Medial patellofemoral ligament reconstruction technique

Amro S. El-Sayed, Yasser S. Hannout, El-Sayed Morsi

Department of Orthopedics and Traumatology, Faculty of Medicine, Menoufia University, Menoufia, Egypt

Correspondence to Yasser S. Hannout, MD, Lecture, Department of Orthopedics and Traumatology, Faculty of Medicine, Menoufia University, Menoufia, Egypt.
E-mail: dryasserhannout@yahoo.com

Received: 22 February 2020
Revised: 5 March 2020
Accepted: 28 March 2020
Published: 20 July 2021

The Egyptian Orthopaedic Journal 2020, 55:57–62

Backgroud
Recurrent patellar dislocation is a challenging medical problem for both the patient and the surgeon because of its multifactorial etiology.The medial patellofemoral ligament (MPFL) extends between the superomedial border of the patella and the anterior aspect of the medial femoral epicondyle in layer 2 of the medial soft tissue structures In the last decade, there have been many techniques for reconstruction of the MPFL. All techniques rely on supplying tendinous reconstruct from the medial border of the patella to the adductor tubercle, using different tendonsThe aim of this study was to describe the technique of reconstruction of MPFL and evaluation of the results using transverse holes in the patella and femoral interference screw.
Patients and methods
From January 2013 to April 2016, 20 cases underwent isolated MPFL reconstruction, after institutional ethics approval and informed consent was obtained from every patient. Out of the operated 20 cases, there were 12 females and eight males, with an average age of 24 years. Average age at the first dislocation episode was 21±2 years. Mean follow-up is about 18.3 months (range: 9–28), a mean of 4.8 dislocations per patient (range: 3–16 times). All were caused by either trauma or physical activity (14 trauma, six physical activity).
Results
All cases regained full range of motion; the apprehension sign dropped from 90% preoperative in 18 cases to 15% postoperative (only three cases). The glide test dropped from 100to 0% in follow-up. Mean Lysholm score improved significantly from 58%±3 to 93%±4.
Conclusion
MPFL reconstruction for treatment of recurrent patellar dislocation with a gracilis tendon autograft, using transverse holes in the patella and a screw for femoral fixation, showed good results at short-term follow-up

Keywords:
knee, ligament, patella, reconstruction

Egypt Orthop J 55:57–62

1110-1148

Introduction

Recurrent patellar dislocation is a challenging medical problem for both the patient and the surgeon because of its multifactorial etiology. It is a disabling condition that primarily affects young populations, leading to progressive articular cartilage damage [1]. The yearly incidence of patellar dislocation in the US is 6/100 000 increasing to 29/100 000 with age between 10 and 17 years, affecting both sexes with more prevalence in females [2].

The most common predisposing factors are bony as trochlear dysplasia and patella alta, increased tibial tubercle–trochlear groove (TT–TG) distance, and malalignment as genu-valgum (increasing Q angle and lateral tension on the patella) or tibial torsion [3,4].

The medial patellofemoral ligament (MPFL) extends between the superomedial border of the patella and the anterior aspect of the medial femoral epicondyle in layer 2 of the medial soft tissue structures. The patellar insertion is wider than the femoral origin. The vertical distance from the top of the patella to the upper border of the ligament is about 6.1 mm [5].

The inferior edge of the MPFL is located near the midpoint of the patella. On the femoral side, it inserts 1.9 mm anterior and 3.8 mm distal to the adductor tubercle [5,6].

The stability of the patellofemoral joint is maintained by static and dynamic factors. The MPFL acts as the main ligament restricting lateral displacement of the patella at knee flexion between 0 and 30° [7]. Because of its biomechanical properties, it is essential for controlling the normal kinematics of the patellofemoral joint [8]. During the first episode of acute patellar dislocation, this anatomical structure becomes partially or completely torn. This injury is

considered the essential factor for recurrence of dislocation [9]. Biomechanical studies have found that the limited ability of the MPFL to elongate, results in total rupture in the case of complete dislocation. In addition, the limited healing capacity of the MPFL, makes the medial retincular structures more lax [10].

The first reports of MPFL reconstruction were made by Sugamuna *et al*. [11] who used tendon autograft, and by Ellera Gomes [12] who used synthetic graft. Different techniques evolved using static and dynamic techniques of reconstruction, but none of them was considered the gold standard.

In the last decade, there have been many techniques for reconstruction of the MPFL. All techniques rely on supplying tendinous reconstruct from the medial border of the patella to the adductor tubercle, using different tendons (gracillis, semitendiosus, partial patellar tendon, partial quadriceps tendon, vastus medialis, artificial tendon, and allograft). Different fixation techniques have been used, including sutures, suture anchors, and interference screws. There is a rapid expansion in the number of studies reporting results after MPFL, as well as the number of surgeons reporting their results and their own experience using these different techniques [13].

The aim of this study was to describe the technique of reconstruction of MPFL and evaluation of the results using transverse holes in the patella and femoral interference screw.

Patients and methods

From January 2013 to April 2016, 20 cases underwent isolated MPFL reconstruction, after institutional ethics approval and informed consent was obtained from every patient.

Out of the operated 20 cases, there were 12 females and eight males, with an average age of 24 years. Average age at the first dislocation episode was 21±2 years. Mean follow-up is about 18.3 months (range: 9–28), a mean of 4.8 dislocations per patient (range: 3–16 times). All were caused by either trauma or physical activity (14 trauma, six physical activity).

Inclusion criteria

Patients with recurrent patellar dislocation have the following criteria:

(1) Tuberculus sulcus angle from 0 to 5°.
(2) TT–TG less than 20 mm.
(3) Medial retinculear slackening secondary to recurrent dislocation.
(4) Normal trochlea or dysplastic trochlea type (I).
(5) MPFL reconstruction not associated with any surgical procedure.

Exclusion criteria

(1) Patients with neurologic disorders.
(2) Patella alta more than 1.2 using Caton Deschampindex [14] or sagittal patello femoral engagement less than 12.5%.
(3) Patients with extensive patella femoral arthritis.
(4) Patients with severe trochlear dysplasia (Dejour type C) [3].

Patients were evaluated in the preoperative stage and followed up for 18.3 months (range: 9–28).

Preoperative evaluation involved both clinical and radiological evaluation. Clinical evaluation was used to assess generalized ligamentous laxity, alignment of the lower limb, measurement of the Q angle, as well as any associated ligamentous injury of the knee. Clinical evaluation included range of motion, apprehension test, and patellar grinding as well as Lysholm score [15].

Radiography of both knee standing and of the affected knee (anterioposterior, lateral, sky line views), scanogram of both lower limbs was used to assess limb alignment, computed tomography was used for evaluation of the trochlea and to measure the TT–TG ratio, and MRI assisted in identifying any associated chondral injury as well as soft tissue slackening in the medial aspect of the patella (Fig. 1).

Operative technique

Examination under anesthesia was the first step to be performed in the theater. The patient was placed supine on the operating table with tourniquet applied on the thigh. After sterilization of the whole lower limb, arthroscopic examination had been performed to assess the patellar tilt and any associated injury of the knee. Pesanserinus tendons were palpated, and through an oblique incision, about 4 cm long-centered over the tendon, the gracilis tendon was harvested.

After harvesting the graft, it was prepared by removing the fleshy part and sutured from both ends (Fig. 2).

A 3-cm-long incision was then performed over the medial aspect of the patella. The deep fascia and the

vastus medialis were opened but taking care to avoid opening the capsule of the joint (Fig. 3).

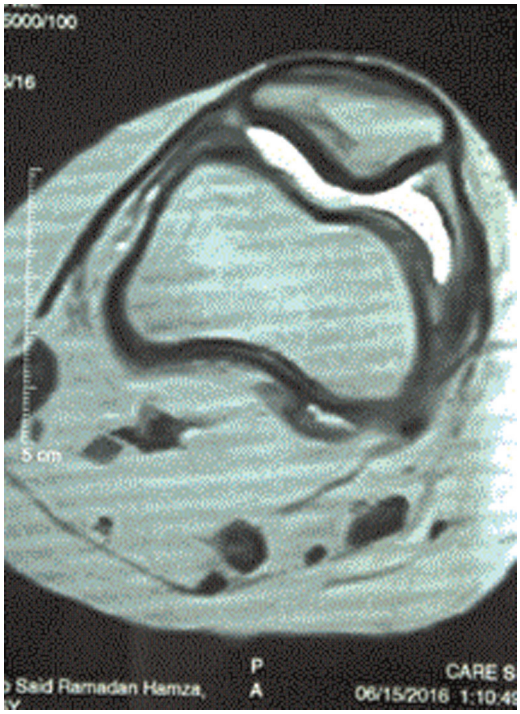
A guide wire was inserted transversely across the patella guided by the C-arm. The point of entry was about (6–10 mm) from the upper pole of the patella from the inferomedial to superolateral direction exiting at the dorsal surface of the patella in a posterior-to-anterior direction. The second one is parallel to the first guide and about 1 cm distal (Fig. 4).

A cannulated drill bit (4.5 mm) is then drilled over the guide wires.

Another 2–3-cm incision centered over the medial femoral condyle was performed. Schottle [16] point is localized guided by the C-arm (1 cm anterior and proximal to the intersection of the posterior cortex of the femur and a second line perpendicular to the blumensatt line). A guide is passed under fluoroscopic control, at this point, from inferomedial to superolateral direction (Fig. 5).

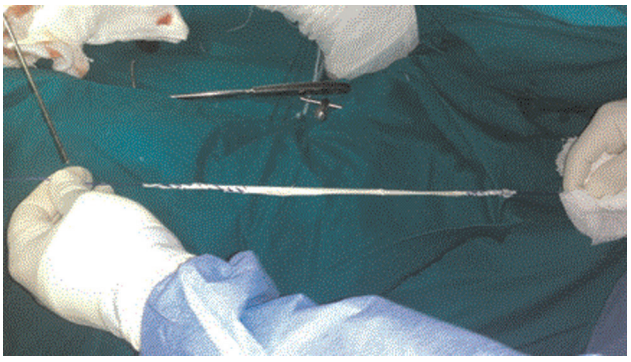
A 7-mm cannulated drill bit was used to drill the femoral tunnel, for about 6-cm depth. The guide was used to pull a fiber wire through the tunnel.

Figure 1



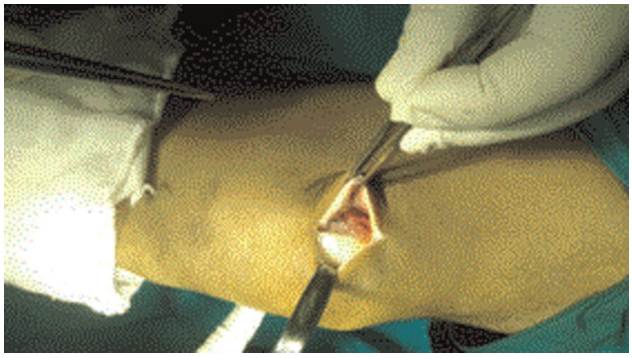
Axial MRI showing slackening of the soft tissue constraint in the medial aspect of the patella.

Figure 2



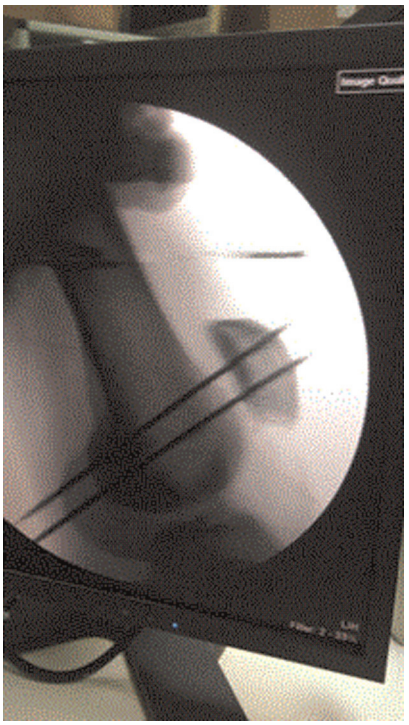
Preparation of the graft on a side table.

Figure 3



A 3-cm incision on the anteromedial aspect of the patella.

Figure 4

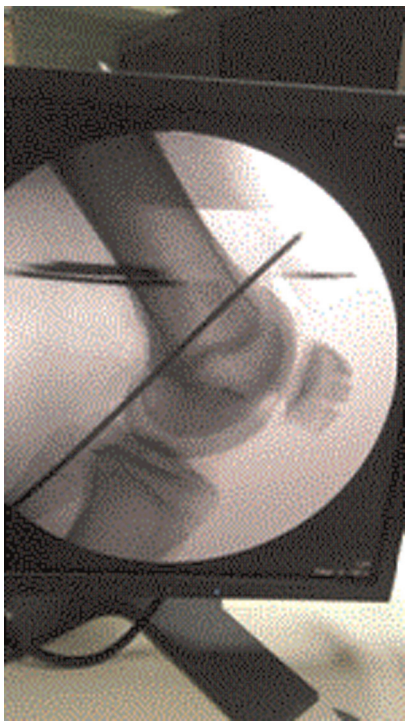


Two drill guide pins inserted into the patella for proper localization of the patellar attachment of medial patellofemoral ligament.

The graft was passed by the help of sutures through the patellar tunnels, keeping the loop of the patella on the dorsal aspect and the free ends on the medial side (Fig. 6).

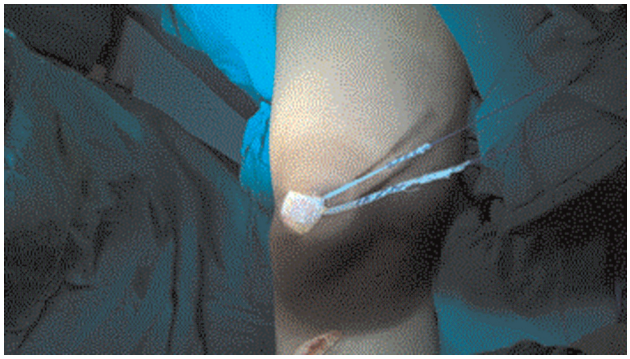
The free ends of the graft were passed through a tunnel under the deep fascia from the medial border of the patella to the femoral tunnel. The free ends of the graft were pulled through the femoral tunnel and fixed by a biointerference screw at 30° flexion as the ligament was found to be slightly relaxed at 30° of knee flection to decrease the loads as compared with full extension and also because after 30°. Of knee flection, the femoral trochlea contributes more to patellar stability.

Figure 5



Scottle point localization guided by the C-arm. The patellar drilling can be detected.

Figure 6



The graft after being passed through the patella with the loop on the anterolateral aspect of the patella.

Finally, arthroscopic assessment of the reconstructed ligament was performed to be sure that it is extra-articular. The wound was closed and the patient was placed in a hinged knee brace. All patients were placed in a hinged knee brace in full extension and instructed quadriceps exercise and allowed partial weight bearing for about 4 weeks.

From 4 to 8 weeks, the brace was intermittently unlocked and full weight bearing was allowed. From 8 to 16 weeks, there was gradual removal of the brace and regaining full range of motion.

Results

A clinical evaluation reported a remarkable clinical improvement; we had no cases of recurrence of instability or complications. Only one case had persistent anterior knee pain. All cases regained full range of motion; the apprehension sign dropped from 90% preoperative in 18 cases to 15% postoperative (only three cases). The glide test dropped from 100 to 0% in follow-up. Mean Lysholm score improved significantly from 58%±3 to 93%±4.

Discussion

The MPFL is the main soft tissue restraint preventing lateral displacement of the patella, especially in the first 30° of flexion having a tensile strength of about 208 N and a stiffness of 8 N/mm [17].

Treatment of recurrent patellar dislocation remains controversial and challenging because of the complexity and broad variety of predisposing factors, as well as the concern of persisting patellofemoral complaint [18].

Randomized prospective studies about treatment of patients with traumatic patellar dislocation showed that the results were much better after surgical treatment than after conservative treatment [19].

Because of the initially reported good results with MPFL in recurrent patellar dislocation, the procedure is gaining more interest and becoming more popular. One of the important prerequisites for the procedure is graft selection that should have greater strength but nearly equal stiffness as the native MPFL. This makes the gracilis tendon the graft of choice nowadays as other tendons have greater stiffness and tensile strength [20].

This interest and popularity lead to evolution of different techniques, the differences between them depend not only on graft selection but also fixation methods (washers, interference screw, anchors, and even hardware-free reconstruction), as well as the femoral attachment point whether static, Schottle *et al.* [21] or dynamic Deie [22].

Schottle *et al.* [21] treated 12 patients with recurrent patellar instability, described an isometric femoral attachment point, at the medial epicondyle just proximal and anterior to the intersection of the posterior cortex of the femur and a line perpendicular to the Blumensatt line.In contrast, Deie [22] described a more dynamic femoral point, using the posterior one-third of the MCL as a pulley for the semitendinosus graft for treating patellar instability.

There is much discussion on the isometry of the native MPFL, and how the graft should behave during the arc of movement of the knee. The normal ligament presents greater tension when fully extended with the quadriceps contracted, but the ideal variation in length for the MPFL graft has still not been established [23].

There is also a great controversy about the degree of knee flexion during femoral fixation and tensioning. Different angles had been recommended that may be 0, 30, 45, or 90 [24].

In our study, we fixed the femur at 30° of knee flexion.

Ronga *et al.* [25] treated 28 cases of recurrent patellar dislocation without any anatomical predisposing factors, by reconstructing MPFL, concluding that it is a safe and reliable method for treating recurrent patellar dislocation after 3.1 years of follow-up.

Enderlein *et al.* [26] reported the largest MPFL reconstruction patient study to date. The study included 224 patients (240 knees) treated with MPFL reconstruction using gracilis autograft. Moderate medial knee pain was reported in 30%. Predictors of poor outcome include obesity, age over 30, grade 3 or 4 cartilage injury, and female sex. In our series, we had one case with persistent anterior knee pain, no cases of recurrent instability, and marked improvement of clinical criteria.

The limitations of this study included a small number of cases, lack of biomechanical testing of the reconstructed ligament, absence of the control group, and a short period of follow-up. Future studies are recommended fulfilling these criteria together with arthroscopic evaluation of the articular cartilage of the medial facet of the patella.

Conclusion

MPFL reconstruction for treatment of recurrent patellar dislocation with a gracilis tendon autograft, using transverse holes in the patella and a screw for femoral fixation, showed good results at short-term follow-up.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Petri M, Liodakis L, Hofmeister M. Operative VS conservative treatment in traumatic patellar dislocation. Results of prospective randomized clinical study. Arch Orthop Trauma Surg 2013; 133:209–213.

2 Fithian DC, Paxton EW, Stone ML. Epidemiology of acute patellar dislocation. Am J Sports Med 2004; 32:1114–1121.

3 Dejour D, Lecoulter B. Osteotonies in patelo femoral instability. Sports Med Arthrosc Rev 2007; 15:39–46.

4 Gomes JE. Comparison between stataic and dynamic methods of medial patella femoral ligament reconstruction. Arthroscoy 2008; 24:430–435.

5 Stensen RN, Dopirak RM, Mc Donald DGIII. The anatomy and isometry of the MPFL. Implications for reconstructions. Am Sports Med 2004; 32:1509–1513.

6 Anbari A, Cole BJ. Medial Patello femoral ligament reconstruction: a novel approach. J Knee Surg 2008; 241–245

7 Zafagenini S, Colle F, Lompo N, Sharma B, Bignozzi S, Dejour D, Marcacci M. The influence of MPFL on patella femoral joint kinematics and patellar stability. Knee Surg Sports Traumatol Arthrosco 2013; 21:2164–2171.

8 Smirk C, Norris H. Anatomy and reconstruction of medial patella femoral ligament. Knee 2003; 10:221–227.

9 Elias DE, white LM, Fithian DC. Acute lateral patellar dislocation at MR injury pattern of medial patellar soft tissue restraint and osteochondral injury pattern of inferomedial patella. Radiology 2002;225736–743

10 Nomura E. Classification of lesions of MPFL in patellar dislocations. Int Orthop 1999; 23:260–263.

11 Sugamuna J, Mitani T, Suzuki N, Iseki F, Fujikawa K. Reconstruction of the medial patella femoral ligament. J Tokyo Knee Soc 1990; 10:137–148.

12 Ellera Gomes JL. Medial patello femoral ligament reconstruction for treatment of recurrent patellar dislocation. A preliminary report Arthroscopy 1992; 8:335–340.

13 Christensen SE, Jackobsen BW, Lund B, Lind M. Reconstruction of the medial patella femoral ligament with gracillis tendon autograft in transverse patellar drill holes. J Arthrosc Relat Surg 2008; 24:82–87.

14 Pal S, Thor F, Gary S, Fredricson M, Scott L. Patellarmal tracking is prevalent among payelofemoral pain subject with patella alta. An upright weight bearing MRI. J Orthop Res 2012; 31:1–10.

15 Tegne Y, Lysholm J. Rating systems in the evaluation of knee ligament injuries. Clin Orthop Relat Res 1985; 198:43–49.

16 Schottele PB, Schmeling A, Rosenstie LN, Weiler A. Radiographic landmarks for femoral tunnel placement in medial patello femeral ligament reconstruction. Am J Sports Med 2007; 35:801–804.

17 Reider B, Marshal JL, Koslin B, Girgis FG. The anterior aspect of the knee jont. J Bone Joint Surg 1981; 63-A:351–356.

18 Amis AA, Senavonges D, Bull AM. Patelo femoral kinematics during knee flexion-extension. An in-vitro study. J Orthop Res 2006; 24:2201–22011.

19 Constantino JC, Marcelo Corvino Noguira JMJ. Reconstruction of the MPFL using autologous graft from Quadriceps tendon to treat recurrent patellar dislocation. Rev Bras Ortop 2016; 188–193.

20 Arendt EA. MPFL reconstruction for PF instability: the soft (tissue) approach. Orthop Traumatol Surg Res 2009; 95(Suppl 1):S97–S100.

21 Schottele PB, Fucentese SF, Romero J. Clinical and radiological outcome of medial patella femoral reconstruction with semitendinosus auto graft for patellar instability. Knee Surg Sports Traumatol Arthrosc 2005;516–521

22 Deie M. reconstruction of MPFL for treatment of recurrent or habitual dislocation of the patella in children. J Bone Joint Surg (Br) 2003; 85:887–890.

23 Fithian DC, Gupta N. Patella instability: principals of soft tissue repair and reconstruction. Tech Knee Surg 2006; 5:19–26.

24 Gonçalves MBJ, de Carvalho Júnior LH, Soares LFM. Medial patella-femoral reconstruction to treat recurrent patellar dislocation. Rev Bras Ortop 2011; 46:160–164.

25 Ronga M, Oliva F, Longo UG, Testa V, Capasso G, Maffulli N. Isolated medial patello-femoral ligament reconstruction for recurrent patellar dislocation. Am J Sports Med 2009; 37:1735–1742.

26 Enderlein D, Nielsen T, Christiansen SE, Fauno P, Lind M. Clinical outcome after reconstruction of the medial patello femoral ligament in patients with recurrent patella instability. Knee Surg Sports Traumatol Arthrosc 2014; 22:2458–2464.