Anatomical double-bundle medial patellofemoral ligament reconstruction in recurrent patellar dislocation using autologous gracilis tendon graft

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Background
Recurrent lateral instability of the patella after traumatic patellar dislocation always involves injury to the medial patellar soft tissue restraints. The purpose of the study was to assess the results of double-bundle medial patellofemoral ligament (MPFL) reconstruction in the management of recurrent lateral patellar dislocations.
Patients and methods
Between January 2012 and November 2014, MPFL reconstruction was performed in 25 knees in 19 patients (12 females and seven males) at Benha University Hospital. The inclusion criteria included patients with recurrent dislocations of the patella (more than two times) with deficient medial retinacula. Autogenous gracilis graft was used as double bundle. Graft was fixed at the femoral side using interference screws and at the patellar side using incomplete tunnels and bone groove in the medial half of the patella.
Results
Average follow-up period was 32.16±5.8 months. At the final follow-up, average postoperative Lysholm score improved significantly from 58.88±5.87 to 90.68±2.77 ($P<0.00001$), and average postoperative Kujala score improved significantly from 65.24±3.12 to 90.08±5.47 ($P<0.0001$). No complications were recorded, as well as no reported postoperative dislocations.
Conclusion
Anatomical double-bundle MPFL reconstruction is a simple and cheap technique used in the current case series that provides accurate femoral and patellar anatomical insertion points at the insertion sites and allows proper tensioning of the graft maintaining normal patellar glide, with overall favorable outcome results.

Keywords:
medial patellofemoral ligament, patellar dislocations, patellar instability

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Introduction

Recurrent lateral instability of the patella after traumatic patellar dislocation always involves injury to the medial patellar soft tissue restraints [1]. Historically, surgical management focused on the release of lateral restraints [2]. However, bad results shifted attention to strengthening of medial restraint by either vastus medialis obliquus advancements or shortening/imbrication of the medial patellar retinaculum [3].

Recent anatomical and biomechanical studies identified the role of medial patellofemoral ligament (MPFL), which is a thickened band of retinacular tissue originating in the area between the medial epicondyle and the adductor tubercle, and inserted on the proximal half of the medial border of the patella, in patellar stability. It function as a checkrein in preventing abnormal lateral movement of the patella (not pulling the patella medially) in the first 30° of flexion and is of no importance once the patella has engaged the trochlea [4,5].

Biomechanical studies have demonstrated that MPFL reconstruction restores normal patellar tracking [6,7], avoiding increased patellofemoral pressure with consequent patellofemoral arthritis, which is the main disadvantage of distal realignment procedures. This makes MPFL reconstruction the procedure of choice in the management of recurrent lateral patellar instability with deficient medial restraints in the absence of severe trochlear dysplasia and severe malrotations.

Recently, numerous techniques for MPFL reconstruction have been described with good clinical results [8–10]. However, a nonanatomical MPFL reconstruction can lead to nonphysiological patellofemoral loads and kinematics [11]. The aim of the study is to evaluate the results of anatomical

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MPFL reconstruction with bone tunnel fixation at the medial margin of the patella.

Patients and methods

Between January 2012 and November 2014, MPFL reconstruction was performed in 25 knees in 19 patients (12 females and seven males) at Benha University Hospital. The study was approved by the institutional ethics committee in the Orthopedic Department of Orthopaedic Surgery, Benha University, Benha, Egypt. The inclusion criteria included patients with recurrent dislocations of the patella (more than two times) with deficient medial retinacula as evident by the glide test. Exclusion criteria were (a) severe trochlear dysplasia (Dejour types C and D), (b) patella alta with Caton-Deschamps index more than 1.3, (c) tibial tubercle-trochlear groove distance more than 20, (d) previous knee surgeries, and (e) associated knee pathologies such as meniscal or ligamentous injuries requiring repair or severe chondral injury (Outerbridge III or IV).

A total of 25 knees in 19 patients were operated upon. The average age at surgery was 28.2 years (range, 19–36 years). Eight operations were performed on the left knee and 17 on the right knee (six bilateral).

Clinical assessment

Detailed history and physical examinations were conducted preoperatively with emphasis on lower limb alignment and rotational profile, patellar mobility, j sign, patellar glide test with record of the quality of endpoint, patellar compression test, and assessment of generalized laxity. Preoperative Lysholm and Kujala scores were then completed.

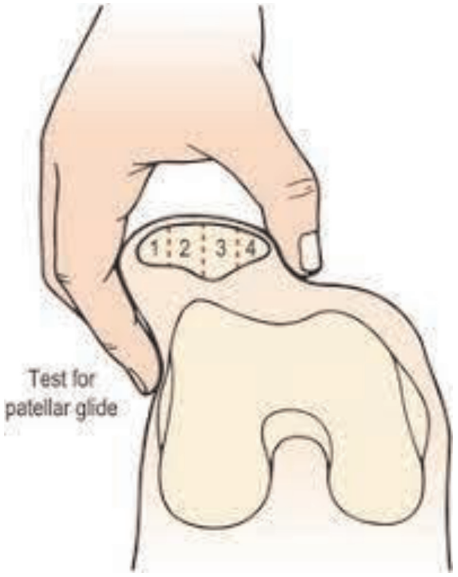
Radiographic examination included knee anteroposterior, lateral, and axial views. Computed tomography scan was used to assess trochlear morphology and measure tibial tubercle-trochlear groove distance.

Surgical technique

All operations were done under spinal anesthesia with the use of a pneumatic tourniquet. Patients were positioned supine, and examination under anesthesia was done to assess patellar tracking and condition of medial soft tissue restraints (Fig. 1a).

Routine knee arthroscopy was done using the classic anterolateral portal and anteromedial border to assess the condition of articular cartilage and any concomitant knee pathology. Superolateral portal was then marked from outside using spinal needle at the superolateral angle of the patella and used to assess patellar tracking.

Figure 1



Examination under anesthesia and patellar glide test.

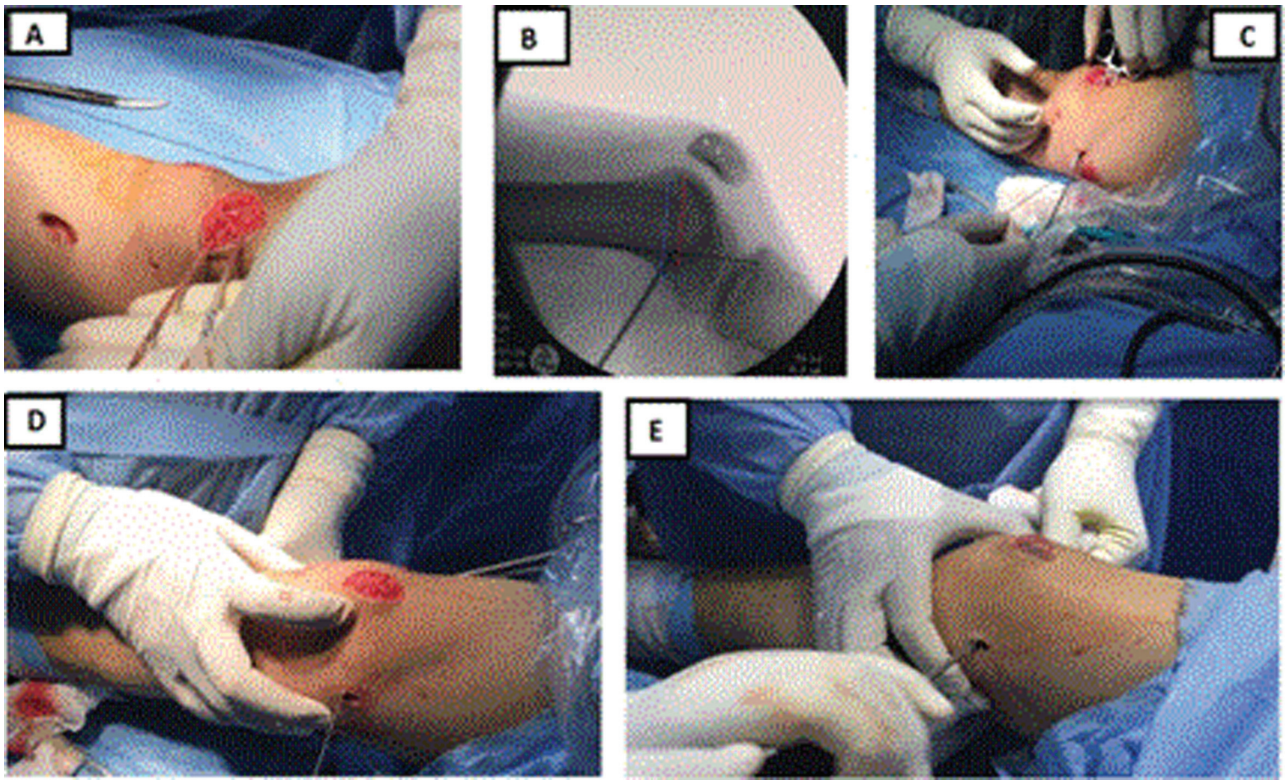
The gracilis tendon graft was then harvested using the closed stripper (Fig. 1b) and measured, and a whip stitch was applied for 30 mm on each end as the routine preparation used for ACL reconstruction, followed by putting on a tensioner device for 15 min at 10 pounds.

A medial patellar incision along the proximal half of the patella was used, followed by dissection of the medial retinaculum, taking care not to open the capsule. Two transverse k-wires 2 cm apart were advanced in the proximal half of the patella for about 3 cm, and their position was checked using intraoperative radiology (Fig. 1c).

A 4.5-mm cannulated drill was used to make 20-mm incomplete tunnels. The lateral ends of the tunnels were connected longitudinally using small rongeur and curette (Fig. 1d). A shuttle suture was then used to shuttle the graft through the tunnels (Fig. 2a).

The medial femoral epicondyle and adductor tubercle were palpated, and the anatomical femoral insertion point was then marked by k-wire under image control according to Schottle criteria [12] (Fig. 2b). A small skin incision over the wire was done, and a cannulated drill was used to make the femoral tunnel. The diameter of drill holes in the femur and the patella was selected according to the graft diameter. We used a 4.5-mm drill in the patella and 7 mm in the femur in all cases.

Figure 2



Intraoperative photograph demonstrating MPFL reconstruction. (a) Passing the graft in the patellar groove. (b) Marking femoral insertion site under fluoroscopic control (black line tangent of the posterior femoral cortex, blue line perpendicular to black line at post end of femoral condyle, red line perpendicular to black line at posterior end of Blumensaat line). (c) Passing the graft to femoral insertion site. D: testing the tension of the graft through range of motion and glide test. (e) Final fixation of femoral end of the graft by interference screw in 30° knee flexion. MPFL, medial patellofemoral ligament.

The graft was then passed from the patella to the femoral insertion incision by meticulous dissection between layer two and three, taking care not to violate the capsule (Fig. 2c). The graft was then pulled from the femoral tunnel, and the stitches were fixed by forceps at the desired tension (Fig. 2d). Patellar tracking and glide were then checked followed by definitive fixation by interference screw at 30° flexion (Fig. 2e).

Postoperative follow-up

A knee brace locked at 0° flexion was used in all patients in the first 6 postoperative weeks. Flexion exercises till 90° began after second week. Weight bearing was allowed as tolerated.

Results

The average follow-up period was 32.16±5.8 months. At final follow-up, average postoperative Lysholm score improved significantly from 58.88±5.87 to 90.68±2.77 ($P<0.00001$), and average postoperative Kujala score improved significantly from 65.24±3.12 to 90.08±5.47 ($P<0.0001$).

No complications were recorded, and no reported postoperative dislocations. Apprehension test was negative in all patients. All patients returned to their previous activity and sports level.

Discussion

Since Amis *et al.* [5] described the wide patellar attachment and Kang *et al.* [13] described the double-bundle configuration of the MPFL, double-bundle reconstruction at patellar side seemed a reasonable option having the advantages of mimicking the anatomy of native MPFL and decreasing patellar tilt during flexion. In their study, Wang *et al.* [14] had 20% failure rate in single-bundle group and 0% in double-bundle group using same anchors in both groups.

Various fixation techniques have been used to fix the graft to the patella which can be divided into transverse tunnels across the patella and fixation to the medial edge of the patella either by nonabsorbable sutures [15], or suture anchors [16], or tenodesis screws [17]. Drilling tunnels transversely across the patella create a stress riser and can lead to fracture [18]. The use of

Table 1 Results of multiple medial patellofemoral ligament reconstruction techniques

	Calanna *et al.* [16]	Wang *et al.* [14]	Kim *et al.* [15]	Quirbach *et al.* [17]	Current study
Number of cases	19	26	9	27	25
Average duration follow-up (months)	22	38.2	19.3	12	32.2
Patellar fixation technique	Suture anchor	Patellar grove and anchors	Suturing to periosteum by nonabsorbable sutures	Bioscrews	Bone grove
Lysholm score	64.30–94.72	59.6–90.3	45.8–82	–	58.88–90.68
Kujala score	65.23–94.69	53.2–89.4	42.7–79.6	61–93	65.24–90.08
Redislocation	No	No	One case	No	No

anchors increases the economic burden of the procedure, and anchoring security in the soft patellar bone is questionable.

In the current case series, we present a simple and cheap technique of fixing the graft to medial margin of the patella without the risk of patellar fracture and with fixation stability like bone tunnels. The postoperative functional scores were comparable to recent studies using various fixation techniques as demonstrated in Table 1.

Tensioning of the graft is an essential step because over-tensioning increases patellofemoral compressive forces, resulting in pain and arthritis. There is no consensus regarding the degree of knee flexion during fixation of the femoral side. Most surgeons fix it at 30 flexion, as this is the maximum tension of the MPFL. Others prefer to fix it at 90° to avoid over-tensioning [19]. Some even fix it at full extension [20]. In the current study, it was fixed at 30° flexion.

Conclusion

Anatomical double-bundle MPFL reconstruction is a simple and cheap technique used in the current case series that provides accurate femoral and patellar anatomical insertion points at the insertion sites and allows proper tensioning of the graft maintaining normal patellar glide, with overall favorable outcome results.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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