Minimally Invasive Reconstruction of the Medial Patellofemoral Ligament Using Quadriceps Tendon

Christian Fink, M.D., Matjaz Veselko, M.D., Mirco Herbort, M.D., and Christian Hoser, M.D.

Abstract: Reconstruction of the medial patellofemoral ligament (MPFL) for the treatment of patellar instability has received increased attention over the past few years. Most operative techniques use hamstring grafts fixed with bone tunnels and/or anchors on the patella. Despite good clinical results using these techniques, complications such as implant breakage, patellar fractures through bone tunnels, and loss of knee motion have occurred. We present a minimally invasive technique for MPFL reconstruction using a strip of quadriceps tendon. With the use of specially designed instruments, the graft is harvested through a 3-cm transverse incision at the proximal pole of the patella. The tendon strip is then dissected distally on the patella, left attached, and diverged 90° medially underneath the medial prepatellar tissue. The graft is fixed on the femur in 20° of knee flexion in a bone tunnel with a bioabsorbable interference screw (adults) or a bone anchor (children). We think that this technique presents a valuable alternative to common hamstring techniques for primary MPFL reconstruction in children and adults, as well as for MPFL revision surgery.

Reconstruction of the medial patellofemoral ligament (MPFL) for the treatment of patellar instability has received increased attention over the past few years. Several surgical techniques have been described, most of which use hamstring tendons as the graft of choice.1-4 All of these techniques use bone tunnels and/or anchors for graft fixation on the patella. Besides implant costs, complications such as implant breakage or patellar fractures through bone tunnels have occurred.5,6

There are few reports on MPFL reconstruction using a strip of quadriceps tendon (QT) without anchors or bone tunnels in the patella.7-9 Despite good clinical results, the cosmetic appearance of longitudinal scars over the thigh, as well as technical difficulties of harvesting a consistently appropriate strip of QT, has not led to widespread use of this technique.

To overcome some of the aforementioned limitations, we developed a new harvesting technique for the QT that not only allows a constant graft harvest with respect to width and thickness but also necessitates a smaller skin incision.

Surgical Technique

Positioning

Patient positioning has to allow for free knee motion between 0° and 120°. Intraoperative access for the fluoroscope is important to keep in mind and should ideally be checked before draping. We prefer fixation of the operative leg in an electric leg holder (Maquet, Rastatt, Germany).

Surgical Steps

The surgical steps are as follows:

1. With knee flexion of 90°, a 3-cm transverse skin incision is made over the superomedial pole of the patella. The prepatellar bursa is incised longitudinally, and the patellar aponeurosis is then carefully exposed.
2. A long Langenbeck retractor is introduced, and the QT is subcutaneously exposed proximal to the patella.
3. A double knife (Karl Storz, Tuttlingen, Germany) with a width of 10 mm (optionally, 12 mm) is
then introduced, starting at the middle of the superior patellar border, and pushed up to a minimum of 8 cm (as marked on the instrument) (Fig 1).

4. The thickness of the graft is determined with a 3-mm tendon separator (Karl Storz). The separator is pushed proximal to the same length (minimum 8 cm) (Fig 2).

5. The tendon strip is cut subcutaneously by a special tendon cutter (Karl Storz) (Fig 3, Table 1).

6. The graft is left attached distally, and the free proximal end is armed with resorbable sutures by use of web-stitch technique (Fig 4).

7. Over the patellar surface, the cuts are continued about 2 cm with a surgical knife toward the patella with the chosen width (10 or 12 mm). The QT strip is then subperiosteally elevated from the surface of the patella (Fig 5).

8. The proximal third of the medial patellar border is exposed. From the medial patellar border, the
Prepatellar tissue is elevated, creating a tunnel that reaches the medial edge of the graft using a periosteal elevator. A surgical clamp is introduced into the tunnel from medial to lateral, and the graft is passed through the tunnel. The graft is then secured to the retinaculum tissue on the medial patellar edge by resorbable No. 2-0 sutures (Fig 6).

9. A 1.5-cm skin incision is made over the adductor tubercle. Starting at the patella, a curved clamp is used to create a tunnel in the space between the vastus medialis and the capsule. A suture loop is then pulled through the tunnel. This loop is used later to pull the graft toward the femoral insertion.

10. Under fluoroscopic guidance, a 2.4-mm guide pin is drilled into the insertion of the MPFL. It is directed anterolaterally to exit the femur on the lateral cortex well proximal to the lateral epicondyle. If found accurate by fluoroscopy, the guide pin is over-reamed with a 6-mm (or 7-mm) cannulated reamer to a depth of 30 mm.

11. The graft is inserted into the tunnel. The knee is cycled 5 times with moderate tension on the graft. Fixation is performed with a resorbable interference screw with a similar diameter to the tunnel at 20° of knee flexion. The lateral border of the patella should be flush with the lateral border of the trochlea.

In children with open physes, the graft is fixed with 1 bone anchor or sutures alone (Table 1). All surgical steps are summarized in Video 1.

Discussion

MPFL reconstruction using a strip of QT harvested subcutaneously in the described technique has been found to be feasible and associated with good short-term clinical and cosmetic results.

Up to now, hamstrings have been the most common graft source for MPFL reconstruction. A high rate of clinical success for patients with patellofemoral instability has been documented with these procedures; however, they have also been found to be associated with an overall complication rate of 26.1%. Patellar fractures through bone tunnels and loss of knee flexion have been described as the most common complications. Our technique does not necessitate implants or bone tunnels in the patella and therefore avoids the imminent risk of patellar fracture. Therefore this technique is also ideal for revision MPFL surgery, when pre-existing tunnels or hardware is present in the patella.

In a small prospective series of 13 patients followed up over a period of 1 year, we did not find any loss of knee flexion. This observation may be attributed in part to the fact that the QT construct is less stiff compared with a hamstring MPFL reconstruction. There are only a few previous reports on MPFL reconstruction using a strip of QT without anchors or bone tunnels in the patella. In these techniques longitudinal incisions from the superior pole of the QT...
patella extending proximally (about 6 to 8 cm) are used. Noyes and Albright\(^8\) harvest an 8 × 70-mm full-thickness graft from the medial aspect of the QT, leaving it attached at the superomedial border of the patella. More similar to our technique, Goyal\(^7\) and Steensen et al.\(^9\) dissect a partial-thickness graft of 10 to 12 mm in width from the central part of the QT. Contrary to our technique, the tendon strip is then diverged medially over the prepatellar tissue. We think that diverging the tendon strip underneath the prepatellar tissue improves healing and provides a more anatomic fixation of the QT strip.

We see 2 potential intraoperative complications with our technique (Table 2): (1) The QT strip could peel off from the bony surface of the patella. (2) The QT strip could be too short. A peel off did not happen in our clinical series but has occurred in our early anatomic dissections. In this case bone anchors may be used to fix the QT strip to the medial aspect of the patella (free QT graft), or if the graft is long enough, it can be looped around the prepatellar tissue and sutured onto itself. In our clinical series, we had 1 case in which the QT strip was cut too short (only 5 cm). In this case we harvested a second 3-mm strip from the QT, which was then sutured onto the primary QT strip. To avoid these complications, careful dissection has to be performed.

In summary, we think that the minimally invasive QT technique is a valuable alternative to common hamstring techniques for primary MPFL reconstruction in children and adults, as well as for MPFL revision surgery.

**Acknowledgment**

We thank Karl Storz, Tuttlingen, Germany, for the figures.
Video 1 was created from a live surgical demonstration at the International Society of Arthroscopy, Knee Surgery & Orthopaedic Sports Medicine Congress, Toronto, Canada, 2013.

References


