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Midterm clinical and functional outcomes after isolated double bundle anatomic MPFL reconstruction in patients with patellofemoral instability

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Abstract

The purpose of this study was to demonstrate midterm outcomes after isolated double bundle anatomic MPFL reconstruction in a young patient cohort. Between 2014 and 2016; 24 knee joints of 23 patients were operated and evaluated in our retrospective study. The time and duration of the patients' complaints, preoperative and postoperative knee range of motion, extent of patellofemoral pain and episodes of lateral patellofemoral instability were evaluated. Functional outcomes were evaluated with Kujala, IKDC, KOOS-QoL and Tegner activity scores. Patellar height was analysed radiographically using the Caton–Deschamps index. Patients were also asked if they were satisfied with the operation. The mean age of the patients during index surgery was 16.7 ± 8.4 years. 87 % of our patients was satisfied with the surgery. The average Kujala score increased from 72 to 96 ($p<0.001$), and the average IKDC score increased from 69 to 88 ($p < 0.001$). The average KOOS-QoL score was found to increase from 61 to 83 ($p <0.001$). The average Tegner activity score of our patients increased from 2.6 to 4.9. Preoperative and postoperative patellar height according to Caton-Deschamps index was similar for both groups. There were two postoperative complications (one recurrence of patellar dislocation (1/24) and one loss of knee joint flexion >10 degrees). MPFL reconstruction is an effective and reliable treatment method to utilize in the treatment of lateral patellofemoral instability.

Keywords: Patellofemoral instability, MPFL reconstruction, midterm outcome

Introduction

Lateral patellofemoral instability (LPFI) is a common disabling knee condition that generally affects younger individuals [1,2]. The medial patellofemoral ligament (MPFL) acts as the main medial stabilizer of the patellofemoral joint during smaller degrees of flexion, and provides approximately 50%–60% of the total restraining force against lateral dislocation of the patella [3–6]. In a vast majority of patients, the MPFL is injured during the first patellar dislocation [6,7] which, in turn, may cause recurrent LPFI with subluxation, dislocation, pain, decreased activity, and chondral injuries that may progress to patellofemoral osteoarthritis (PFOA) if left untreated [8,9].

Unfortunately, conservative management of patellar instability often leads to recurrence, thus necessitating surgical intervention to restore and preserve normal functional status and prevent repeated dislocation [10,11]. MPFL reconstruction is one of the common surgical treatments for LPFI [6,12], and is usually performed alone or in combination with other soft tissue or bony procedures [9].

The aim of this study was to investigate the mid-term clinical and radiological outcomes of isolated MPFL reconstruction for treatment of recurrent lateral LPFI.

Materils and Methods

Ethical approval(File number:2020/1045) for this study was obtained from the institutional review board and informed consent was collected from all patients prior to commencement. This study retrospectively reviewed MPFL reconstruction procedures for patellofemoral instability (26 knees in 25 patients) carried out between January 2014 and December 2016. As a rule, all recurrent LPFI patients first underwent six months of physical rehabilitation and exercise before being recommended for surgery. Patients with a history of at least two lateral patellar dislocations, recurrent subluxation episodes, and minimum postoperative follow up of 2 years included in this study. The exclusion criteria were as

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follows: 1) patients aged >40 years at the time of surgery; 2) those requiring long bone derotation and/or tibial tubercle osteotomy as a combination; and 3) those with a previous history of surgery of any kind on the affected knee. Two patients were lost to follow up and were excluded, resulting in a final sample of 24 knees in 23 patients.

LPFI was diagnosed based on physical examination of range of motion (ROM), positivity of apprehension test, and J sign. Preoperative radiographic evaluation included standing full extension anteroposterior (AP) and true weight-bearing lateral (LAT) views of the knee at 30° flexion to allow assessment of trochlear dysplasia [in accordance with Dejour et al,.[13]] and patellar height (measured using the Caton-Deschamps index). All patients also underwent preoperative Computerized Tomography examination at 10° knee flexion to measure the TT-TG (tibial tuberosity-trochlear groove) distance, as well as Magnetic Resonance Imaging to allow identification of the location of MPFL injury, any trochlear or patellar chondral defects that would dictate unloading type tubercle osteotomy, and any other simultaneously occurring intra-articular pathologies that may need to be addressed during surgery.

The clinical outcomes were evaluated using the following scores: Kujala, International Knee Documentation Committee (IKDC), Knee injury and Osteoarthritis Outcome Score–Quality of Life (KOOS-QoL), and Tegner activity. Scores were measured both preoperatively and at the last follow up consultation, and all postoperative complications were also recorded.

Surgical Technique

The patient was first placed in the supine position and a tourniquet was applied to the thigh. The ipsilateral autologenous gracilis tendon was harvested using a tendon stripper, and each tail was sutured with a No. 2 polyester suture and prepared for fixation. Thereafter, a medial parapatellar incision, approximately 3 to 4 cm in length, was made to expose the medial border of the patella. A soft tissue tunnel directed toward the medial epicondyle was created between the 2nd and 3rd soft tissue layers of the knee. Thereafter, the inferior tunnel was first placed immediately above the line that divides the patella into superior and inferior halves along the sagittal plane, in keeping with the preoperative measurements and plan. The second tunnel was placed at a point 7 mm proximal to the first tunnel and at least 7 mm distal to the uppermost point of the proximal pole. Both tunnels were drilled using a 4.5 mm cannulated reamer up to a depth of 25 mm, and care was taken to ensure that the articular surface and anterior cortex were not disrupted. Two bio-composite anchors were used for fixation of the two legs of the graft to the patella (Figure 1).

The femoral fixation site was assessed using fluoroscopic guidance on the true lateral view of the knee, as described by Schöttle et al. [12], and a guide pin was inserted at this point. Thereafter, a 3 cm skin incision was made and the prepared soft tissue tunnel was extended toward this incision using blunt dissection with a curved clamp. The femoral tunnel was reamed according to the diameter of the prepared tendon up to a depth of approximately 30 mm. The graft was then passed into the femoral tunnel and the knee was taken to 30° of flexion to allow assessment of the lateral edge of the patella for tightness of the graft. A bio-absorbable screw was used for femoral fixation after ensuring that the patella was in the appropriate position. The ROM of the knee was checked and all wounds were closed.

Figure 1. Postoperative X-ray of a patient performed double bundle anatomic MPFL reconstruction

Postoperative Care

A hinged knee brace was applied postoperatively and the joint was immobilized in extension during walking for a period of 3 weeks. ROM exercises and full weight bearing using two crutches was began immediately on postoperative first day. Knee ROM was gradually increased for four weeks, with the aim of achieving full ROM and no extension lag by the sixth week at which point the knee brace and crutches were discontinued. The patient was allowed to participate in sports activities 4–6 months post-surgically provided he/she exhibited good rehabilitation progress, particularly with regards to proprioception.

Statistical Analysis

All statistical analyses were performed using the statistical software, SPSS ver. 22.0 (IBM-SPSS Inc., Chicago, Illinois). The results were presented as mean ± standard deviation. The normality of distribution of the data was assessed using the Shapiro–Wilk test, and preoperative and postoperative functional scores were compared using non-parametric Wilcoxon signed-rank test. Comparison of patellar height was carried out using the Wilcoxon test. A p-value < 0.05 was considered statistically significant.

Results

This study examined 24 knees in 23 patients, of which 9 were males (39.1%) and 13 were female (68.9%). The mean age of the cohort at the time of operation was 16.7 ± 8.4 years, while the mean follow up period was 55.7 ± 4.9 months. The average time period between occurrence of first dislocation and surgery was 36.2 ± 33.9 months, and the mean age at the time of first dislocation was 13.7 ± 7.9 years. The average TT-TG distance was 13.3 ± 2 mm, and the preoperative and postoperative patellar height, as per the Caton-Deschamps index, was similar in both groups (1.33 ± 0.2 and 1.23 ± 0.2, respectively; $p = 0.264$). Type A trochlear dysplasia was observed in 9 knees (38%), Type B in

10 knees (42%), and Type C in 5 knees (20%) (Table 1).

Table 1. Demographic data of the patients

Age at the surgery(years)	16.7±8.4
Gender	9 Male/14 Female
Caton-Deschamps Index	
Preoperative	1.33±0.2
Postoperative	1.23±0.2
TT-TG Distance(mm)	13,3±2.1
Age at the first dislocation(years)	13.7±7.9
Trochlear Dysplasia	
Type A	9(38%)
Type B	10(42%)
Type C	5(20%)
Follow up(months)	55.7±4.9

TT-TG: Tibial tubercle-trochlear groove distance

Eighty-seven percent of the patients were satisfied with their postoperative outcomes at the last follow up consultation. The mean Kujala score of the cohort improved significantly from 72.1 ± 13.3 preoperatively to 96.8 ± 5.5 postoperatively ($p < 0.001$), and a significant difference in the preoperative and postoperative Tegner score (2.6 ± 0.7 and 4.9 ± 0.9, respectively; $p < 0.001$) was also observed. The mean IKDC score improved significantly from 69.1 ± 5.1 preoperatively to 88 ± 8.9 postoperatively ($p < 0.001$), and the KOOS-QoL was seen to change significantly (from 61.5 ± 6.3 to 83 ± 12.24; $p < 0.001$) between the preoperative assessment and the last follow up consultation (Table 2).

Table 2. Preoperative and postoperative outcome measurements of the patients

	preoperative	postoperative	p value
Kujala score	72.1±13.3	96.8±5.5	P<0.001
IKDC score	69.1±5.1	88±8.9	p<0,001
KOOS-QoL	61.5±6.3	83±12.24	p<0,001
Tegner score	2.6±0.7	4.9±0.9	p<0.001

IKDC: International Knee Documentation Committee, KOOS-QoL: Knee injury and Osteoarthritis Outcome Score–Quality of Life

Postoperative follow up showed occurrence of complications in two cases (8%). One knee demonstrated recurrence of patellar dislocation and instability (4%), and tibial tubercle transfer was performed along with revision of the MPFL reconstruction as the patient exhibited cessation of physeal growth. A loss of ROM ≥10° compared to the non-operated knee was observed in 1 patient (4%) at final follow up. The postoperative apprehension test was negative for all patients.

Discussion

MPFL reconstruction was first described in 1992 by Gomes [14], and began to gain popularity in the early 2000's. Nearly 60 different MPFL reconstruction surgical techniques have been reported in the literature to date, with the procedure being carried out either alone or in combination with other bony or soft tissue procedures for patellofemoral instability. Autograft or allograft can be used for MPFL reconstruction just as in the extensor mechanism reconstruction[15,16].

Pesenti et al. [17] performed isolated MPFL reconstruction using hamstring allografts in patients with LPFI and predisposing bony abnormalities, and reported excellent outcomes with only 8 % of their patients experiencing recurrence.

Erikkson et al.[15] carried out isolated MPFL reconstructions resulting in significantly improved outcome scores and low recurrence of dislocation/instability rates, irrespective of the presence of bony pathologies (such as those affecting TT-TG distance, patellar height and trochlear dysplasia). Kohn et al. [18] also reported that isolated MPFL reconstruction was an effective treatment method for revision surgeries.

The most significant finding of the current study was that isolated MFPL reconstructions improved activity levels and mid-term functional outcomes in patients with LPFI. The postoperative satisfaction rate after MPFL reconstruction was high at 87% (mean follow up period: 55.7 months).

Age at the time of surgery is an important determinant of postoperative outcomes in cases of recurrent patellofemoral instability, with Hiemstra et al.[19] reporting a correlation between the two after examining a cohort of patients with a mean age of 24.5 years. The mean age of participants in the current study was lower at 16.7 years.

The current study also found that functional results improved significantly after MPFL reconstruction, with the mean Kujala score increasing from 72.1 ± 13.3 to 96.8 ± 5.5, and this was in accordance with previous studies by Mulliez et al.[20] (mean preoperative Kujala score: 55.5, mean postoperative Kujala score:74.7) and Bouras et al.[21] (preoperative Kujala score: 60, mean postoperative Kujala score: 92; $p < 0.001$) who also reported significant improvements. However, the postoperative Kujala scores of the current study were among the highest reported in the literature to date [22], and this could be attributed to careful patient selection and inclusion of a smaller patient sample compared to other studies.

Erickson et al. reported mean preoperative and postoperative KOOS scores of 32.7 and 72.0, respectively, while the corresponding IKDC scores were 51.4 and 82.6 [15]. The current study also demonstrated significant improvement in both KOOS and IKDC scores, with the preoperative and postoperative values being higher than those observed by Erickson et al. This difference could be attributed to the fact that the patients included in the current study exhibited higher preoperative KOOS and IKDC scores. A statistically significant improvement in the Tegner score was also observed ($p < 0.001$).

Postoperative complications were observed in 8% of the sample included in this study, and this was in accordance with Mulliez et al.[20] and Pessenti et al.[17] who also reported similar rates (8.5% and 19%, respectively).

The severity of trochlear dysplasia was found to affect postoperative outcome scores, with lower clinical improvement observed in patients with high-grade trochlear dysplasia. This was in accordance with the findings reported by Hopper et al [23] and Fucentese et al. [24], but contradicted those reported by Howells et al [2] and Schöttle et al. [12]. who found no association between severity of trochlear dysplasia and surgical outcome.

This study was limited by its retrospective study design, small sample size, and relatively short follow up period. Future studies including a larger sample of patients and a longer follow up period are necessary in order to better assess long term outcomes and occurrence of complications following isolated MPFL reconstruction using our principles and technique.

Conclusion

MPFL reconstruction is an effective and reliable treatment option for patellofemoral instability as it delivers good clinical outcomes, high patient satisfaction, and low complication rates.

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

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Ethical approval
Ethical approval(File number:2020/1045) for this study was obtained from the institutional review board and informed consent was collected from all patients prior to commencement.

References

1. Atkin DM, Fithian DC, Marangi KS, et al. Characteristics of patients with primary acute lateral patellar dislocation and their recovery within the first 6 months of injury. Am J Sports Med. 2000;28:472–9.
2. Howells NR, Barnett AJ, Ahearn N, et al. Medial patellofemoral ligament reconstruction: A prospective outcome assessment of a large single centre series. J Bone Jt Surg - Ser B. 2012;94:1202–8.
3. Conlan T, Garth WP, Lemons JE. Evaluation of the medial soft-tissue restraints of the extensor mechanism of the knee. J Bone Jt Surg - Ser A. 1993;75:682–93.
4. Desio SM, Burks RT, Bachus KN. Soft tissue restraints to lateral patellar translation in the human knee. Am J Sports Med. 1998;26:59–65.
5. Ntagiopoulos PG, Sharma B, Bignozzi S, et al. Are the tubular grafts in the femoral tunnel in an anatomical or isometric position in the reconstruction of medial patellofemoral ligament? Int Orthop. 2013;37:1933–41.
6. Nomura E, Horiuchi Y, Kihara M. Medial patellofemoral ligament restraint in lateral patellar translation and reconstruction. Knee. 2000;7:121–7.
7. Zaffagnini S, Colle F, Lopomo N, et al. The influence of medial patellofemoral ligament on patellofemoral joint kinematics and patellar stability. Knee Surg Sport Traumatol Arthrosc. 2013;21:2164–71.
8. Sanders TL, Pareek A, Johnson NR, et al. Patellofemoral Arthritis after Lateral Patellar Dislocation: A Matched Population-Based Analysis. Am J Sports Med. 2017;45:1012–7.
9. Weber AE, Nathani A, Dines JS, et al. An algorithmic approach to the management of recurrent lateral patellar dislocation. J Bone Joint Surg Am. 2016;98:417-27.
10. Camanho GL, Viegas A de C, Bitar AC, et al. Conservative versus surgical treatment for repair of the medial patellofemoral ligament in acute dislocations of the patella. Arthrosc - J Arthrosc Relat Surg. 2009;25:620–5.
11. Bitar AC, Demange MK, D'Elia CO, et al. Traumatic patellar dislocation: Nonoperative treatment compared with MPFL reconstruction using patellar tendon. Am J Sports Med. 2012;40:114–22.
12. Schöttle PB, Fucentese SF, Romero J. Clinical and radiological outcome of medial patellofemoral ligament reconstruction with a semitendinosus autograft for patella instability. Knee Surgery, Sport Traumatol Arthrosc. 2005;13:516–21.
13. Dejour D, Le Coultre B. Osteotomies in patello-femoral instabilities. Sports Med Arthrosc Rev. 2007;15:39-46.
14. Ellera Gomes JL. Medial patellofemoral ligament reconstruction for recurrent dislocation of the patella: A preliminary report. Arthrosc J Arthrosc Relat Surg. 1992;8:335–40.
15. Erickson BJ, Nguyen J, Gasik K, et al. Isolated medial patellofemoral ligament reconstruction for patellar instability regardless of tibial tubercle–trochlear groove distance and patellar height: outcomes at 1 and 2 years. Am J Sports Med. 2019;47:1331–7.
16. Görmeli G, Görmeli CA, Özdemir ZM, et al. Yumuşak doku tutulumu olan patellanin dev hücreli tümörü: Alternatif bir tedavi yöntemi ve literatür derlemesi. Eklem Hast ve Cerrahisi. 2015;26(2):110–5.
17. Pesenti S, Ollivier M, Escudier JC, et al. Medial patellofemoral ligament reconstruction in children: do osseous abnormalities matter? Int Orthop. 2018;42:1357–62.
18. Kohn LM, Meidinger G, Beitzel K, et al. Isolated and combined medial patellofemoral ligament reconstruction in revision surgery for patellofemoral instability: A prospective study. Am J Sports Med. 2013;41:2128-35.
19. Hiemstra LA, Kerslake S. Age at time of surgery but not sex is related to outcomes after medial patellofemoral ligament reconstruction. Am J Sports Med. 2019;47:1638–44.
20. Mulliez A, Lambrecht D, Verbruggen D, et al. Clinical outcome in MPFL reconstruction with and without tuberositas transposition. Knee Surgery, Sport Traumatol Arthrosc. 2017;25:2708–14.
21. Bouras T, Edmond U, Brown A, et al. Isolated medial patellofemoral ligament reconstruction significantly improved quality of life in patients with recurrent patella dislocation. Knee Surg Sports Traumatol Arthrosc. 2019;27:3513-7.
22. Desai VS, Tagliero AJ, Parkes CW, et al. Systematic review of medial patellofemoral ligament reconstruction techniques: comparison of patellar bone socket and cortical surface fixation techniques. Arthroscopy.2019;35:1618-28.
23. Hopper GP, Leach WJ, Rooney BP, et al. Does degree of trochlear dysplasia and position of femoral tunnel influence outcome after medial patellofemoral ligament reconstruction? Am J Sports Med. 2014;42:716–22.
24. Fucentese SF, Zingg PO, Schmitt J, et al. Classification of trochlear dysplasia as predictor of clinical outcome after trochleoplasty. Knee Surgery, Sport Traumatol Arthrosc. 2011;19:1655–61.