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Patellar Stabilization Using a Modified Basket-Weave Allograft MPFL/MQTFL Reconstruction

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Introduction

Patellofemoral Instability (PFI) is a common disorder with an incidence ranging from 5-29 per 100,000.[1–3] The medial patellofemoral ligament (MPFL) is the primary soft tissue stabilizer to lateral displacement of the patella that along with the medial quadriceps tendon-femoral ligament (MQTFL)[4-6] provides 50-60% of the restraining force.[7–10] These structures are frequently disrupted or attenuated in patients with PFI. MPFL reconstruction is a component of treatment for the majority of patients with recurrent instability.[11]

Background

Numerous techniques have been described for MPFL reconstruction, many of which require the creation of bony tunnels in the patella.[12,13] Iatrogenic patella fracture related to tunnel drilling has been reported and is a catastrophic complication thus prompting a search for alternative patellar fixation methods.[14-19]

In this article, we present a modification of a "Basket-Weave Technique" originally described by Kodkani[19] that provides an anatomic, double-bundle MPFL/MQTFL all soft-tissue patellar reconstruction with bony femoral fixation.[5,6] This technique ensures secure graft fixation with anatomic localization whilst avoiding patellar fracture.

Preoperative Evaluation and Indications

MPFL reconstruction is a primary component of surgical intervention for any patient with recurrent PFI who has failed conservative treatments such as bracing and physical therapy. It is our practice to utilize multiple alignment measures to guide surgical decision-making including the Caton-Deschamps index (CDI) and Tibial Tubercle-Trochlear Groove (TT-TG) distance. Skeletally mature patients with significantly abnormal measurements are counseled on a tibial tubercle osteotomy (TTO) concurrent with MPFL reconstruction.[20]

Procedure

Diagnostic arthroscopy is first performed using standard anterolateral and anteromedial portals. Any retropatellar or trochlear chondral injury is addressed and the joint surveyed for loose bodies or other pathology.

Semitendinosus allograft is the preferred graft with the selected length based on patient anatomy (typically ~26mm). Each end is whipstitched with 1.3mm SutureTape* for tubularization. The middle of the graft is looped around a passing suture and an adjustable loop fixation device for optional back-up fixation. The graft is then tensioned. Next, a 3cm midline longitudinal incision is made over the patella. Dissection is carried down to the extensor mechanism with the creation of full-thickness skin flaps. Dissection is performed through the first two layers of the knee 2mm off the medial patella. A tunnel is created bluntly between layers 2 and 3. A separate counter-incision is made over the medial epicondyle and the fascia is split in line with this incision.

Next, a subperiosteal tunnel of 1cm in length and width is created at the medial patella. Two additional 1cm subperiosteal tunnels are created across the anterior surface of the patella with 1cm of prepatellar fascia left intact in between them (Figure 1). The MPFL limb of the graft is passed through the subperiosteal tunnels until the end of the graft reaches the lateral pole of the patella thus creating a basket-weave appearance. The graft is secured to the lateral retinaculum and at each weave point with 0 FiberWire using a pretzel stitch.[19] Next, two 1 cm partial thickness slits are created in the superficial layer of the quadriceps tendon just above the patella and tunneled in a similar pattern. The second MQTFL limb of the graft is then passed and secured in an identical fashion (Figure 2). One suture end from each graft limb is passed through the lateral retinaculum and tied to a suture from the other limb providing a closed loop fixation system.

Schottle's point is identified using fluoroscopic guidance and the Beath pin is advanced and angled proximally to exit along the anterolateral femur.[21] Modifications to Schottle's can be made for skeletally immature patients based on developmental anatomy.[22-24] The beath pin is overdrilled with the cannulated reamer to a depth sufficient to dock the graft (typically 30-40

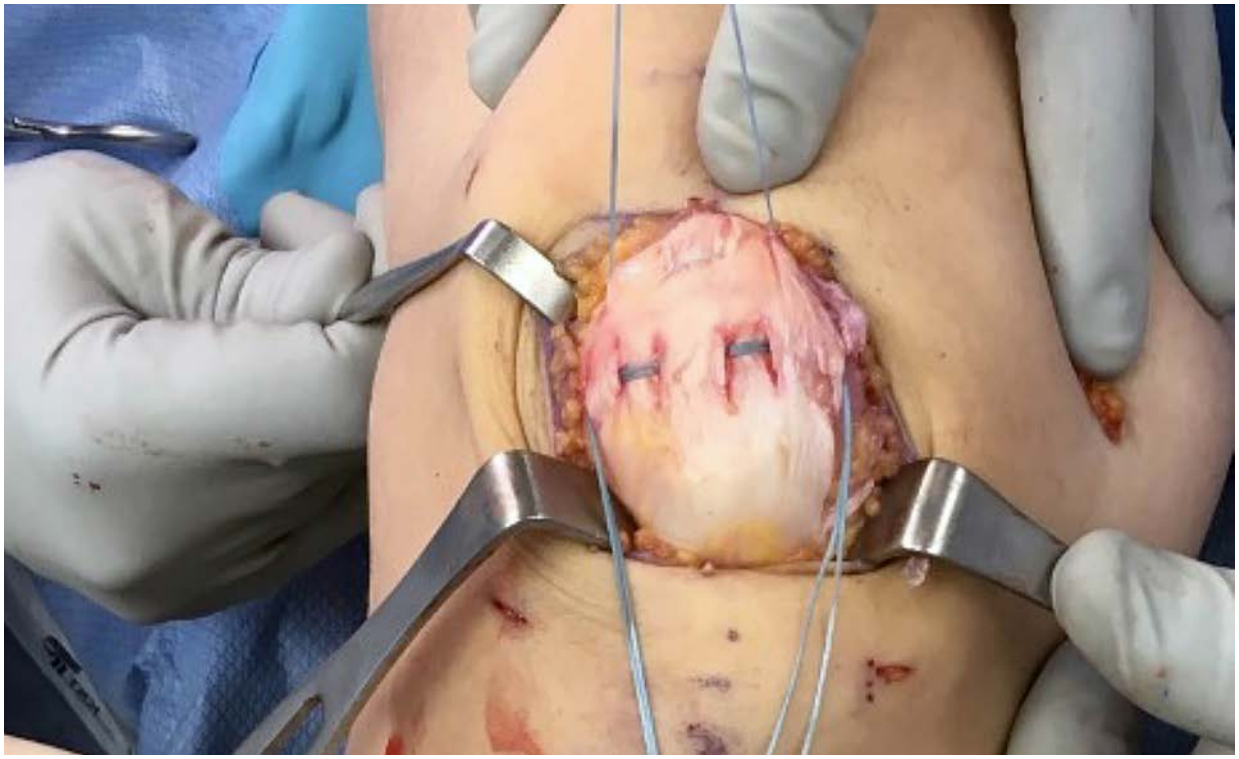

Figure 1. Basket weave preparation with passing sutures prepared for MPFL/MQTFL allograft limb passage.

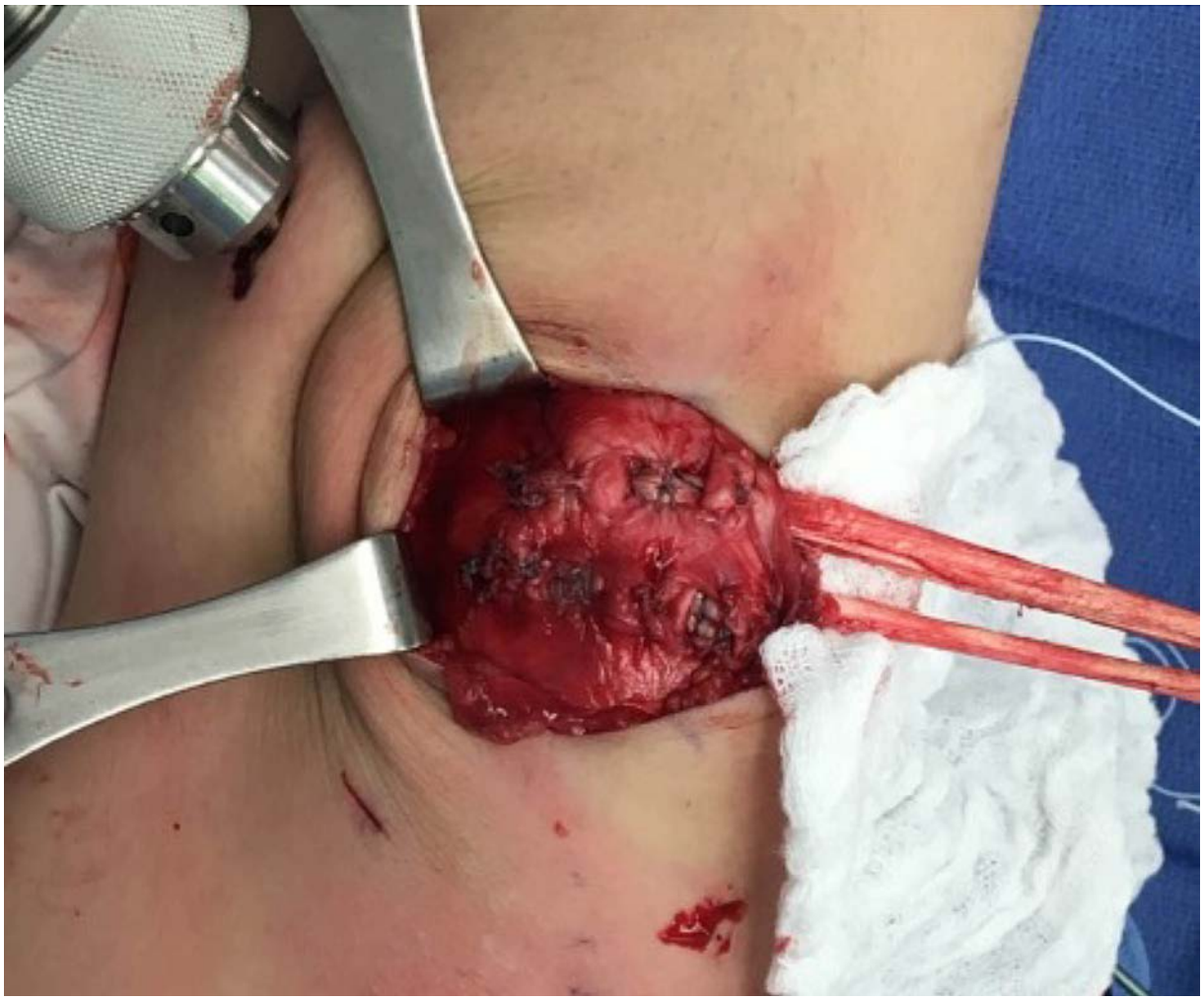

Figure 2. Basketweave double limbed MPFL graft after graft passage of whipstitched graft ends from medial to lateral and pretzel stitching at weave transition points with #0 fiberwire. Whipstiched limbs were passed subfascially through lateral patellar retinaculum and tied to provide secondary pullout fixation.

Figure 3. View from medial parapatellar incision of double limbed MPFL graft after tunneling to accessory incision (inferior) and docking into femur at Schottle's point. Fixation was performed with a bioabsorbable suture anchor backed up with an ABS tightrope fixated over a Dog Bone Button (Arthrex, Inc., Naples, FL) over lateral femur.

mm). The graft is then passed between layers 2 and 3. Isometry and patellar tracking are assessed. Once satisfactory, the Beath pin is removed and the graft seated. A nitinol wire is inserted into the femoral tunnel posteriorly. The graft is tensioned to centralize the patella within the trochlea at 45 degrees of knee flexion. An interference screw is inserted (Figure 3) and patellofemoral tracking is reassessed. If back-up femoral fixation is preferred, a DogBone cortical button* applied over an adjustable loop fixation device secured to the graft. The medial retinacular tissue can be imbricated in a pants-over-vest fashion for additional medial stabilization. The remainder of the wounds are closed in standard layered fashion.

*(Arthrex, Inc., Naples, FL)

Post-operative Protocol

Patients are discharged home on the day of surgery with a hinged knee brace permitting knee motion up to 90 degrees of flexion. They advanced to weightbearing as tolerated (WBAT) at 1 week. Straight ahead running is permitted by 3 months and return to sport is targeted at 6 months pending clearance via strength and functional testing.

Discussion

MPFL reconstruction is a popular surgical technique in the management of recurrent patellar instability that has demonstrated favorable outcomes.[25] Numerous techniques exist but Kodkani was the first to describe a Basket-weave allograft reconstruction technique that obviates the need for osseous fixation.[16-19,26]

The modification outlined in this article differs from that described by Kodkani[19] in four key ways. First, this technique provides an anatomic reconstruction of MPFL and MQTFL graft limbs. Second, our closed-loop patellar-sided design enhances the strength of the all soft-tissue fixation construct. Third, femoral fixation is via graft docking with interference screw using radiographic localization of the femoral origin whereas Kodkani describes femoral fixation with only a single soft tissue fixation point of questionable anatomic precision.[21] Lastly, in our modification, femoral fixation is performed after patellar fixation. This permits dynamic assessment of graft localization and patellar tracking allowing for adjustments prior to the final fixation. Potential disadvantages to the described technique include the reliance on soft-tissue patellar fixation, potential for graft prominence anteriorly due to suturing, and added case duration due to patellar graft suturing.

The modified technique described in this article has unique benefits that will be useful to surgeons desiring an anatomic MPFL/MQTFL reconstruction technique that avoids the risk of iatrogenic patellar injury.

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