatively. Most importantly, the case demonstrates rapid improvement in ROM and strength, more so than is typically seen at 3 months post-operatively with non-agumented repairs. Our case demonstrates that cuff repairs augmented with the Integrity implant may allow for faster rehabilitation, earlier transition to a home exercise program, and earlier return in rotator cuff strength. Synthetic implants may also help avoid reactive buritis complications associated with bovine collagen grafts.[11,12]

Conclusion

Rotator cuff repairs have high re-tear rates and extended post-operative rehabilitation. Many techniques have been employed to boost healing rates and shorten recovery but with inconsistent outcomes. Our case highlights that synthetic scaffolds, such as the Integrity implant, can shorten rehabilitation and lead to a faster regain in strength and ROM than non-augmented repairs, particularly in higher risk patients, while avoiding the complications of bovine grafts. The Integrity implant offers a unique combination of PET and HA-derived components that offer both improved implant strength and enhanced biologic healing.[2]

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