

# Traumatic Midsubstance Patellar Tendon Ruptures: A Unique Surgical Repair Technique in the Setting of Poor Tissue Quality



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**Abstract:** In the setting of traumatic midsubstance patellar tendon ruptures in which the tissue is unable to be repaired end to end, surgical options are limited. We offer a technique using suture anchors for the native tendon reconstruction, allograft augmentation, and a bioinductive implant.

In the setting of midsubstance patellar tendon ruptures for which end-to-end repair is not feasible because of poor tissue quality, options are limited and there is no gold-standard repair technique. Augmenting the patellar tendon repair has been well documented in the literature and is still performed today. It provides the repair with stress shielding, allowing early range of motion, decreased gapping in the tendon repair, and increased load to failure.<sup>1,2</sup> Different methods are available for augmentation, including transosseous suture techniques and internal braces, among many others.<sup>3,4</sup> Unfortunately, there is no gold-standard technique, but there is a consensus that augmentation protects the repair and should be performed.

The application of a bioinductive implant may also assist with tendon healing because there are data on its application for rotator cuff tears.<sup>5</sup> The Regeneten bioinductive implant (Smith & Nephew, Andover, MA), which is composed of type I collagen, provides tissue scaffolding, creating an environment for tendon healing.<sup>5</sup>

We describe our surgical technique using allograft augmentation to protect the repair, suture anchoring of the tendon, and application of a bioinductive implant to promote healing.

## Surgical Technique

### Indications

In the setting of traumatic midsubstance patellar tendon ruptures when there is no option for end-to-end repair because of tissue quality, the options are limited. In these cases, it is highly recommended to augment the repair because this will provide stress shielding and give the tendon time to heal.

### Patient Evaluation

Prior to surgery, a thorough history and physical examination must be performed. Radiography and magnetic resonance imaging are recommended for a complete evaluation (Figs 1 and 2). It is important to identify the location of the patellar tendon rupture because this will dictate surgical treatment options. As shown in Fig 1, there may be well-corticated ossicles that are consistent with old Osgood-Schlatter disease. This is not an acute fracture. It is also important to obtain contralateral knee radiographs to assess for patellar height. The goal of surgery is to have equal patellar heights.

### Procedure

#### Exposure of Patellar Tendon

A midline incision is made overlying the patellar tendon (Video 1). A thorough evaluation of the tendon quality must be performed. In cases in which the tissue quality of the midsubstance tear is too degenerated for

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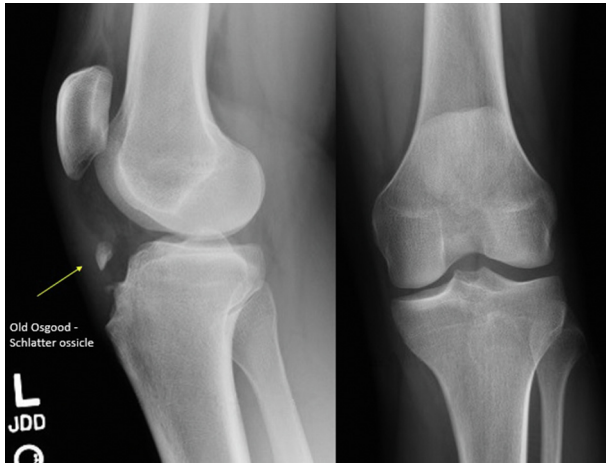
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**Fig 1.** Lateral (A) and anteroposterior (B) radiographs of knee. On the lateral radiograph, significant patella alta can be seen, most likely indicative of a patellar tendon tear. An old Osgood-Schlatter ossicle is identified on these films; it is not a fracture. (L, left.)

an end-to-end repair (Fig 3), our technique should be performed.

#### Patellar Tendon Remnant Suture Management

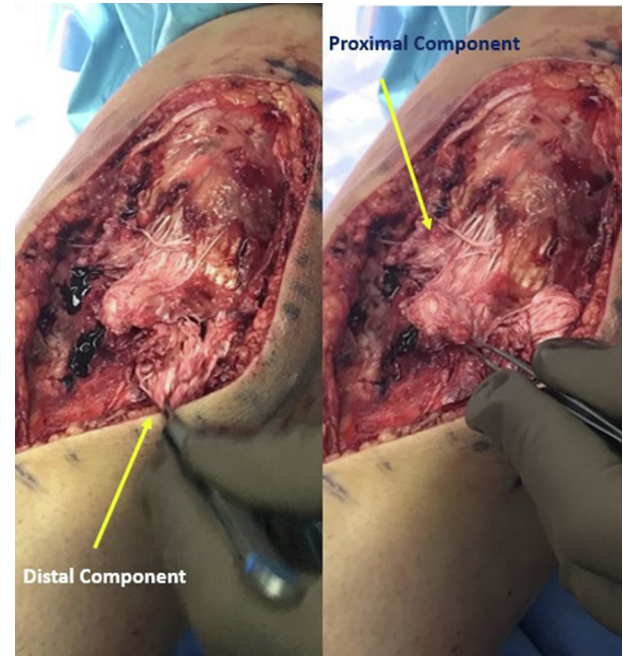
Two No. 5 FiberWires (Arthrex, Naples, FL) are placed in a running locking fashion in the proximal tissue fibers, off the patellar tendon (Video 1, Fig 4). Then, 2 additional FiberTapes (Arthrex) are placed, coming off the tibial tubercle distal fibers, in a running locking fashion.

#### Allograft Augmentation

A 6.5-mm anterior tibialis tendon allograft is the recommended graft owing to strength and size. On the



**Fig 2.** T1 sagittal magnetic resonance imaging of the knee shows a patellar tendon tear.



**Fig 3.** With the patient supine on the operating room table, a midline incision is made to expose the patellar tendon. It is critical to evaluate the tendon quality, tear type, and reparability. The midsubstance tendon tear can be seen, along with poor-quality tissue owing to trauma.

back table, both ends are whipstitched with FiberLoop (Arthrex).

The surgeon should identify the tibial tubercle. A guide pin is placed in the lateral-to-medial fashion posterior to the anterior surface of the tibial tubercle. Over-reaming is performed with a 6.5-mm reamer. By use of a passing suture, the graft is slid through the tunnel just created in the tibial tubercle. Both the



**Fig 4.** FiberWire sutures are placed in a locking fashion in the proximal patellar tendon leaflet. The proximal aspect of the tendon will be anchored into the proximal tibia.

allograft limbs are brought up along the medial and lateral side of the patellar tendon (Video 1, Fig 5). By use of a tonsil clamp, the graft is passed below the retinacular layer to the superior pole of the patella (Video 1, Fig 6). With the knee flexed to 30°, the allograft is tensioned down and 3 No. 5 FiberWire sutures are placed in a figure-of-8 fashion to help approximate the 2 graft ends (Video 1, Fig 7). This will maintain the allograft in the appropriate position.

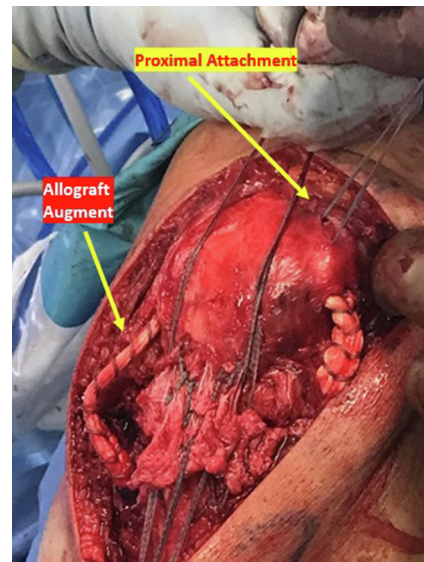
#### Patellar Tendon Repair and Anchor Placement

Two guide pins are placed in the inferior pole of the patella, separated by 20 mm (Video 1, Fig 8). Overreaming is performed with a 4.5-mm reamer. Then, the FiberTape suture ends from the distal tendon are preloaded onto two 4.75-mm SwiveLock anchors (Arthrex). The two 4.75-mm SwiveLocks are inserted in the inferior pole of the patella on both sides. The accessory sutures should remain in place. The FiberTapes are appropriately tensioned, and the anchor is seated.

Next, the surgeon preloads 2 additional 4.75-mm SwiveLocks and the remaining FiberTape suture limbs from the proximal leaflet. This is performed in a SpeedBridge fashion (Arthrex). Two guide pins are inserted adjacent to the tibial tubercle and over-reamed with a 4.5-mm reamer. The surgeon then again inserts both anchors simultaneously and appropriately tensions the tapes so as not to over-tension the repair (Video 1). These are both seated. Evaluation shows great overlap of the tendon with appropriate tension (Fig 9).



**Fig 5.** An allograft augmentation is chosen to protect the repair. A 6.5-mm allograft is shuttled through the tibial tubercle tunnel and passed proximally.

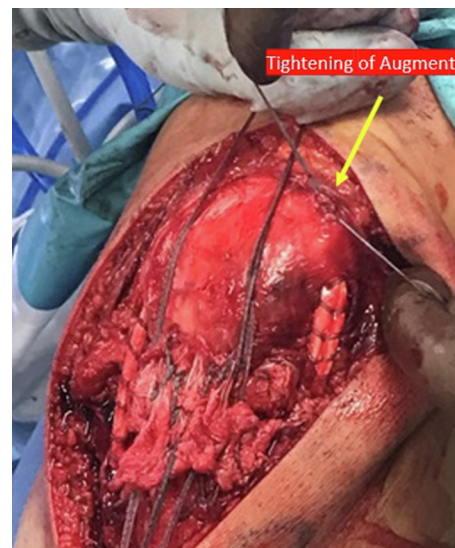


**Fig 6.** The allograft augmentation is passed through the retinacular layer and united at the superior pole of the patella.

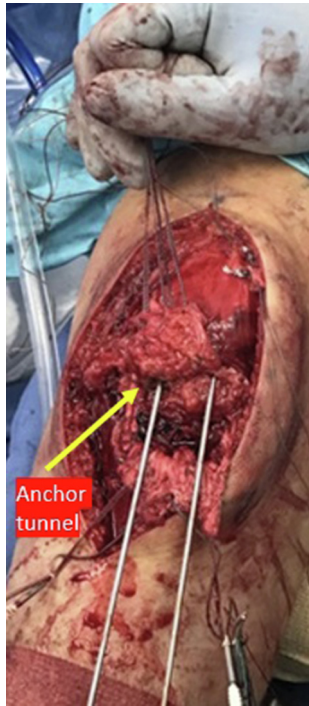
The 2 additional accessory sutures from the proximal SwiveLock are passed in a mattress fashion through both the allograft and the native tendon. This is performed to help reduce the allograft nicely to the native patellar tendon. Additional Vicryl sutures (Ethicon, Somerville, NJ) are placed between the native tendon and the allograft to help the repair.

#### Bioinductive Implant Placement

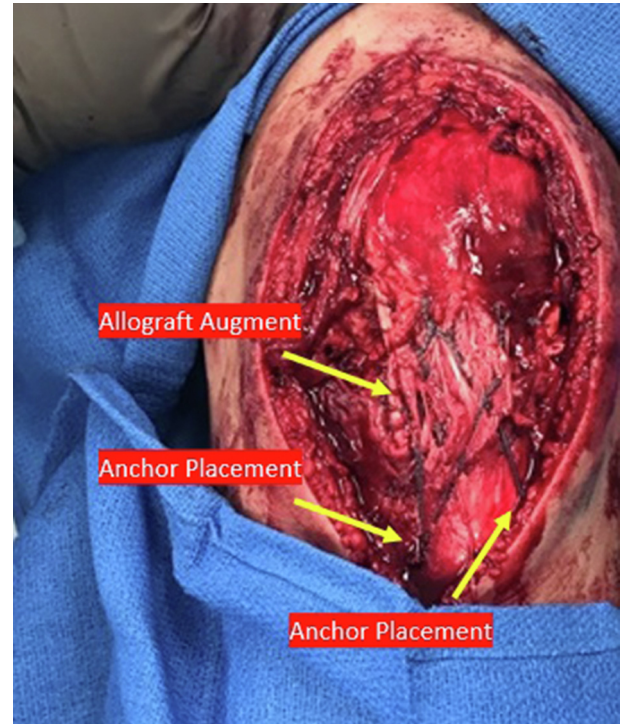
Because of the poor nature of the midsubstance fibers, in many cases, it is appropriate to place a



**Fig 7.** With the knee in 30° of flexion, the allograft augmentation is appropriately tensioned and sutured together. This is critical because the augmentation is what protects the tendon repair. The surgeon should ensure that the augmentation is tightened and sutured securely.



**Fig 8.** In preparation for anchors, 2 guide pins are placed in the inferior pole of the patella and over-reamed. This is where the anchors will be placed for fixation of the distal patellar tendon tissue.



**Fig 9.** The proximal tendon tissue is overlapping the distal tendon tissue and is anchored into the proximal tibia. Not shown is the distal tendon tissue underlying the proximal tissue fibers and anchored into the inferior pole of the patella.

bioinductive implant consisting of a large Regeneten patch (Smith & Nephew) to stimulate healing. The graft is placed over the midportion of the patellar tendon and sutured with interrupted No. 1 Vicryl (Video 1, Fig 10). Intraoperative radiographs are obtained to ensure the patellar height is restored and equal to that of the contralateral extremity (Fig 11).

After a thorough irrigation, closure of the retinacular and paratenon layers with interrupted No. 1 Vicryl is performed. Subcutaneous tissues are closed with No. 2-0 Vicryl, and skin is closed with No. 4-0 Monocryl (Ethicon). A TROM brace (DJO, Vista, CA) locked in extension is then placed in the operating room.

### Postoperative Protocol

The brace is locked in extension at all times from 0 to 3 weeks. The patient can begin range of motion at 3 weeks, consisting of 0° to 45°, followed by 0° to 90° at 6 weeks, 0° to 120° at 9 weeks, and full range of motion with no limitations at 12 weeks.

### Discussion

Traumatic midsubstance patellar tendon ruptures with poor tissue quality can be difficult to treat because there is limited literature and no gold-standard technique. The most recent surgical

technique in the literature regarding the treatment of acute midsubstance tears is that of Rothfeld et al.<sup>4</sup> They perform a primary end-to-end repair of the 2 tendon remnants and augment this using a knotless suture anchor–internal brace system. Their augmentation uses knotless suture anchors in both the proximal tibia and inferior pole of the patella, which provides stress shielding of the primary repair. Our technique differs in that we focus on midsubstance tears that are not amenable to a primary end-to-end repair. We use the patient's native tendon remnants and anchor them into either the inferior pole of the patella and proximal tibia (the proximal leaflet inserts distally and the distal leaflet inserts proximally). We avoid performing an allograft reconstruction by performing the reconstruction using the native tendon. This is important in the younger population with good tissue quality and strength.

The described technique offers many advantages (Table 1). In the setting of a midsubstance tear that is not repairable end to end, this technique allows the surgeon to reconstruct the tendon using the patient's native tissue and avoiding an allograft reconstruction. We offer a unique technique and one that has not been described in the literature for midsubstance tears. The proximal leaflet is anchored into the proximal tibia, and the distal leaflet is anchored into the inferior pole of the



**Fig 10.** Application of bioinductive implant over patellar tendon tear. The implant is secured to the tissue with Vicryl suture. This promotes healing of the tissue.

patella. Particularly in the younger patient, the ability to avoid an allograft reconstruction and use the patient's native, strong remaining tendon is an advantage to the patient.

The described technique has a few disadvantages (Table 1). Because of the size of the patella and



**Fig 11.** Postoperative lateral knee radiographs showing the resolution of patella alta along with the tunnel through the tubercle where the allograft is slid through.

**Table 1.** Pearls and Pitfalls

**Pearls**

- Tie the allograft augmentation at the superior pole of the patella with the knee in 30° of flexion.
- Anchor the distal tendon leaflet first into the inferior pole of the patella; then, overlap this with the proximal leaflet and anchor it into the proximal tibia.
- Using suture, tie down the bioinductive graft circumferentially and in multiple locations to avoid displacement. Do not simply rely on suturing down the corners to the tissue.
- Take a preoperative lateral radiograph of the contralateral knee to work toward an equal Insall-Salvati ratio postoperatively.

**Pitfalls**

- Do not pass the allograft augmentation into the capsule. Note that the layer is above the capsule and below the retinaculum.
- Ensure the bone quality in the inferior pole of the patella is appropriate for anchor placement and size.

limited bone stock, there is a risk of fracture during anchor placement. It is important to evaluate the bone stock preoperatively to determine whether the surgeon can safely place anchors. It is important to know the size of the anchors, and the surgeon can preoperatively measure the patella. Anchors are also to be placed without breaching inferiorly through the cartilage and into the joint (Table 2). Radiography should be used for this procedure to confirm the appropriate placement.

Limitations of our technique include that acute, traumatic midsubstance patellar tendon tears that are not amenable to primary end-to-end repair are relatively rare. Study of the long-term outcomes in these cases should continue.

Ultimately, in cases of midsubstance patellar tendon tears that are not amenable to an end-to-end repair, as well as to avoid allograft reconstruction, we offer a unique technique in which reconstruction is performed using suture anchors, allograft augmentation, and a bioinductive implant.

**Table 2.** Advantages and Disadvantages

**Advantages**

- Allograft augmentation allows the patient to start range of motion earlier by protecting the repair.
- The bioinductive implant promotes tendon healing at the tear site.
- The technique allows the surgeon to reconstruct the tendon using the patient's tissue rather than performing an allograft reconstruction.

**Disadvantages**

- There is a risk of fracture with anchors in the inferior pole of the patella.
- There is a risk of fracture due to drilling of a tunnel for the augmentation through the tibial tubercle.
- The surgeon should avoid anchor placement at the inferior pole of the patella through the cartilage and into the joint.

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