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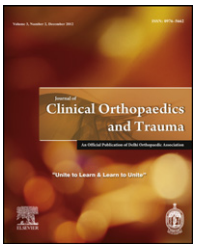

Case report

Medial patellofemoral ligament reconstruction – A novel technique☆

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ABSTRACT

Patellofemoral instability is initially treated conservatively and surgical treatment is reserved for resistant cases. Reconstruction of medial patellofemoral ligament has gained popularity these days as it attempts at restoring soft tissue anatomy and biomechanics of medial patellar restraint back to normal. Here we describe our novel transverse patella single tunnel and femoral interference screw technique to reconstruct the medial patellofemoral ligament using free autologous gracilis and semitendinosus grafts.

1. Introduction

Patellar instability is a relatively common problem, with prevalence of 6–77 per 100,000 population.[1] The cause of recurrent patellar dislocation (RPD) is multifactorial including alterations in articular geometry (trochlear dysplasia), limb alignment, rotational deformity, patellar height and ligamentous laxity.[2,3] However pathological insufficiency of the medial patellofemoral ligament (MPFL) has been described as the essential lesion of RDP.[4]

The medial side of the knee consists of three layers: the first layer consisting of the deep or crural fascia forming a layer which invests sartorius (but is superficial to gracilis and semitendinosus), the second forming the fibers of the superficial medial ligament whose anterior fibers pass upwards to blend with the vastus medialis, and posterior fibers run from the patella to insert at the medial epicondyle (medial patellofemoral ligament) and the third deep layer forming the capsule of the knee joint. Vertically aligned fibers form the deep layer of the medial ligament or the middle capsular ligament to the mid portion of the medial meniscus and the tibia. The MPFL is thus a distinct soft tissue structure within the medial retinaculum (second layer of knee), which originates from saddle between the adductor tubercle and epicondyle and inserts at the superior two-thirds of medial border of patella, typically at the location where the perimeter of the patella becomes more vertical (Fig. 1). It is approximately 55 mm long and its width ranges from 3 to 30 mm and has a mean tensile strength of 203N. This ligament is most taut in full extension, with the quadriceps contracted, and

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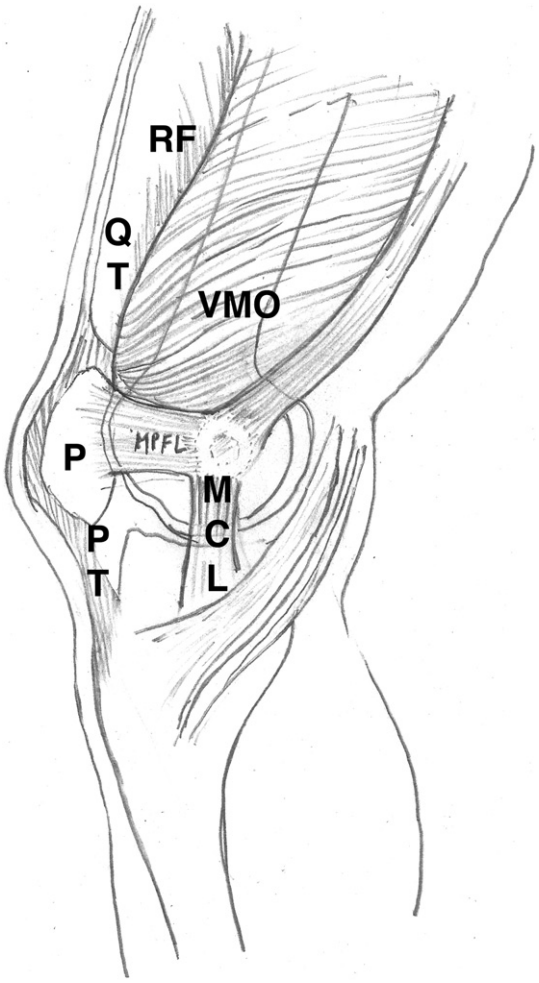

Fig. 1 – Anatomy of normal medial patellofemoral ligament.

assists in guiding the patella into the trochlea during the early stages of flexion. The common attachment of the tendon of the vastus medialis muscle and the ligament to the superiomedial patella suggests that there may be a dynamic element for stability.[2,5,6]

The initial treatment of patellar instability is always conservative, comprising of pelvi-femoral rehabilitation, quadriceps progressive strengthening exercises (focusing on vastus medialis obliqus) and braces.[4,7] Surgical treatment is indicated only when patient remains symptomatic after a good conservative trial.[8] Medial patellofemoral ligament (MPFL) is the most important static stabilizer of the patella, contributing 50–60% (average 53%) of the restraint during initial 30° of knee flexion and 94% patients of patellar dislocation have been found to have involvement of MPFL, 70% at the patellar insertion and the rest at the femoral origin. In all, however, there is also interstitial damage. Patellar tracking is significantly affected by a lateral force in the absence of the MPFL, but returns to normal following reconstruction.[9–11] So MPFL reconstruction surgeries are increasingly being used for recurrent patellar dislocations. In the present case report we are presenting a new method for MPFL reconstruction.

2. Case report

A 30 years old housewife presented to the clinic complaining of recurrent pain and instability in the front of right knee. There was no elicitable history of preceding trauma. On examination she was obese (body mass index 29.2), patella was dislocatable at moderate pressure, patellar apprehension test was positive, patellar maltracking was present and vastus medialis was wasted. The medial femoral condyle was more prominent as compared to opposite side. There was no swelling, retropatellar tenderness or any other ligament laxity. There was no angular deformity of the knee, and the quadriceps angle was 21°. The Insall–Salvati index was 1.4 and the sulcus angle was 130° with hypoplasia of the lateral condyle (Dejour type C) with facetal asymmetry.

As she continued to have pain and apprehension even after a rigorous physiotherapy programme, reconstruction of the MPFL was planned. The patient was informed regarding the need and nature of surgical intervention and also that her case will be considered for publication in a medical journal including electronic publication on the internet and she consented. Under spinal anesthesia and tourniquet control after the administration of prophylactic antibiotics, first the semitendinosus and gracilis tendons were harvested in the usual fashion, and a double bundle was prepared. Through a small (1 cm) incision on the lateral border of patella in superior half a bony patellar tunnel was then drilled from lateral to medial (avoiding articular penetration) and the graft was passed lateral to medial and taken out through another small medial parapatellar incision. Medial epicondyle was palpated percutaneously and exposed through another medial incision, on the medial aspect of distal femur centered over the palpated point. Blunt dissection was used to expose the superficial medial retinaculum adjoining the inferior border of the vastus medialis obliqus. The retinaculum was opened carefully, and with meticulous blunt dissection, the layer containing the medial patellofemoral ligament was exposed above the capsule. The saddle area on medial femoral condyle (between the adductor tubercle and the medial epicondyle) was palpated and a tunnel drilled directed laterally and slightly upward under image intensifier guidance. A curved hemostat was placed through the patellar incision, tunneled under the skin between the retinaculum and medial patellofemoral ligament remnant (i.e. between the second and third fascial layers), and used to retrieve the tendon graft into the femoral incision. The tunnel was then enlarged and the medial free end of the graft passed medial to lateral up to the lateral femoral cortex. The graft was sutured to the patella at both medial and lateral ends. Maintaining adequate tension in the graft, the knee was cycled several times from full flexion to full extension to ensure that graft is pre-stretched to eliminate "give", and with the patella centered on the trochlea and the knee at 30° flexion final fixation was done with a cancellous screw with washer at the medial cortex (Fig. 2 a–d). The graft thus acted as a checkrein ensuring that the patella is stabilized within the trochlea. The wound was closed and a knee immobilizer was applied.

Static quadriceps exercises and non-weight bearing walking with walker were started as soon as the patient

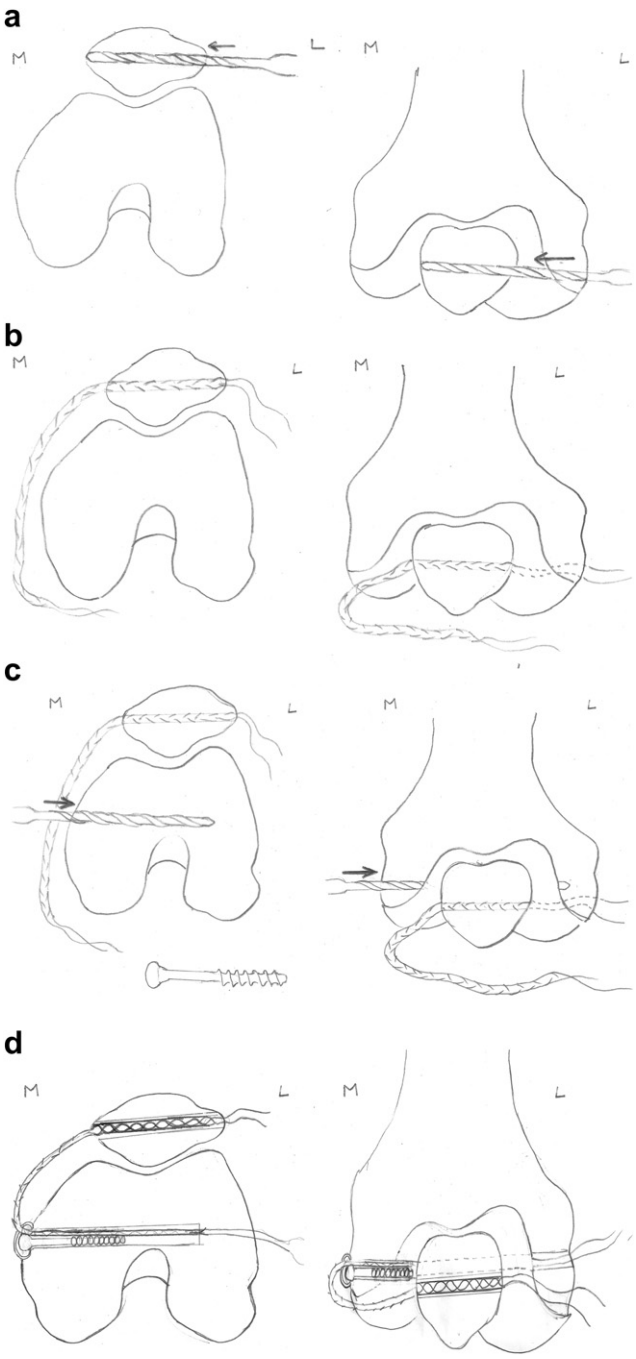

Fig. 2 – Our technique of medial patellofemoral ligament reconstruction – an illustration. Steps of the technique: (a) Drill hole made at the junction of upper and mid third of patella lateral to medial. (b) Doubled (semitendinosus and gracilis) graft passed through tunnel and sutured on lateral and medial sides with periosteum and parapatellar tissues. (c) Drill hole made in distal femur in the saddle area. Graft passed between second and third fascial layers of knee and then through the femoral tunnel. (d) Appropriate tension applied to the graft and after cycling the graft multiple times, fixation done with 6.5 mm cancellous screw with washer keeping knee in 30° flexion and patella fully seated. Final position shown.

tolerated (at 3 weeks). At 6 weeks the brace was discarded and knee range of motion exercises and gradual weight bearing were started. At 12 weeks the patient was allowed normal activities, but running was avoided till 6 months. At the last follow up, which was 7-month postsurgery, there was no pain, apprehension or lateral instability of the patella (Fig. 3a and b). The knee range of motion was 0–100°. The radiograph showed no patellar subluxation (slight patella alta) and some osteopenia (Fig. 4a and b). The Kujala score was 72/100.

3. Discussion

Chronic recurrent dislocations and subluxations of the patella are often more disabling to the patient than any other isolated ligamentous instability of the knee, and they are more disabling than instability associated with injury to the anterior cruciate ligament (ACL) and also unlike ACL injury patellar instability is typically associated with the knee giving way unexpectedly with minimal trauma during activities of daily living.

Initial treatment of recurrent patellar dislocation is always conservative. Surgery is needed when the patient continues to have symptoms after adequate bracing and

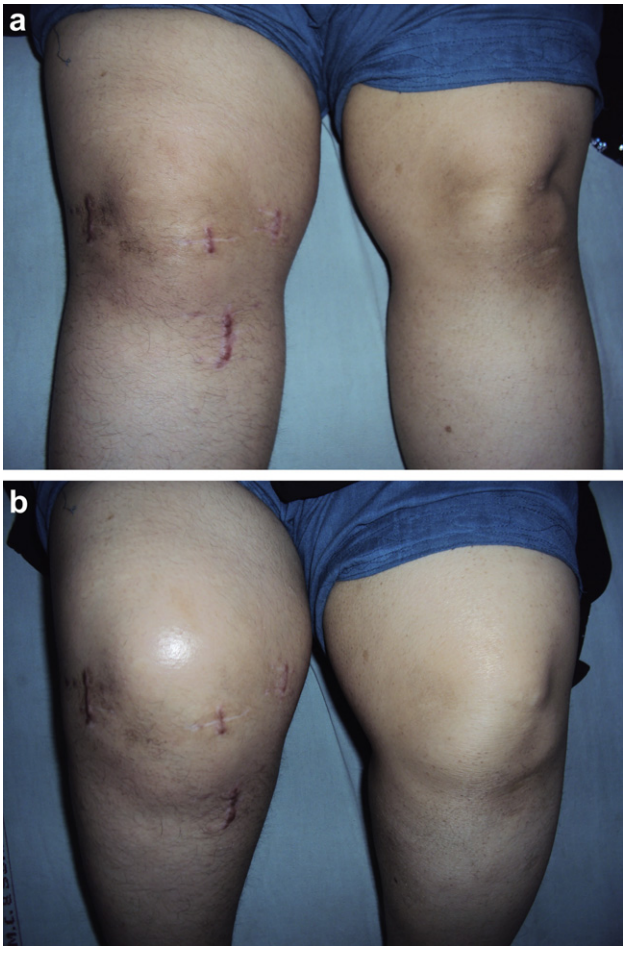

Fig. 3 – Follow up clinical photographs of the patient, standing (a) and sitting (b).

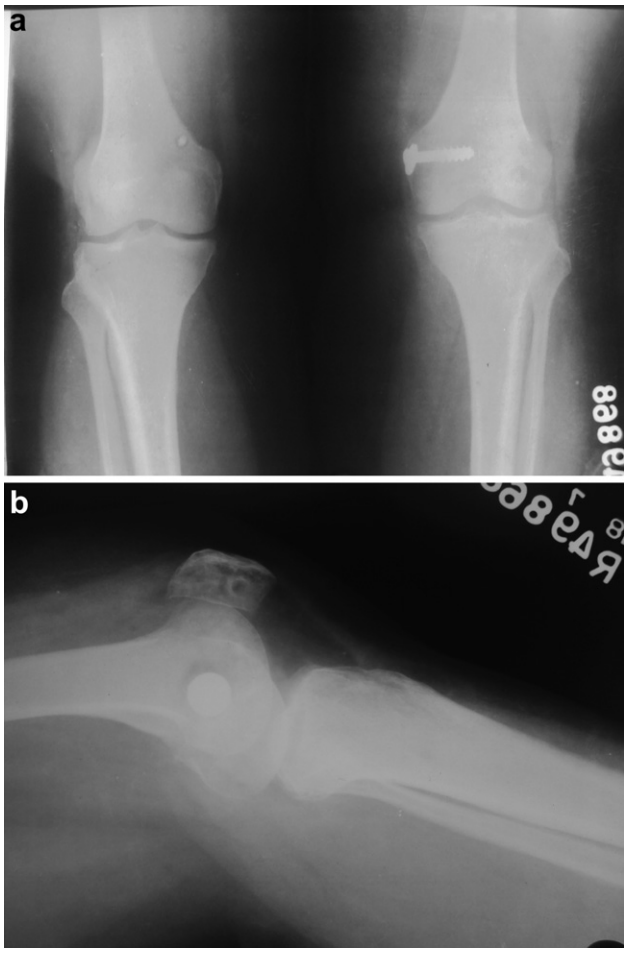

Fig. 4 – Follow up X-rays – anteroposterior (a) and lateral (b) views, showing position of tunnel in the patella and screw in the distal femur.

muscle strengthening.[7,8] More than 100 different techniques have been described for patellar stabilization in recurrent dislocation/subluxation in past 100 years [12] Various procedures, which have been described, are lateral release, medial augmentation, proximal/distal realignment and MPFL reconstruction.[2,12]

The reconstruction of the MPFL gives better results in recurrent patellar dislocations than with non-anatomical reconstruction, which would alter the biomechanics of the patellofemoral joint.[6,12] Medial transfer of the tibial tubercle increases joint loading within the medial tibiofemoral compartment and the medial facet of the patellofemoral joint and induces variable changes within the lateral tibiofemoral compartment. Other proximal or distal realignment procedures also lead to poor results due to associated knee osteoarthritis.[6]

As MPFL contributes for more than half of the restrain and is involved in most cases, its reconstruction restores the stability and normal patellar tracking.[13,14]

Of the various options, the double bundle autologous hamstring graft has the advantages of good strength, no additional cost, technical ease and minimal donor site morbidity.[2,15] To replicate the normal MPFL the graft must span between the superior portion of the medial border of the patella and the superior aspect of the medial femoral condyle. The ideal position of the femoral tunnel is at the saddle area between medial epicondyle and adductor tubercle, which is more posterior than expected.[16] Understanding the possible errors in femoral tunnel positioning during MPFL reconstruction, as well as their complications, is key to performing the procedure successfully. The femoral tunnel can be positioned too proximally or too distally, with proximal tunnels causing grafts to become increasingly tight in flexion and distal tunnels causing tightness in extension. Femoral tunnels can also be placed too anteriorly or too posteriorly. In addition to tunnel position, there are other factors that contribute to a successful MPFL reconstruction. The position of the patellar tunnel and the presence of patella alta can also affect the function of the graft. Even a perfectly positioned graft can cause serious problems if it is fixed too tightly.[16,17]

To have optimal position Bollier et al have advised to use a larger incision so that the epicondyle and adductor tubercle can be clearly palpated, to palpate the adductor magnus tendon to have proper orientation and to check the guide wire position in fluoroscopy.[17] Patellar tunnel position and presence of patella alta are another important determinants of the final result. [17] In our case a lower tunnel position would have contributed to the postoperative patella alta. However the most important issue in MPFL reconstruction is to maintain appropriate tension in the graft throughout the knee range of motion and slight alteration in the tension can significantly restrict the joint range of motion, increase the patellofemoral contact pressure or leave residual instability.[5,17,18] To have ideal tension the tendon graft should be cycled before fixation and patella should be hold flushed to lateral border of trochlea at 30° of flexion so that patella should engage the trochlea at 20–30° flexion and be fully centered at 60° flexion.[17]

Various patellar fixation methods are direct suturing to the periosteum, single tunnel, loop, endobutton and double tunnel. [5,12,19,20] The strength of fixation is better with the double tunnel technique, but this increases the risk of patellar fracture and joint penetration. [12] Mikashima et al have used the looping of the tendon around the single patellar tunnel and had good results.[12] Thus in the present case we have used its modification. In patella we have passed the whole double tendon graft and stitched it with the soft tissue covering of patella at the medial and lateral borders. Also we have used low cost cancellous screw for fixation at the femur instead of endobutton. Various fixation methods described for femoral fixation are looping over the adductor magnus insertion, direct suturing to the periosteum, by endobutton, with staple, "blind tunnel" or "through tunnel".[12,19–22] Mountney et al have compared various fixation techniques in cadaver and found that the best method of fixation is the screw fixation inside the "through tunnel".[2] Similar method has also produced good results in vivo by Carmont et al.[5] In the present case we have used the through tunnel technique for femoral fixation. We have used cancellous screws similar to Schock et al.[19] Additionally in our technique, we have used small cosmetic incisions and tunneled the graft in between the 2 incisions.

To conclude, our low cost and relatively simple technique of MPFL reconstruction has given acceptable results.

Conflicts of interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES

1. Fithian DC, Paxton EW, Stone ML, et al. Epidemiology and natural history of acute patellar dislocation. *Am J Sports Med*. 2004;32(5):1114–1121.
2. Mountney J, Senavongse W, Amis AA, Thomas NP. Tensile strength of the medial patellofemoral ligament before and after repair or reconstruction. *J Bone Joint Surg [Br]*. 2005;87:36–40.
3. Dejour H, Walch G, Nevret P, Adeleine P. Dysplasia of the femoral trochlea. *Rev Chir Orthop Reparatrice Appar Mot*. 1990;76(1):45–54.
4. Andrish J. The management of recurrent patellar dislocation. *Orthop Clin North Am*. 2008;39:313–327.
5. Carmont MR, Maffulli N. Medial patellofemoral ligament reconstruction: a new technique. *BMC Musculoskelet Disord*. 2007;8:22.
6. Reddy KR, Mishra CB. Reconstruction of medial patellofemoral ligament for chronic patellar instability. *Indian J Orthop*. 2012;46(4):447–454.
7. Buchner M, Baudendistel B, Sabo D, Schmitt H. Acute traumatic primary patellar dislocation: long term results comparing conservative and surgical treatment. *Clin J Sport Med*. 2005;15(2):62–66.
8. Beth E, Shubin S, Christopher SA. The management of patellar instability in the skeletally immature patient. *Oper Tech Orthop*. 2007;17(4):250–256.
9. Conlan T, Garth WP, Lemons JE. Evaluation of the medial soft-tissue restraints of the extensor mechanism of the knee. *J Bone Joint Surg [Am]*. 1993;75:682–693.
10. Hautamaa PV, Fithian DC, Kaufman KR, Daniel DM, Pohlmeyer AM. Medial soft tissue restraints in lateral patellar instability and repair. *Clin Orthop*. 1998;349:174–182.
11. Sallay PI, Poggi J, Speer KP, Garrett WE. Acute dislocation of the patella; a correlative pathoanatomic study. *Am J Sports Med*. 1996;24(1):52–60.
12. Mikashima Y, Kimura M, Kobayashi Y, Miyawaki M, Tomatsu T. Clinical results of isolated reconstruction of the medial patellofemoral ligament for recurrent dislocation and subluxation of the patella. *Acta Orthop Belg*. 2006;72:65–71.
13. Sandmeier RH, Burks RT, Bachus KN, Billings A. The effect of reconstruction of the patellofemoral ligament on patella tracking. *Am J Sports Med*. 2000;28(3):345–349.
14. Nomura E. Classification of lesions of the medial patellofemoral ligament in patellar dislocation. *Int Orthop*. 1999;23(5):260–263.
15. Cross M, Roger G, Kujawa P. Regeneration of the semitendinosus and gracilis tendons following their transection for repair of the anterior cruciate ligament. *Am J Sports Med*. 1991;20:221–223.
16. Schottle PB, Fucentese SF, Romero J. Clinical and radiological outcome of medial patellofemoral ligament reconstruction with a semitendinosus autograft for patella instability. *Knee Surg Sports Traumatol Arthrosc*. 2005;13:516–521.
17. Bollier M, Fulkerson J, Cosgarea A, Tanaka M. Technical failure of medial patellofemoral ligament reconstruction. *Arthroscopy*. 2011;27(8):1153–1159.
18. Beck P, Brown NA, Greis PE, Burks RT. Patellofemoral contact pressures and lateral patellar translation after medial patellofemoral ligament reconstruction. *Am J Sports Med*. 2007;35:1557–1563.
19. Schock EJ, Burks RT. Medial patellofemoral ligament reconstruction using a hamstring graft. *Oper Tech Sports Med*. 2001;9(3):169–175.
20. Drez D, Edwards TB, Williams CS. Results of medial patellofemoral ligament reconstruction in the treatment of patellar dislocation. *Arthroscopy*. 2001;17(3):298–306.
21. Ellera Gomes JL. Medial patellofemoral ligament reconstruction for recurrent dislocation of the patella: a preliminary report. *Arthroscopy*. 1992;8(3):335–340.
22. Muneta T, Sekiya I, Tsuchiya M, Shinomiya K. A technique for reconstruction of the medial patellofemoral ligament. *Clin Orthop Relat Res*. 1999;359:151–155.