Technical Note

Surgical Technique: Using an Acellular Dermal Allograft and Bioresorbable Wick Scaffold During Endoscopic Gluteus Medius and Minimus Repair

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Abstract: Lateral hip pain, also known as greater trochanteric pain syndrome, encompasses a spectrum of pathology, including trochanteric bursitis, gluteus medius and minimus tears, and iliotibial band pathology. Patients with greater trochanteric pain syndrome can have tearing of the hip abductors, leading to refractory pain that may necessitate surgical repair. Compared to an open approach, endoscopic gluteus tendon repair is becoming more popular and has been shown to decrease morbidity. Similar to rotator cuff repairs, hip abductor repairs are subject to failure secondary to many factors. These include poor biology, tear size, tissue quality, and deficiency of tendon-to-bone healing. Previous work included the use of acellular dermal allograft to augment at-risk gluteus medius and minimus repairs and improve repair strength. The following technique utilizes a rotium bioresorbable wick scaffold at the bone-tendon interface in addition to an acellular dermal allograft covering the repair in a "biological sandwich" to further augment repair. This technique focuses on the addition of rotium augment implementation and fixation in a safe and reproducible manner.

Gluteus medius and minimus tears contribute to the spectrum of pathology resulting in lateral hip pain. Chronic tendonitis and tendinopathy are common causes of gluteal muscle tears and are typically treated with corticosteroid injections, nonsteroidal anti-inflammatory medications, and physiotherapy.[1] Unresolved cases can be secondary to hip abductor tearing and may require surgical intervention. Endoscopic repair of the hip abductor tendons is becoming more common.[2] Compared to open surgery, endoscopic approaches are reported to have fewer postoperative complications.[2,3] However, multiple factors such as fatty infiltration, older age, revision, and massive tears lead to worse functional outcomes in such repairs and could benefit from augmentation of repair.[4-6] Browning et al.[7] recently reported high clinical success >90% for magnetic resonance imaging grade 1 to 4 tears of the abductor tendons but decreased success with Goutallier classification grade 4 versus grade 1 tears (70% vs 100%). This suggests that poor biology still poses a challenge. Laskovski and Urchek[5] discussed a technique using human dermal allograft to augment gluteal tendon repair. This Technical Note seeks to expand upon Laskovski and Urchek[5] by adding a rotium bioresorbable wick (Atreon Orthopedics) to an acellular human dermal allograft to improve patient outcomes.

Rotium augment is a synthetic, biodegradable nanofiber scaffold that mimics the structure of the extracellular matrix.[8] Studies performed using bioresorbable scaffolds in the rotator cuff have shown promising results. Seetharam et al.[9] analyzed the outcomes of 33 patients who underwent arthroscopic rotator cuff repair using a nanofiber scaffold for small- to medium-sized tears. They found significant improvement in shoulder function tests, with 91% of patients showing the scaffold resorbed and not visible on magnetic resonance imaging 11 months postoperatively.[9] The increased growth potential and strength with scaffolds have been implicated in both animal and human studies. Sheep

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Received June 24, 2024; accepted September 28, 2024.

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2212-6287/241019

https://doi.org/10.1016/j.eats.2024.103312

studies with nanofiber scaffold used for infraspinatus repairs showed statistically significant increases in ultimate failure force, load, and stress from 6 to 12 weeks.[10] Histologic examination also showed collagen formation resembling Sharpey fibers, perforating collagen from tendon to bone, that was not seen in the control group.[10]

We describe an endoscopic technique combining the rotium wick, which has excellent biocompatibility and facilitates the biological healing process, with nonirradiated human acellular dermis to the repaired tendon tissue. The purpose of this technique is to augment at-risk tendon repairs, focusing on technique, implementation, and fixation in a safe and reproducible manner.

Surgical Technique

We describe a detailed technique of the procedure shown in Video 1. Much of the following technique is similar to Laskovski and Urchek's previously described endoscopic gluteal repair article, with the addition of rotium augment.[5] We have included common portions of the procedure here as well for practical purposes.

Patient Setup

The patient is placed supine on the hip arthroscopy table under general anesthesia. The feet are stabilized in padded boots with the foot internally rotated 20° and adducted to neutral. We do not use traction as that may close the peritrochanteric space. We use fluoroscopy to plan our proximal anterolateral (PALA) portal and our distal anterolateral (DALA) portal using a 17-gauge spinal needle. The PALA portal is placed perpendicular to the footprint of the greater trochanter for visualization and anchor placement. The DALA portal is placed parallel to the footprint of the gluteal tendons (Fig 1). The spinal needles are placed in the desired trajectory outlined above, with small stab incisions made to allow for instrument placement.

Approach

The arthroscope is placed in the PALA portal, and a coblation wand is placed in the DALA portal. The iliotibial band (ITB) is exposed and the coblation wand used to make a longitudinal cut in the ITB to expose the peritrochanteric space. This ITB release is carried approximately 2 cm past the tip of the greater trochanter. Approximately 20° to 30° of abduction is placed on the operative limb to provide better access and more volume to the peritrochanteric space. The trochanteric bursa is encountered and removed using the coblation wand and reciprocating shaver. The tendons of the gluteus medius, gluteus minimus, vastus lateralis, and gluteus maximus are then identified. Once the tear has been identified, the footprint is debrided using a shaver to expose cancellous bone for tendon-to-bone healing (Fig 2). At this point, the DALA portal length is measured using a calibrated switching stick, and an EZ switch cannula (CONMED Linvatech) is placed and cut to the measured length.

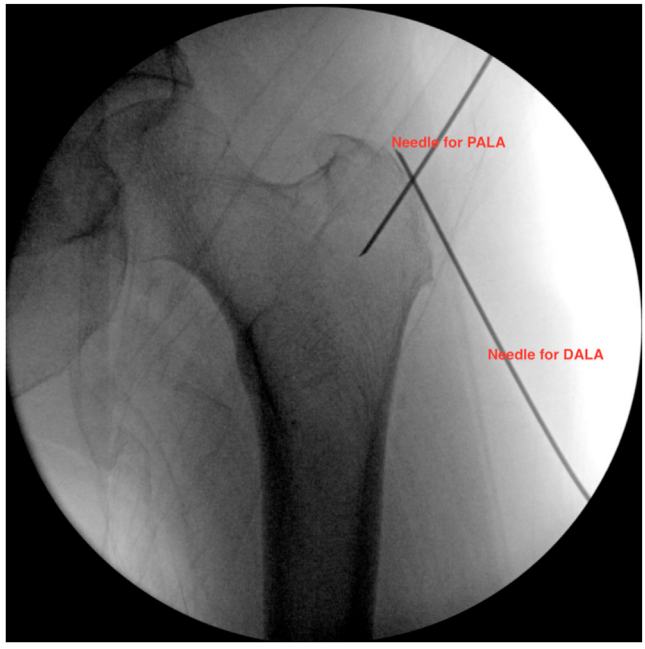

Fig 1. Fluoroscopy showing the proximal anterolateral portal and distal anterolateral portal placement on a left hip with the patient supine.[5]

Tendon Repair With Rotium Augmentation

The PALA portal is measured with the calibrated switching stick and secured using the CONMED EZ

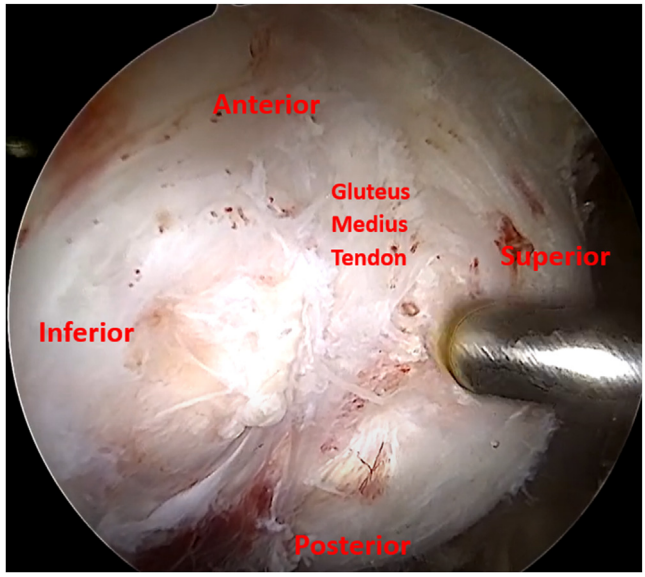

Fig 2. Endoscopic picture of left hip gluteus medius high-grade partial-thickness tear viewed through the distal anterolateral portal.

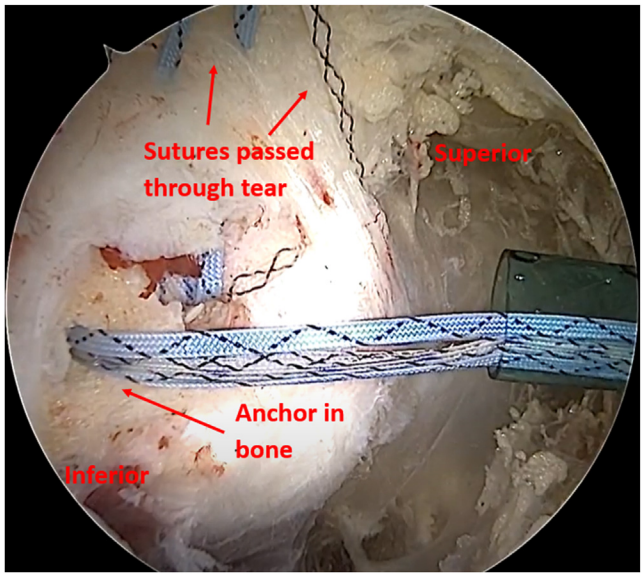

Fig 3. Tripled-loaded anchor placement at the footprint of the gluteus medius tendon prior to repair, viewed from the distal anterolateral portal.

switch cannula. An accessory percutaneous PALA portal is also established perpendicular to the gluteal tendon footprint on the greater trochanter for anchor placement. Between 1 and 3 triple-loaded anchors are placed through the accessory percutaneous PALA portal depending on the size of the tear (Fig 3). The most proximal suture set is retrieved from the DALA portal with the ringed grasper. The rotium biological augment (Rotium Bioresorbable Wick; Atreon Orthopedics) is prepared with a small incision in the center, enough for the ringed grasper to fit through without tearing. The sutures retrieved through the DALA portal are then passed through the rotium augment. The rotium augment is folded in half and, with tension on the sutures, passed down the DALA cannula, underneath the tendon, to the trochanteric footprint with the ringed suture retriever (Fig 4). The sutures are then retrieved back out of the accessory percutaneous PALA portal. Retrograde suture passers and antegrade suture passers are used to primarily repair the gluteus medius and minimus tendons back down to the footprint (Fig 5).

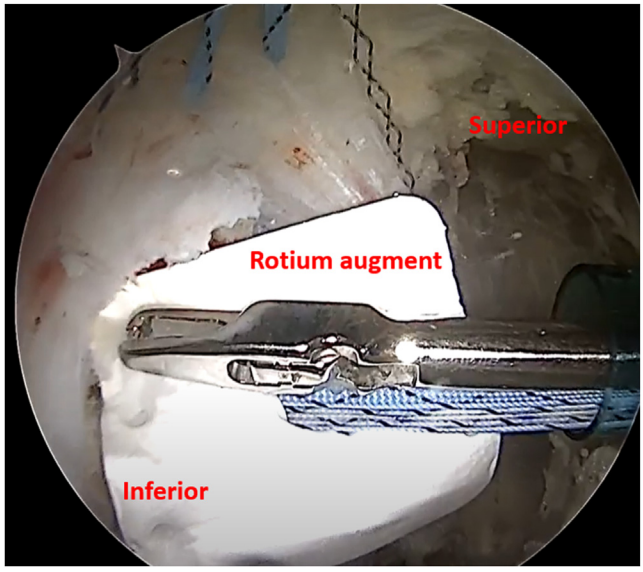

Fig 4. Passage of the rotium graft to the footprint at the greater trochanter and placement under the tendon at the bone-tendon interface, viewed from the distal anterolateral portal.

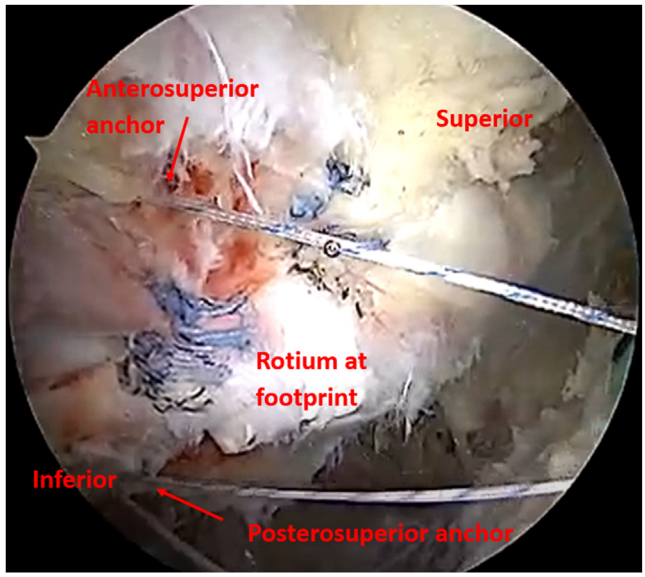

Fig 5. Completed gluteus minimus repair overlying the rotium augment viewed from the distal anterolateral portal. In this image, the sutures from additional anchors are visible. They will be used to both pass and tie down the dermal allograft on top of the repair.

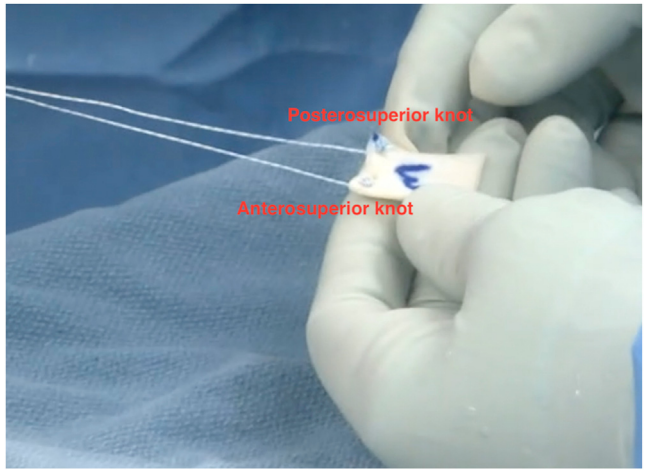

Fig 6. Sutures from the anterosuperior and posterosuperior anchors passed through the dermal allograft and mulberry knot tied for graft shuttling into the hip. The epidermal side of the graft is marked for correct orientation inside the hip.[5]

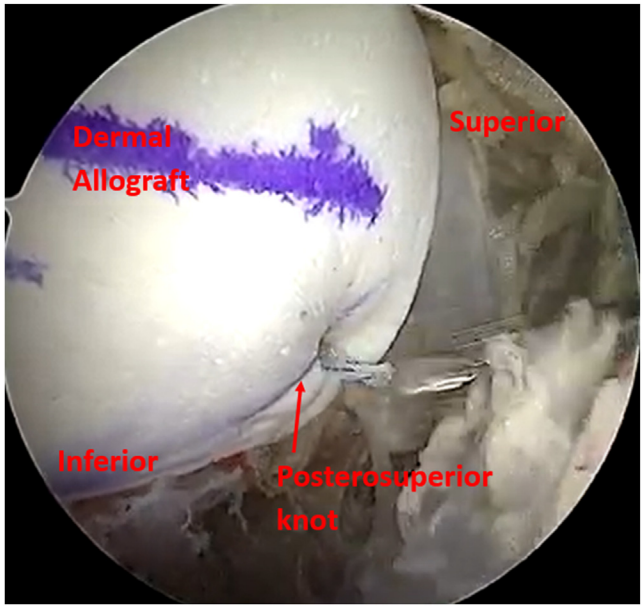

Fig 7. Acellular dermal graft in place, with the posterosuperior edge tied down. A total of 4 anchors, 1 at each corner, are used to secure the graft. Viewed from the distal anterolateral portal.

Various suture techniques may be used for the repair, such as simple convergence and modified Mason Allen, depending on tear quality and pattern. Once all the sutures are tied and cut, we may proceed with allograft placement.

Allograft Preparation, Delivery, and Initial Fixation

The acellular dermal allograft is passed in a fashion similar to what has been described in previous work.[5] The footprint of the tendons is measured using an arthroscopic ruler, and the graft is prepared to fit the measured footprint. Superior to inferior and anterior to posterior measurements are made, and the graft is prepared on the separate Mayo stand. The epidermal surface of the graft is marked. Two percutaneous anchors are placed anterosuperiorly and posterosuperiorly, and the sutures are used for passage of the graft. One limb from each suture is then retrieved through the DALA portal. The anterosuperior suture is passed through the anterosuperior portion of the allograft with a free needle or antegrade suture passer, and a mulberry knot is tied (Fig 6). The posterosuperior suture limb is passed through the posterosuperior portion of the graft. The graft is then placed into the DALA cannula and folded in half along the longitudinal axis of the graft. The opposite limbs are pulled simultaneously, which allows the allograft to be shuttled through the DALA cannula. An arthroscopic knot pusher will likely be needed to help the allograft traverse the cannula. The allograft is then placed onto the footprint, and the sutures are individually tied, securing the superior portion of the graft (Fig 7).

Table 1. Pearls and Pitfalls of the Surgical Technique

Pearls	Pitfalls
Proper patient position, minimal traction, and abduction of the leg to increase peritrochanteric space	Failing to establish portals in proper orientation and trajectory
Maintain adequate visualization and hemostasis throughout the case	Failing to obtain adequate visualization of footprint
Placement of rotium under the repaired tendon	Inadequate placement of the rotium at the bone-tendon interface
Use of mulberry knots and suture tails to shuttle augments into the endoscopic space	Failing to fix the rotium wick to tendon before fixing the allograft
Good knot and loop security to compress the allograft to the repair site	Failing to maintain suture management while fixating the grafts
Compliance with postoperative instructions during the healing phase	Failing to place the dermal side of the acellular dermal allograft toward the repaired tendon

Final Allograft Fixation

Lastly, the inferior portion of the allograft is fixed with 2 inferiorly placed anchors. The graft is pulled with enough tension to fit snugly across the repair during final fixation. Once the allograft is fully secured, the repair construct is tested by ranging the operative extremity while evaluating for tendon gapping and integrity of the dermal allograft. Given the technical demands of the procedure, knowledge of the pearls and pitfalls is invaluable (Table 1).

Postoperative Rehabilitation

The patient is made foot-flat touch-down weightbearing for 4 weeks. Physiotherapy is initiated at 2 weeks for most repairs and 6 weeks for massive, retracted gluteus medius/minimus tears, focusing initially on gentle range of motion and isometrics. Progressive weightbearing to 50% is initiated at 4 weeks postoperatively, with the goal of full weightbearing without an assistive device by postoperative weeks 6 to 8. Strengthening is initiated at that time point, with the goal of full strength to be achieved by 24 weeks postoperatively.

Discussion

While the acellular human dermal augment provides structural support on top of the repair, rotium augment is placed at the bone-tendon interface to facilitate healing. Most of the literature regarding rotium involves the rotator cuff.[8-10] However, we feel that

Table 2. Advantages and Disadvantages of Adding a Rotium Bioabsorbable Wick During Gluteus Medius and Minimus Repair

Advantages	Disadvantages
Augments tendon repair for increased strength and healing	Added expense for augments and anchors
Technique is reproducible	Strict patient compliance with postoperative restrictions required during the healing phase
Acellular human dermis provides immediate strength to repair while healing	Added technical difficulty
Rotium wick enhances healing at tendon-bone interface	Prolonged surgical time with the addition of rotium wick to acellular human dermis augment
Simultaneous beneficial effects of both rotium wick and acellular human dermis allograft	
Can be used in patients with hypersensitivity	

application to the hip is reasonable.[6,7,10-12] The gluteus medius and minimus have been compared to the rotator cuff and termed the "rotator cuff of the hip" because they are similar in terms of function, biology, and capacity for healing.[9,12] However, one major difference is the demand of weightbearing, which may further complicate repair and cause an even higher risk of retear.

In the treatment of gluteus medius and minimus tears, a subset of patients with risk factors for retear may benefit from augmentation of the repair (Table 2). Combining acellular dermal allograft with a rotium bioresorbable wick in a "biologic sandwich" will likely increase the strength of a repair based on the current literature.[6,8,9] Our current use of this technique includes revision of failed endoscopic glute repair and patients at high risk for tearing based on biological factors. Considerations when using this technique should be taken. One must consider patient risk factors and the cost of the augmentation, as well as the potential benefit to the patient. While this technique likely improves the strength of a repair, studies analyzing patient outcomes are needed to show efficacy. This presents a challenge due to the small population of patients requiring such augmentation and their potential high risk for retears despite the procedure.

In conclusion, the addition of a rotium bioresorbable wick and acellular human dermal allograft combines 2 safe and effective methods of augmenting at-risk tendon repairs in a safe and reproducible manner.

Disclosures

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: J.L. receives speaking and lecture fees from Smith & Nephew and CONMED. All other authors (D.R., N.T., E.C.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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