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Medial Patellofemoral Ligament Reconstruction Combined With Distal Realignment for Recurrent Dislocations of the Patella

5-Year Results of a Randomized Controlled Trial

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Background: Tibial tubercle transfer (TTT) and medial patellofemoral ligament (MPFL) reconstruction have both shown, either in isolation or in combination, to provide improved patellofemoral joint (PFJ) stability. There are few studies that provide evidence that this remains true in the long term.

Purpose: To compare the long-term results of patellar instability after TTT with and without MPFL reconstruction in 2 randomized groups.

Study Design: Randomized controlled trial; Level of evidence, 1.

Methods: A total of 34 patients (36 knees) were randomized to 2 groups. The first group underwent lateral release (LR) and TTT for confirmed maltracking of the patella (control group). The second group underwent MPFL reconstruction in addition to TTT and LR (reconstruction group). Patients were followed up with validated questionnaires (Kujala score, Tegner activity score), a visual analog scale (VAS) assessing their insecurity, and a clinical assessment at a minimum of 5 years postoperatively. Participants also underwent quantitative computed tomography (CT) at 1 year for comparison. Two patients in the control group and 1 patient in the reconstruction group were lost to follow-up at 5 years.

Results: There were no significant differences in the Kujala (P = .75), Tegner (P = .36), or VAS (P = .75) scores at any time period. One patient in the control group sustained a patellar redislocation at 3 years. Five patients in the control group and 2 in the reconstruction group had functional failures and required reoperations; however, this was not statistically significant (P = .30). There were no significant differences between groups in the time to return to school or work (P = .65) or sports (P = .38) after surgery. Overall patient satisfaction was higher in the reconstruction group compared with the control group (P = .04), and quantitative CT scans showed that the reconstruction group had a statistically significant improvement in the mean patellar tilt (6° vs −8°, respectively; P = .03) and mean congruence angle (13° vs −11°, respectively; P = .03) in the quadriceps-contracted state compared with the control group.

Conclusion: Reconstruction of the MPFL in addition to TTT and LR resulted in improved alignment parameters (congruence angle, patellar tilt angle) as well as patient satisfaction. The Kujala and Tegner scores were no different between the 2 groups at any time period. There was insufficient evidence to conclude that the addition of MPFL reconstruction to TTT results in fewer redislocations or reoperations. This study concludes that MPFL reconstruction improves PFJ alignment and patient satisfaction; however, further studies with larger patient numbers are required to satisfy its significance with respect to redislocation rates and functional scores in the long term.

Keywords: patellofemoral instability; recurrent patellar dislocation; MPFL reconstruction; tibial tubercle transfer

The nonoperative management of patellofemoral instability has been reported to have long-term recurrence rates of up to 49%.[16,17] Half of those who do not suffer a further dislocation fail to return to their chosen sport by 6 months.[1] The condition is known to be multifactorial, with malalignment, patellofemoral dysplasia, patella alta, soft tissue imbalance, and ligamentous laxity contributing variably in individual cases. Operations to address these factors can be grouped into proximal soft tissue balancing,

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distal bony procedures, and trochleoplasty. The modified Elmslie-Trillat procedure consisting of medial rotation tibial tubercle transfer (TTT) combined with lateral release (LR) addresses both soft tissue and bony abnormalities.[28] Case series have generally reported satisfactory outcomes,[13] although long-term recurrence rates of up to 13% have been reported.[5,18]

Autograft reconstruction of the medial patellofemoral ligament (MPFL) has become an increasingly common procedure in the last decade. Three systematic reviews reported satisfactory functional outcomes and low redislocation rates but noted that available evidence consists mainly of case series of varying techniques and participants of differing age ranges.[3,15,24] Two randomized controlled trials (RCTs) have compared isolated MPFL repair to nonoperative management in first-time dislocators and reported conflicting outcomes for redislocation rates and functional outcomes.[2,6] There has been no RCT of MPFL reconstruction compared with other surgical treatments.

This study investigated the additional benefit of MPFL reconstruction for patients undergoing TTT and LR for recurrent patellar instability. Our primary hypothesis was that MPFL reconstruction would improve subjective outcome measures. Additionally, we aimed to examine the effect of MPFL reconstruction on postoperative redislocations, functional failures, patient satisfaction, and postoperative patellar kinematics based on dynamic computed tomography (CT).

METHODS

Design

We designed a prospective RCT. Eighty-seven knees in 84 consecutively referred patients with recurrent lateral patellar dislocations were assessed for enrollment in the study between December 2007 and November 2010. Approval was obtained from a hospital ethics committee, and all participants gave informed consent. Patients were not informed of their allocation until the conclusion of the study.

The inclusion criteria were (1) ≥3 lateral patellar dislocations, (2) no congenital or habitual dislocations, (3) abnormal patellar tracking as determined by the presence of "J" tracking and lateral subluxation of the patella through a qualitative assessment of CT scans, (4) skeletal maturity, (5) no previous patellofemoral realignment procedure (bony or soft tissue), (6) no significant ligamentous knee injury, (7) absent or minor patellofemoral joint (PFJ) degenerative arthropathy, and (8) competence to consent to the trial and follow-up period.

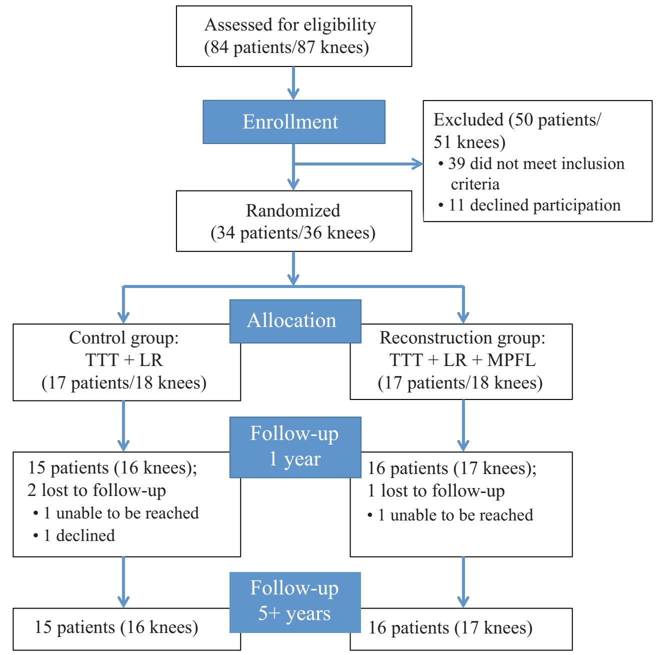

Figure 1. Patient flowchart. LR, lateral release; MPFL, medial patellofemoral ligament; TTT, tibial tubercle transfer.

A total of 39 patients (39 knees) were excluded (Figure 1): 15 had undergone previous realignment surgery, 8 had fewer than 3 dislocations, 6 were skeletally immature, 4 had other significant ligamentous knee injuries, 4 had moderate to severe degenerative PFJ arthropathy, 1 did not have subluxation on CT, and 1 was a habitual dislocator. Eleven patients (12 knees) declined involvement in the study. Thirty-six knees in 34 consecutive patients with recurrent lateral patellar dislocations were randomized to undergo TTT and LR (control group) or TTT, LR, and MPFL reconstruction (reconstruction group). Patients were randomized to each group by computer-generated instructions placed into sealed, opaque envelopes. The envelopes were then opened in the operating theater once general anesthesia had been administered.

Seventeen patients (18 knees) were randomized to the control group, and all underwent TTT and LR as allocated. Two patients (2 knees) were lost to follow-up. One patient was not able to be contacted by any means at all follow-up intervals. One patient declined to attend follow-up visits after the 3-month follow-up and before postoperative CT because of an interstate move. The remaining 16 knees were observed at a minimum of 5 years postoperatively.

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Seventeen patients (18 knees) were randomized to the reconstruction group, and all underwent TTT, LR, and MPFL reconstruction as allocated. One patient could not be contacted at any follow-up interval. The remaining 17 knees were observed at a minimum of 5 years postoperatively.

Sample Size

Based on a comparison of 2 independent groups, a sample size of 16 participants per group was estimated to have sufficient power (β = 0.2) to detect a difference of 7 points in the Kujala score. This difference was based on the Kujala scores in a case series of modified Elmslie-Trillat procedures published in the literature[13] compared with an unpublished case series from this center of a modified Elmslie-Trillat procedure combined with MPFL reconstruction. Assuming a 10% rate of a loss to follow-up, a sample size of 18 in each group was recruited.

Surgical Technique

All procedures were performed by the senior author (P.A.). An arthroscopic assessment of the knee was performed and additional pathological conditions addressed as required. If present, patellofemoral chondropathy was assessed for severity by the Outerbridge classification and the pattern according to Pidoriano et al.[19]

LR was performed arthroscopically using radiofrequency ablation (VAPR; DePuy Mitek). This was performed in the inferolateral retinaculum in all patients to prevent tethering of the extensor mechanism with TTT. When there was less than 1 quadrant of medial patellar glide, the release was extended to the level of the proximal pole of the patella. TTT was then performed through a 5-cm transverse incision centered over the middle third of the tibial tuberosity extending medially to the pes anserinus using longitudinal osteotomy oriented for anteromedialization. The osteotomy site was translated approximately 8 to 10 mm and temporarily held with a drill bit. Tracking through a range of motion was reassessed arthroscopically. Normal tracking was defined as patellar central engagement on the trochlea ≤40° of knee flexion viewed through an anterolateral portal. The osteotomy procedure was adjusted if required. When confirmed appropriate, the tubercle was fixed with 2 fully threaded cancellous AO 4.0-mm screws (DePuy Synthes).

In the reconstruction group, the graft was harvested before TTT. The semitendinosus tendon was harvested using a custom tendon stripper, leaving the pes anserinus insertion preserved. The free end was whipstitched by 4 cm with No. 1 Vicryl (Ethicon Inc) suture to allow graft passage and tensioning. Through a 3-cm transverse medial patellar incision, a medial-to-anterolateral bone tunnel was created at the midpoint of the patella using a 4.5-mm drill bit. The graft was passed subcutaneously from the first incision to the second, through the bone tunnel from anterolateral to medial, and then deep to the medial retinaculum to a tunnel based 3 mm proximal to the medial epicondyle. The graft was not fixed within the patellar tunnel. The femoral tunnel was reamed to 7 mm over a guide wire directed 30° proximally and anteriorly exiting the lateral femoral cortex to allow free tensioning of the graft. The graft was initially tensioned in extension with the patella manually reduced to the center of the trochlea and then adjusted to allow 1 patellar quadrant of lateral glide. Tracking was arthroscopically reassessed through a range of motion, with the patella confirmed to be engaging the trochlea at <40° of knee flexion. If there was medial tilt or translation in terminal extension or excessive tension in deep flexion, then the graft tension was adjusted. When confirmed appropriate, the knee was placed in full extension and the graft secured with a 7-mm interference screw (Guardsman; Conmed Linvatec) in the tunnel at the medial epicondyle.

Rehabilitation was identical for both groups. Active flexion exercises began on the first day postoperatively. Patients were fully weightbearing immediately but wore an extension splint when ambulating for the first 3 weeks. Return to sport was permitted when the rehabilitation goals had been achieved.

Clinical Evaluation

Patients were assessed preoperatively; at 6 weeks, 3 months, and 12 months; and at a minimum of 5 years at final follow-up. The clinical assessment at the 6-week follow-up was performed by the senior author (P.A.). The assessments at all other time periods were performed by 3 authors (I.D., M.B., D.W.) who were independent of the surgical procedures and patient care. The assessors could not be blinded, as the pattern of incisions indicates whether MPFL reconstruction had been performed. At each time period, patients were assessed for passive knee extension, active knee flexion, apprehension, tenderness over the osteotomy and hamstring donor sites, dislocations, return to work or school, and return to sports in addition to self-administered scores consisting of the Kujala patellofemoral functional score,[12] the Tegner activity level score,[26] a patient satisfaction score, and an "insecurity" visual analog scale (VAS) score. For the VAS, the patients made a mark on a 100-mm line indicating how insecure they perceived their patella to be, as described by Watanabe et al[29] (from "completely secure" at 0 mm to "dislocating" at 100 mm). Patient satisfaction was assessed on a 5-point Likert-type scale, with participants asked to rate the outcome of their surgery as excellent (1), good (2), fair (3), poor (4), and worse (5). Primary outcomes were measured as the redislocation rate and functional failures requiring reoperations. Secondary outcomes were measured as the Kujala score, Tegner score, and VAS score.

Radiological Evaluation

Patients underwent quantitative patellofemoral CT preoperatively and postoperatively between the 3- and 12-month follow-ups. CT was performed in a standardized manner. The patellar height measurement was adapted from a technique described for magnetic resonance imaging (MRI)[21] to

TABLE 1
Demographic and Knee Characteristics

	Control Group (n = 16)	Reconstruction Group (n = 17)
Sex, male/female, n	5/11	3/14
Age, y, mean (range)	16 (14-29)	21 (12-47)
Age of first dislocation, y, mean (range)	16 (12-19)	17 (7-29)
Other ipsilateral knee injuries, n	1	0
Other ipsilateral knee operations, n	4	4

TABLE 2
Arthroscopic Intraoperative Findings at the Time of Reconstruction

	Control Group (n = 16)	Reconstruction Group (n = 17)
Patellar chondropathy, n	11	9
Outerbridge grade, mean (range)	2.1 (1-3)	2.3 (1-3)
Chondropathy pattern, mean (range)[a]	2.6 (1-4)	2.8 (1-4)
Other intra-articular injuries, n	3	2

[a]According to Kujala et al.[12]

allow all measurements to be performed from the same investigations.

Statistical Analysis

The Kujala scores for both groups were compared at all postoperative time periods after adjusting for baseline variables using analysis of covariance (repeated-measures analysis of covariance [ANCOVA]). These comparisons were repeated for the Tegner activity score; VAS score; range of motion data; and change in patellar tilt, patellar height, congruency angle, and trochlear dysplasia based on CT findings. The necessary assumptions for the analysis were assessed and deemed appropriate for the data. The association between group and categorical data was evaluated by means of a Pearson chi-square test or Fisher exact test depending on which was most suitable. Subjective patient satisfaction (Likert-type scales with 2 groups) was analyzed using a Wilcoxon rank-sum test. A 2-sided *P* value of <.05 indicated statistical significance.

RESULTS

Patients

The groups were comparable for sex, age, side, age of first dislocation, other knee injuries, and previous operations (Table 1). One patient in the control group had a nonoperatively managed posterior cruciate ligament injury 3 years after her initial patellar dislocation. She had a stable posterior drawer test result before her procedure. All previous operations on the ipsilateral knee consisted of arthroscopic removal of loose bodies or osteochondral fragments and debridement. All patients had a positive preoperative patellar apprehension test result. The groups were comparable for patellofemoral and other intra-articular pathological conditions (Table 2).

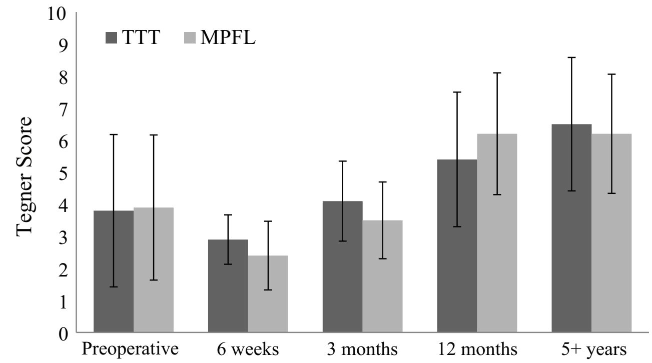

Figure 2. Tegner activity score. MPFL, medial patellofemoral ligament; TTT, tibial tubercle transfer.

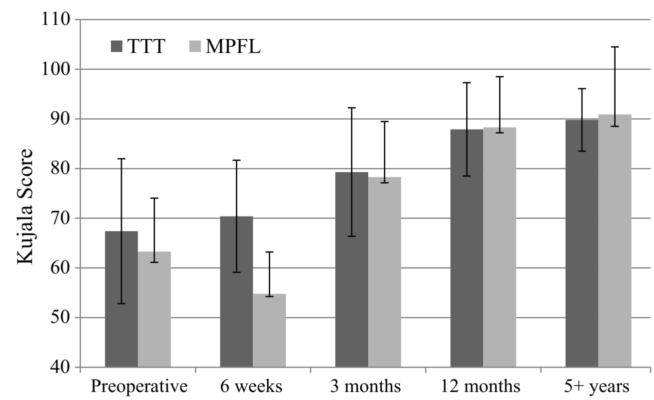

Figure 3. Kujala score. MPFL, medial patellofemoral ligament; TTT, tibial tubercle transfer.

Functional Scores

The Tegner, Kujala, and VAS scores for each time period are presented in Figures 2, 3, and 4, respectively. The ANCOVA indicated no significant differences between the groups for any of the scores. At the 6-week follow-up, there was a trend for the reconstruction group to have a lower insecurity VAS score (mean ± SD, 13 ± 8.5 mm) compared with the control group (27 ± 19.8 mm), although this was not statistically significant (P = .07). At ≥5 years, functional scores were maintained or improved in comparison to those at the 12-month follow-up, although there was no statistical significance between the 2 groups (P = .75 [Kujala] and .36 [Tegner]).

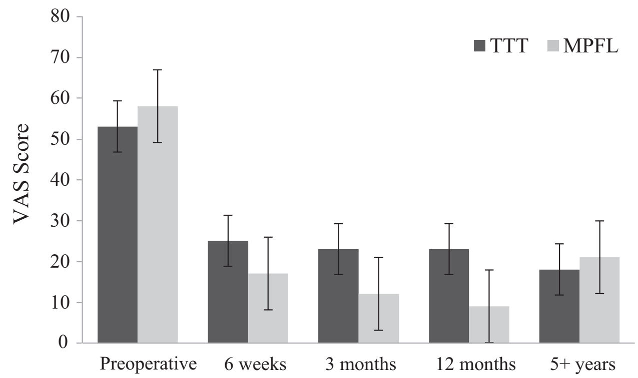

Figure 4. Visual analog scale (VAS) score for insecurity. MPFL, medial patellofemoral ligament; TTT, tibial tubercle transfer.

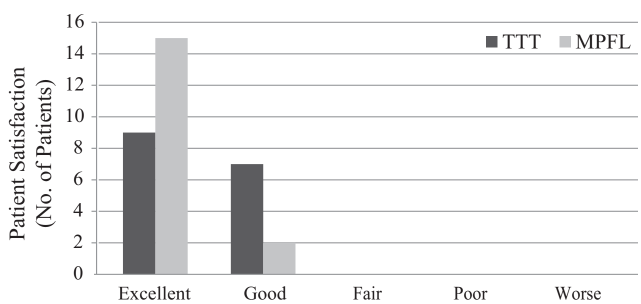

Figure 5. Subjective patient satisfaction at ≥5 years. MPFL, medial patellofemoral ligament; TTT, tibial tubercle transfer.

Clinical Evaluation

At final follow-up, 5 of 16 patients in the control group and 2 of 17 in the reconstruction group were found to have a "functional failure" (ie, a positive apprehension test result, a history of subluxation episodes after surgery, or a PFJ dislocation). There was no statistical difference between the 2 groups (P = .30). Patient satisfaction scores (Figure 5) were higher in the reconstruction group, 88% (15/17) excellent compared with 56% (9/16) in the control group, and this was statistically significant (P = .04).

Patients returned to work or school at a mean of 1.5 ± 2.6 months in the control group and 1.2 ± 0.7 months in the reconstruction group (P = .65). Three (19%) in the control group and 6 (35%) in the reconstruction group did not return to sport by the 1-year follow-up, but this was not statistically significant (P = .43). At 5 years, all patients had returned to a sporting activity; however, the majority of them (90%) had not returned to their preinjury level of sport. Of the patients who did return to sport, this occurred at a mean of 3.8 ± 3.2 months in the control group and 3.0 ± 1.8 months in the reconstruction group (P = .38).

There were no significant differences in range of motion preoperatively or postoperatively at any follow-up period (Table 3). At the 6-week follow-up, there was a trend toward greater flexion in the control group than the reconstruction group, with a mean of 136.5° ± 13.4° compared with 120.4° ± 20.5°, respectively (P = .07).

TABLE 3
Range of Motion for Both Groups at Each Time Period[a]

	Control Group		Reconstruction Group	
	Extension, deg	Flexion, deg	Extension, deg	Flexion, deg
Preoperatively	2.8 ± 5.9	142.8 ± 7.3	4.1 ± 4.6	145.1 ± 8.5
6 weeks	–0.4 ± 1.3	136.5 ± 13.4	–0.8 ± 2.7	120.4 ± 20.5
3 months	1.6 ± 4.6	142.8 ± 9.3	3.0 ± 4.0	136.3 ± 9.7
1 year	1.7 ± 4.3	141.7 ± 6.2	3.1 ± 4.6	141.4 ± 11.5
≥5 years	1.5 ± 4.2	141.9 ± 6.3	2.3 ± 3.6	142.1 ± 7.6

[a]Data are reported as mean ± SD.

Radiological Evaluation

The quantitative CT findings are shown in Table 4. The preoperative CT scans showed that the 2 groups had a similar but wide variation of tibial tubercle (TT) lateralization, the congruence angle, and the patellar tilt. There was no difference in the patellar height (tendon length/patellar length) between the 2 groups preoperatively (P = .26) or postoperatively (P = .13). Trochlear dysplasia was assessed on preoperative CT, and patients were deemed to have a shallow dysplastic trochlea if they had a trochlear angle (TA) of >145° or a trochlear sulcus depth (TD) of <3 mm. Both groups were comparable (Table 5), and no statistically significant difference was found between the 2 groups for the TA (P = .90) or TD (P = .06). Postoperative assessments showed a similar magnitude of TT medialization between the groups. For the patellar tilt, there was more (worsened) tilt postoperatively in the control group by a mean of 1° in the quadriceps-relaxed state and 8° in the contracted state. The reconstruction group showed a mean 5° and 6° less tilt in the relaxed and contracted states, respectively. The change in patellar tilt between the groups was not significant in the relaxed state (P = .16) but was significant in the contracted state (P = .03).

For the congruence angle, there was more subluxation postoperatively in the control group, with a mean 1° increase in the quadriceps-relaxed state and 11° in the contracted state. The reconstruction group showed a mean 11° and 13° less subluxation in the relaxed and contracted states, respectively. The change in congruence angle between the groups was not significant in the relaxed state (P = .24) but was significant in the contracted state (P = .03). Typical postoperative lateral radiographs are displayed in Figure 6.

Complications

One patient in the control group sustained a patellar dislocation 3 years after surgery while playing sports; the reconstruction group had no dislocations. There were 7 other complications in the control group: 2 superficial wound infections, 1 patient requiring removal of TT screws, 2 patients with TT screw irritation but not requiring removal, 1 paresthesia of the infrapatellar branch of the saphenous nerve,

TABLE 4
Preoperative and Postoperative Quantitative Computed Tomography Results[a]

	Preoperative		Postoperative	
	Control Group (n = 16)	Reconstruction Group (n = 17)	Control Group (n = 15)	Reconstruction Group (n = 16)
Trochlear angle, deg	143 ± 8.6	144 ± 7.9		
TT-TG distance, mm	16 ± 3.2	15 ± 3.5	10 ± 5.0	12 ± 4.3
Congruence angle, deg				
Relaxed	24 ± 17.0	17 ± 18.3	25 ± 18.0	6 ± 19.5
Contracted	38 ± 23.1	41 ± 22.6	49 ± 15.3	29 ± 22.1
Patellar tilt angle, deg				
Relaxed	0 ± 11.7	6 ± 7.9	–1 ± 9.9	10 ± 8.8
Contracted	–5 ± 14.8	–2 ± 12.8	–12 ± 10.2	3 ± 14.1
TL/PL (patella alta), mm	1.40 ± 0.15	1.34 ± 0.15	1.44 ± 0.22	1.33 ± 0.18

[a]Data are reported as mean ± SD. PL, patellar length; TL, tendon length; TT-TG, tibial tubercle–trochlear groove.

TABLE 5
Preoperative Computed Tomography Results of Trochlear Dysplasia[a]

	Control Group	Reconstruction Group	*P* Value
Trochlear angle, deg	143.6 ± 8.4	143.8 ± 7.7	.90
Trochlear sulcus depth, mm	5.1 ± 1.6	6.2 ± 1.6	.06

[a]Data are reported as mean ± SD.

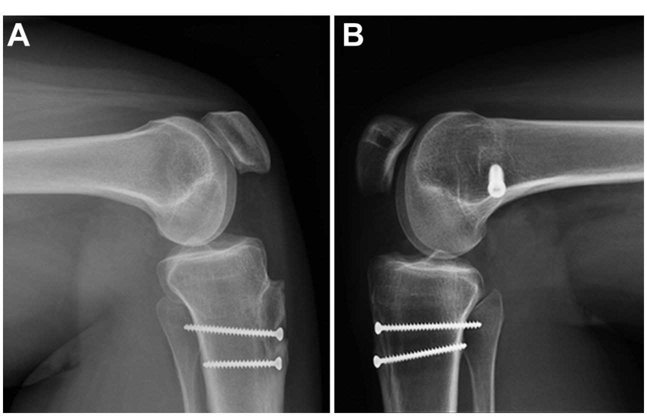

Figure 6. Postoperative lateral radiographs for the (A) control and (B) reconstruction groups.

and 1 postoperative vasospasm that resolved spontaneously. There were 2 complications in the reconstruction group: 1 deep infection requiring arthroscopic lavage and 1 patient requiring removal of TT screws. The patient with a deep infection was included in the analyses at all follow-ups.

DISCUSSION

The challenge facing surgeons in managing patients with recurrent patellar dislocations has been well documented. Decision making is multifactorial, and clear guidelines for optimal treatment are yet to be determined. MPFL reconstruction has proved popular in the past decade, with patients undergoing the procedure having improved functional results and low redislocation rates.[2,3,6,14,15,23,24] Most long-term studies however are case series, use varying methods for reconstructing the MPFL, and often combine them with other procedures, both bony and soft tissue. Reported results often have no comparison group, leaving surgeons with the difficult choice between several treatment options. To our knowledge, this is the first RCT to add MPFL reconstruction to another surgical procedure.

Both the control and reconstruction groups showed improved functional scores at a minimum 5-year follow-up. Tegner activity, Kujala, VAS, and patient satisfaction scores improved for both groups. The clinically significant change in the VAS score for patellar insecurity is unknown, but Crossley et al[7] reported that the minimum clinically important change in the VAS score for patellofemoral pain for both patients and clinicians is 20 of 100 mm. Other measures of rehabilitation progress such as time to return to work or school and return to sports were not different.

CT demonstrated an improvement in both the congruence angle and patellar tilt in the reconstruction group but not in the control group. This was statistically significant in the quadriceps-contracted state but not in the relaxed state. The MPFL graft was tensioned intraoperatively, such that there was at least 1 quadrant of lateral glide possible passively. Therefore, the effect of MPFL reconstruction would only be expected in the contracted state, as was found. Although the difference in the functional scores was not statistically significant between the 2 groups, the reconstruction group had better patient satisfaction, fewer episodes of instability or “functional failures,” and fewer reoperations. It remains to be seen if these findings reflect improved patellofemoral maltracking and hence contact pressures within the PFJ, thereby reducing long-term chondral wear and eventual osteoarthritis. Further long-term results will be required to better answer this question.

The reconstruction group showed a trend toward less flexion and lower functional scores at 6 weeks, which was not found at further follow-up. This may reflect greater pain due to the additional procedure, which was not specifically quantified. Another explanation could be excessive constraint in deep flexion caused by a nonanatomic MPFL position. In this study, the femoral tunnel was positioned at the medial epicondyle. We have since modified our technique by using image intensification to more accurately replicate the anatomic origin proximal and posterior to the medial epicondyle.[20]

That there was little change in the control group's radiographic alignment is surprising. The measured TT medialization, which does not measure anteriorization, was small but similar between the groups and so unlikely to explain the difference in postoperative alignment. All postoperative and most preoperative CT scans were assessed by the same radiologist. When the patient presented to the clinic with CT already performed at another facility, it was thought impractical to repeat the scans; as such, there may have been an interobserver error, although this would not be expected to be selective.

The redislocation rates and functional scores reported for isolated MPFL reconstruction have generally been excellent. The mean postoperative Kujala scores in 2 recent systematic reviews ranged from 83 to 96.[3,24] However, it was noted that there was significant heterogeneity in the inclusion criteria for the studies and the surgical technique. One of the reviews included first-time patellar dislocators together with redislocators.[15] Some studies did not exclude patients if they had undergone previous knee surgery or if they were habitual dislocators, for example.[24] Furthermore, most of the reported studies were only of a short-term follow-up, making a direct comparison between our results and these difficult.

There are a number of weaknesses in our study. First, the assessors were not blinded to the treatment. The additional incisions required for MPFL reconstruction made it impossible to blind the assessors, leading to a risk of measurement bias. Patients themselves were not informed of which arm of the study they were in; however, it must again be deduced that this may be assumed from the surgical scars. Similarly, although the radiologist assessing the CT scans was not informed of patient allocation, this can be determined from the images.

The study did not have a group of patients that underwent MPFL reconstruction alone. Unfortunately, at the time of recruitment, this was not the standard practice of the leading surgeon, the decision to perform TTT being based on an assessment of maltracking, not the TT–trochlear groove (TT-TG) distance. Isolated MPFL reconstruction is generally accepted for TT-TG distances <20 mm, above which TTT is recommended.[8] The mean preoperative TT-TG distance for the control and reconstruction groups was 16 mm and 15 mm, respectively. It could be argued that these patients only required MPFL reconstruction. A recent study by Stephen et al[25] questioned this distance and found that patellar tracking and contact pressures can be restored to normal by isolated MPFL reconstruction up to a TT-TG distance of 15 mm, whereas those patients with TT-TG distances in excess of this may benefit from an additional TT medialization procedure. Camp et al[4] also noted that the TT-TG distance was not an accurate predictor of patellar instability and devised a more patient-specific method that takes patient size and individualized bony anatomy into account. Thaunat and Erasmus[27] went a step further and suggested that their failed MPFL reconstructions were caused by unaddressed bony pathological abnormalities, including abnormal TT-TG distances.

Although both groups were comparable for CT measures of trochlear dysplasia, the accuracy of this may be questioned. Some authors have previously reported difficulty in measuring the trochlear sulcus angle at 0° of flexion, as was done in this study.[9,11,21] The interobserver and intraobserver reliability of this measure was much better at 20° of flexion. Ideally, trochlear dysplasia would have been measured at 20° of flexion on preoperative radiographs (classified by Dejour) or MRI; however, this was not possible in our study.

There has been a trend toward quantitative radiology-directed realignment protocols to tailor operations to individual patients.[10] This is in contrast with the standardized surgical technique used in this study after selection by clinical and qualitative CT assessments. The former approach may help identify subcategories of patellofemoral instability, particularly the severity of dysplasia, in which the addition of MPFL reconstruction is beneficial or is appropriate alone. Achieving sufficiently powered studies of such subgroups will be difficult.

Sillanpaa et al[22] were the first to report on the long-term results of MPFL reconstruction compared with distal realignment for recurrent patellar dislocations. In their retrospective case series, 47 Finnish military servicemen were reviewed at a mean follow-up time of 10.2 years. Eighteen underwent adductor magnus tenodesis and 29 a Roux-Goldthwait procedure for distal realignment. These authors noted that 5 patients demonstrated patellofemoral osteoarthritis in the Roux-Goldthwait group and none in the adductor magnus tenodesis group. They concluded that MPFL reconstruction reduces the risk of osteoarthritis compared with distal realignment surgery. Although this study was not randomized, used only male participants, and did not include preoperative results, their findings suggest that MPFL reconstruction may improve patellofemoral kinematics and hence reduce chondral wear. There is not enough evidence in the literature however to comment on isolated MPFL reconstruction in patients with documented TT-TG distances >15 mm. In these patients, larger contact pressures in the PFJ result from greater tension in the MPFL graft.[25] As a result, the increased joint reaction forces and elevated articular contact pressures may predispose to early chondral wear in the PFJ. We therefore recommend realignment procedures be considered in these patients in addition to MPFL reconstruction to reduce wear patterns and potentially patellofemoral osteoarthritis.

CONCLUSION

Reconstruction of the MPFL in addition to TTT and LR resulted in improved alignment parameters (congruence angle, patellar tilt angle) as well as patient satisfaction. The Kujala and Tegner activity scores were no different between the 2 groups at any time period. There was insufficient evidence to conclude that the addition of MPFL reconstruction to TTT results in fewer redislocations or reoperations. This study concludes that MPFL reconstruction improves PFJ alignment and patient satisfaction; however, further studies with larger patient numbers are required to satisfy its significance with respect to redislocation rates and functional scores in the long term.

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