Simultaneous MPFL and LPFL reconstruction for recurrent lateral patellar dislocation with medial patellofemoral instability

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Abstract

We report an extremely rare case of both recurrent lateral patellar dislocation and medial patellofemoral instability, following prior operations to correct patella maltracking. Manual translation of the patella revealed medial and lateral instability with a positive apprehension sign. 3-D computer modelling of kinematics based on MRI data demonstrated that the patella deviated laterally at full extension and translated medially with knee flexion. The medial and lateral patellofemoral ligaments were reconstructed simultaneously with hamstring tendons, alleviating peripatellar pain and patellar instability in both directions.

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Introduction

Patella dislocation is a common clinical condition where static and dynamic forces laterally displace the patella in most cases. Reconstruction of the medial patellofemoral ligament (MPFL) has become the current, popular treatment for recurrent lateral dislocation. Subluxation or dislocation of the patella in a medial direction, on the other hand, is a rare condition often seen as a late complication of lateral retinacular release procedures with or without tibial tubercle transfer for patellofemoral joint disorders. Medial retinacular release, lateral retinacular repair, and reconstruction of the lateral patellofemoral ligament (LPFL) are surgical procedures reported to have satisfactory outcomes for medial dislocation. However, there have been no specific reports on patients with both recurrent lateral patellar dislocation and medial patellar instability. The following case study examines an affected patient who was successfully treated with simultaneous reconstruction of the MPFL and LPFL.

Case report

A 40-year-old woman presented with peripatellar pain in the left knee and a sense of patellar instability in both lateral and medial directions. The pain and lateral instability began after her first lateral dislocation at age 15, and the Roux-Goldthwait procedure was performed with loose body removal 9 months later for distal realignment of the extensor mechanism. The patient continued to experience patellar instability and the knee giving way postoperatively. Thirteen years after the procedure, lateral release for unstable patella was also performed. Despite the two operations, patellar instability and peripatellar pain
persisted. When the patient visited our hospital, she could not walk without crutches due to the severe instability. Manual translation of the patella revealed medial as well as lateral instability, with a positive apprehension sign. The Q angle of the left knee was $25^\circ$, and plain radiographs revealed a sulcus angle of $138^\circ$, a congruence angle of $-25^\circ$, and an Insall-Salvati ratio of 1.25 (Fig. 1). Three-dimensional computer modelling of kinematics compiled from MRI data, a technique reported by Yamada et al., demonstrated that the patella deviated laterally at full extension and shifted medially with flexion (Figs. 2, 3). Non-operative treatment, including stretching the retinaculum and strengthening quadriceps, had no effect. We diagnosed recurrent lateral patellar dislocation combined with medial patellofemoral instability in the patient and planned MPFL and LPFL reconstruction using medial hamstring tendons as a therapeutic solution.

Under anaesthesia, the patella dislocated laterally and moved medially to a great extent with ease. The harvested autogenous semitendinous and gracilis tendons were folded to form double-looped grafts for the MPFL and LPFL, respectively. On the femoral side of the grafts, EndoButton CL (Smith & Nephew Endoscopy, Andover, MA, USA) was placed on each loop end after measuring the length of the femoral tunnel. On the patellar side, two no. 2 braided polyester sutures were added to the free end of each graft using the Krackow technique. Both medial and lateral retinaculum were exposed and incised transversely to expose insertion sites for the MPFL and LPFL. A guide wire was inserted from the insertion point for the MPFL located superoposterior to the medial epicondyle and just distal to the adductor magnus. Another guide wire was inserted through the iliobial band from the femoral insertion point for the LPFL located superoposterior to the lateral epicondyle. Each femoral tunnel was created by over-drilling along the guide wire with a 6-mm cannulated drill bit matched with the graft diameter to 20 mm in depth after over-drilling with a 4.5-mm drill bit to the far femoral cortex. Next, two parallel guide pins were then transversely inserted into the patella, and over-drilled with a 4.5-mm cannulated drill bit on both sides up to a depth of 1.5 cm. Each graft was introduced through their respective femoral tunnel and fixed on the lateral femoral cortex by flipping the EndoButton. The free ends of each graft were introduced in the shared patella tunnels and simultaneously fixed on the contralateral side by tying the suture over the EndoButton at $45^\circ$ of knee flexion without causing patellar subluxation (Fig. 4). The knee was immobilized for 2 weeks postoperatively, and partial weight bearing was allowed at 3 weeks and full weight bearing was started at 5 weeks.

At a 2-year follow-up, the absence of dislocation led to the disappearance of peripatellar pain and a negative sign of apprehension in medial and lateral directions. Postoperative plain radiographs revealed improvement in a congruence angle (Fig. 5). As a result, it changed from $-25^\circ$ to $-11^\circ$. Postoperative kinematic three-dimensional computer modelling showed improvement in patellar maltracking, which included a reduction of lateral deviation in terminal extension and improvement of medial shift in knee flexion (Figs. 6, 7).

Discussion

Recent anatomical and biomechanical studies have revealed that the MPFL is a major stabilizer in lateral patellar translation. Reconstruction of this ligament is thus considered to be an appropriate treatment for lateral patellar dislocation. Distal extensor mechanism realignment and lateral retinacular release procedures for this dislocation, however, could cause medial subluxation of the patella as a post-operative complication. In this case study, prior Roux-Goldthwait and lateral release procedures without reconstruction of medial restraints such as the MPFL were considered to be the cause of not only persistent lateral instability but also iatrogenic medial instability. Cases of patellar instability

Fig. 1. Preoperative plain radiographs. (A) Anterior-posterior (standing). (B) Lateral (gravity sag view). (C) Axial. A congruence angle is $-25^\circ$. 
in both directions have not been reported in detail, particularly with respect to surgical treatment. Shellock et al. found “lateral-to-medial subluxation” in 9% of knees with persistent symptoms after lateral release through examination of two-dimensional kinematic MRIs, where the patella shifted from slight lateral subluxation in extension to medial subluxation in 30° of knee flexion, although no further information about pathology or treatment was reported.8

Kinematic three-dimensional computer modelling can clearly visualize patterns of patellar maltracking, a condition of significant lateral deviation in extension and medial shift in knee flexion. For maltracking treatment, reconstruction of the
MPFL is undoubtedly necessary to prevent further lateral dislocation. The lateral retinaculum, which acts as a restraint on the patella to avoid medial deviation, had to be repaired in this patient due to complaints of medial patellar instability as well as lateral instability. However, Abhaykumar et al. reported an almost complete absence of tissue lateral to the patella in four cases of medial patellar dislocation following tibial tubercle transfer surgery and lateral release.\textsuperscript{18}

Reconstruction of the tissue is thus a reasonable option to limit medial shift; Teitge et al. reported excellent results with reconstruction of the LPFL to treat patellar instability after failed lateral release.\textsuperscript{7} Even though Teitge et al. used a quadriceps tendon for their LPFL graft, we chose the gracilis tendon because we had previously used the semitendinous tendon for the MPFL and the use of the gracilis which could be harvested from the same site was reasonable.\textsuperscript{1}

Fig. 5. Plain radiographs at final follow up: (A) anterior-posterior; (B) lateral; (C) axial. A congruence angle is $-11^\circ$. EndoButtons on the patella were removed.

Fig. 6. Three-dimensional computer modelling of patellar kinematics compiled from postoperative MRI data. Knee flexion was simulated at (A) 0°, (B) 20°, (C) 30°, and (D) 50°. The patella settled in the trochlear groove at full extension, and medial shift at the flexed position improved.
Both grafts were fixed at 45° of knee flexion on the basis of report on MPFL reconstruction by Toritsuka et al. A suitable fixation angle of the LPFL graft is unknown due to few reports on LPFL reconstruction. However, the MPFL and the lateral capsular structures including the LPFL have a similar characteristic in that their contribution to the patella stabilization is greatest in the extended knee. Therefore we consider that fixation of both grafts at the same angle is acceptable.

The efficacy of reconstruction for our patient was evaluated postoperatively with kinematic three-dimensional computer modelling from MRI data. The lateral deviation of the patella improved and was found in the trochlear groove during terminal extension, but medial shift of the patella persisted during knee flexion, although its degree decreased. One reason for this partial success is the prior Roux-Goldthwait procedure the patient underwent, in which the lateral half of a split patellar tendon was detached from the tibial tubercle, transferred beneath the intact medial half, and sutured to the soft tissue; these measures made it difficult to later restore the tendon to its original position. Despite this complication, clinical symptoms, including peripatellar pain and a sense of instability in both directions, disappeared after 2 years with a negative apprehension sign. Reconstruction of both the MPFL and LPFL is thus a valuable procedure for recurrent lateral patellar dislocation concurrent with medial patellofemoral instability.

Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review from the Editor-in-Chief of this journal.

Conflicts of interest

The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in the manuscript.

Authors’ contributions

All authors co-wrote the paper and discussed the results and commented on the manuscript. All authors read and approved the final manuscript.

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