Revision Patella Tendon Repair: A Novel Surgical Technique

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Abstract: Revision patella tendon repairs are technically challenging, and to this point there is no gold standard with regard to treatment. Understanding how the surgeon previously repaired the tendon can be of use in the revision case. This includes a repair using anchor fixation in tunnels from the primary procedure, allograft augmentation under the retinacular layer, and application of a bioinductive implant.

Patella tendon ruptures are devastating injuries, with a retear rates after a repair being reported as high as 50%. If the primary repair fails at the inferior pole of the patella, there are many documented techniques on how to treat it. Options include using anchors, transosseous sutures, and augmentation, among many others. Unfortunately, there is no gold standard technique.

We describe a technique that can be used for proximal pole tears in revision cases. This includes a repair using anchor fixation in tunnels from the primary procedure, allograft augmentation under the retinacular layer, and application of a bioinductive implant.

Surgical Technique (With Video Illustration)

Indications

For patients who have ruptured their previous patella tendon repair, surgical intervention is recommended. Along with a basic clinical examination, radiographs and magnetic resonance imaging (MRI) are recommended to confirm the diagnosis and to formulate a preoperative plan. Radiographs, as seen in Fig 1, typically show patella alta with an Insall–Salvati ratio greater than 1.2. MRI is confirmatory and can show the tendon rerupture. In revision cases, it’s important to obtain an old operative report and carefully read the MRI to assess for how the surgeons fixed the tendon the first time. As seen in Figs 2 and 3, previous transosseous tunnels were used. These tunnels can be used for anchor fixation in the revision setting. It’s important to understand how the primary repair was performed, as this can change your revision technique.

Patient Setup

The patient is supine on the operating room table with both legs prepped, as in Fig 4 A-C and Video 3.

Fig 1. Preoperative knee lateral radiograph showing the Insall–Salvati ratio, which is used today to assess for appropriate patella height. In this case, the patella tendon is torn and the radiograph shows patella alta.
Contralateral limb is critical to assess for patella height so when repairing the injured knee, the surgeon can aim to have equal Insall–Salvati ratios. A tourniquet should be placed on the operative extremity, and a sterile bone foam can be used.

Exposure

A midline incision is made down to the patella tendon. It’s important to assess how the surgeon performed the previous procedure (Fig 5 and Video 4). The patella bone quality and tendon tissue must be evaluated before proceeding (Video 5). Sutures or anchors from the previous procedures should be removed, and the poor-quality tissue also should be removed. The inferior pole of the patella should be visualized, and the previous bone tunnels need to be well outlined. If the patella bone tunnels are well intact, these can be incorporated for anchor fixation in revision cases (Fig 6). Radiographs should be taken to ensure you can pull down the patella and recreate the patella height (Fig 7).

If the tissue quality is too poor, or the previous bone tunnels are not sufficient to be used in this revision setting, then this technique would not be appropriate. The tendon tissue needs to be able to be repaired primarily and the bone tunnels in the patella need to be structurally sound.

Augment Graft Preparation

A 6.5-mm posterior tibialis tendon allograft is the recommended graft due to strength and size. Whipstitch both ends with FiberLoop (Arthrex, Naples, FL) (Fig 8).

Patella Tendon Repair Technique

Place two #5 FiberWires (Arthrex) in a running locking manner in the proximal tendon fibers (Fig 9 and Video 6). Then, preload the FiberTape (Arthrex) suture ends from the tendon onto two 4.75-mm SwiveLock anchors (Arthrex) (Fig 10). It’s important to assess the previous bone tunnels in the patella to ensure they are intact (Video 5). Insert the two 4.75-mm SwiveLocks in the inferior pole of patella in the bone tunnels made from the first procedure (Fig 11 and Video 7). Ensure there is no tendon gapping after tightening down the suture (Video 8).

Augment Technique

After the tendon is repaired and anchored into the inferior pole of the patella, it’s time to place an augment to protect the tendon. Place the guide pin in the lateral to medial fashion posterior to the anterior surface of the tibial tubercle (Fig 12 and Video 9). Over-ream with a 6.5-mm reamer. Using a passing suture, slide the graft through the tunnel just created in the tibial tubercle (Fig 13 and Video 10) the allograft up the medial and lateral side of the tendon. Next, using a tonsil clamp, slide the graft below the retinacular layer both medially and laterally (Fig 14 and Video 11). The graft is to then exit the retinacular layer at the superior pole of the patella. With the knee flexed to approximately 30°, tension down our allograft and tie down the 2 ends of the graft using #5 FiberWire. Make sure there is no gapping of the augment.
Fig 4. (A) In the operating room, it’s important to examine bilateral knees. As seen here, the left knee has a large effusion and previous midline incision is noted. The incision location is important for planning on where the revision incision will be made. (B) In the operating room, again, examine both extremities. Here is a lateral view of the left knee effusion compared with the right/noninjured knee. (C) Operating room setup includes placing the patient supine on a radiolucent table. A tourniquet is placed on the operative extremity. A bone foam is placed under the operative extremity.

Fig 5. After exposure, carefully evaluate the wound. As seen here, the previous failed suture repair is in the wound, as sutures can be seen extending from the inferior pole of the patella distal to the tendon insertion.
Bioinductive Implant Application

Place the bioinductive implant consisting of large REGENETEN patch (Smith & Nephew, Andover, MA) over the repair site (Fig 15 and Video 12). In this case it’s the proximal pole. Using #1 VICRYL (Ethicon, Somerville, NJ), suture the graft over the site of the repair in circumferential manner.

Intraoperative radiographs are obtained to ensure the patella height is restored and equal to the contralateral extremity (Fig 13). After a thorough irrigation, close the

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**Fig 6.** The old transosseous patella tunnels from the primary tendon repair that can be used for the revision procedure.

**Fig 7.** In the operating room, the surgeon wants to evaluate the patella height of the noninjured knee to recreate that height on the injured leg. As seen here, a radiograph is used to evaluate the nonoperative knee and see if the injured patella can be pulled down to match its height.
retinacular with interrupted #1 VICRYL. Subcutaneous tissues closed with 2-0 VICRYL and skin with a 4-0 MONOCRYL (Ethicon). A total range of motion is placed in the operating room and locked in extension.

Postoperative Protocol

The patient will always be locked in extension from 0 to 3 weeks. They can be full weight-bearing immediately. At 3 weeks, they can begin range of motion, 0 to 45°; at 6 weeks, 0 to 90°; at 9 weeks, 0 to 120°; and at 12 weeks, full range of motion.

Discussion

Patella tendon rupture after a previous tendon repair can be a devastating injury, and revisions can be very challenging cases. When planning for revision cases, there needs to be discussion regarding how the repair will be done. Thought processes should include how will the tendon be repaired, is augmentation appropriate, and is there any role for additional implants. To this point, there has been many different techniques described, but unfortunately there is no optimal choice.

In patients who retear the patella tendon at the inferior pole, and the patella bone stock is sufficient, using suture anchors is superior to transosseous sutures in quality of repair. In this case, we are using running locking FiberWire suture within the proximal aspect of the tendon and used anchors for fixation into the patella.

Additionally, augmentation has been proven to decrease gap formation across the repair and should be implemented, especially in revision cases. The augment acts by stress shielding and can allow the tendon to heal. Multiple techniques have been described in the literature, included anchoring it into the patella and tibial tubercle, passing it in the retinacular layer, among others, all without a consensus on which is superior. In this case, we made a tunnel in the tibial tubercle and slid the allograft augment under the retinacular layer and tied it at the superior aspect of the patella. The purpose of the augment is to protect the repair and in revision cases it’s highly recommended.

We also used a REGENETEN (Smith & Nephew) bovine bioinductive implant. This implant has been

Fig 8. Posterior tibialis tendon allograft is used for augmentation and should be prepared on the back table with each end whip stitched.

Fig 9. Running locking sutures are placed within the proximal aspect of the patella tendon. These sutures will be anchored into the inferior pole of the patella.
Fig 10. Anchors from the patella tendon to be inserted into the inferior pole of the patella. Also seen is the augment tied at the superior pole of the patella. The dashed lines represent the path of the augment in the retinacular layer.

Fig 11. Anchors are placed into the inferior pole of the patella. The dashed yellow line is the path of the allograft augment in the retinacular layer and tied together at the superior pole of the patella.
Fig 12. K-wire drilled through the tibial tubercle. This is in preparation for the sliding of the allograft augmentation through it.

Fig 13. The allograft augment is passed through the tunnel within the tibial tubercle that was just drilled.
**Fig 14.** The augment is then passed proximally under the retinaculum and above the capsule. This is to protect the repair.

**Fig 15.** The bioinductive implant is placed at the inferior pole of the patella at the site of the rupture.
described mostly with the shoulder and rotator cuff tears. The purpose of the implant is to facilitate healing and can be considered in revision cases.

Lastly, in cases in which the primary repair used sutures through transosseous tunnels, it’s important to avoid making more tunnels in the patella. If those tunnels are still intact, the surgeon should use them for anchor placement. Creating more tunnels within the patella can increase the risk of fracture.

There are both advantages and disadvantages to this technique (Table 1). The main advantage to this technique is the ability to use previously created bone tunnels within the patella from previous techniques (Table 2). This allows the surgeon to avoid drilling in the patella, which decreases the risk of fracture and cartilage injury. The primary disadvantage to this technique is that assessing the previous bone tunnel quality can be difficult and in revision settings may be of high risk for anchor pullout. This is the critical step in the case and it those previous bone tunnels within the patella must be fully evaluated before anchor placement.

Table 1. Advantages and Disadvantages

|               | Advantages                                                                 | Disadvantages                                                                 |
|---------------|----------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Allograft augmentation protects the repair in the early stages of healing and can decrease the risk of rerupture. | In revision cases, it can be difficult due to scarring to fully evaluate the proximal aspect of the tendon and bone tunnel quality in the patella. |
| Using previous bone tunnels avoids the need for drilling in the patella, which decreases the risk of fracture and cartilage injury. A bioinductive implant promotes and stimulates healing at the repair sites. | There is a risk of fracture when drilling through the tibial tubercle for augment placement. |

Limitations to this technique is that revision patella tendon procedures are relatively rare and there needs to be longer follow-up and further studies evaluating these cases.

Ultimately, for proximal tendon tears off the inferior pole of the patella and in the setting of revisions, the application of suture anchors using previous tunnels (if the primary procedure used transosseous sutures), using an augment to protect the repair, and using a bioinductive implant should all be implemented as this gives the tendon the greatest chance for success.

Table 2. Pearls and Pitfalls

| Pearls | Pitfalls                                                                 |
|--------|--------------------------------------------------------------------------|
| Perform the patella tendon repair before allograft augmentation. | Make sure to pass the augment in the appropriate layer, above the capsule and below the retinaculum. |
| Carefully evaluate the bone tunnels within the patella prior to anchor placement. | Do not performed a repair using tissue that has a high risk of failing secondary to poor quality. At that point, allograft reconstruction should be discussed. |

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