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Lateral Retinacular Release During MPFL Reconstruction

A Randomized Clinical Trial

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Background: Reconstruction of the medial patellofemoral ligament (MPFL) has become the gold standard treatment for patellofemoral instability. A lateral retinacular release (LRR) may be performed in conjunction with MPFL reconstruction (MPFLR); however, its effect on outcomes is unclear.

Purpose/Hypothesis: This study aimed to evaluate the effect of LRR on the outcomes of MPFLR. It was hypothesized that isolated MPFLR would not be inferior to MPFLR with LRR in terms of the subjective International Knee Documentation Committee (IKDC) score and patellar tilt (PT).

Study Design: Randomized controlled trial; Level of evidence, 2.

Methods: Patients aged 18 to 45 years undergoing MPFLR without associated osseous procedures were randomized to isolated MPFLR or MPFLR with arthroscopic LRR. Outcome measures were subjective IKDC score and PT assessed by computed tomography with the quadriceps relaxed (PTQR) and contracted (PTQC).

Results: Out of 140 patients randomized and included, 3 were excluded from analysis because of the performance of unexpected osseous procedures or the use of a graft other than a gracilis autograft; 9 patients were lost to follow-up; and 3 patients could not complete the study due to medical reasons. A total of 125 patients (89%) were evaluated at a median follow-up of 36 months (range, 24-144 months) postoperatively. The mean subjective IKDC score was 78.1 ± 16 (range, 29-98) in the MPFL + LRR group and 80.7 ± 15 (range, 33-100) in the Isolated MPFL group (*P* = .309). Postoperatively, the PTQR was 20.9° ± 9.1° in the LRR group and 17.3° ± 7.2° in the isolated MPFL group (*P* = .097). The PTQC was 24.4° ± 10° in the MPFL + LRR group and 21.5° ± 8.9° in the isolated MPFL group (*P* = .149). Three complications were noted in each group.

Conclusion: Routine performance of LRR in association with MPFLR in the absence of bony procedures does not lead to improved patient-reported outcomes or significant alteration of the PT.

Study Registration: ClinicalTrials.gov NCT01719666.

Keywords: International Knee Documentation Committee score; lateral retinacular release; medial patellofemoral ligament reconstruction; patellofemoral instability

Patellofemoral instability is a common pathology affecting young adolescents, with an incidence ranging[38] from 6 to 29 per 100,000. Several anatomic risk factors for patellofemoral instability have been identified—including trochlear dysplasia, patella alta, an elevated tibial tubercle-trochlear groove (TT-TG) distance, genu recurvatum, genu valgum, and excessive femoral anteversion.[15] Medial patellofemoral ligament (MPFL) reconstruction (MPFLR) has become the gold standard for patellofemoral instability treatment.[33] In many cases, MPFLR can be performed as an isolated procedure. If there are risk factors for recurrence, such as high-grade trochlear dysplasia or substantial patella alta, a concurrent bony procedure may be performed with an "à la carte" algorithm[8] with MPFLR generally performed in all cases.[3,7,10]

Lateral retinacular release (LRR) has been described as an adjunct procedure that can be used to balance the patella in the trochlear groove by releasing tight lateral structures that can pull the patella laterally.[12] Indications for LRR are controversial. Some surgeons perform LRR routinely, others not at all, and still others perform it if the patella cannot be everted to a neutral position or if the patellar tilt (PT) is >20° on axial imaging.[8] Several surgical techniques to address the lateral retinaculum have been described, including lateral retinaculum release

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and lengthening,[30] by open and arthroscopic approaches.[40] Adding this procedure to MPFLR may extend operative duration and elevate the potential for iatrogenic medial instability, as well as potentially increasing infection risk in open procedures and postoperative hemarthrosis risk in arthroscopic procedures.[19] Because of the potential risk of complications of LRR, evidence demonstrating the advantages of adding LRR to MPFLR is essential to justify this procedure. At this point, the debate surrounding whether to include an LRR in MPFLR remains unsettled.

Recent studies have examined the role of LLR or lengthening in conjunction with MPFLR, with varying conclusions. Kheir et al[18] used finite element modeling to suggest that lateral release may reduce patellofemoral contact pressures in the setting of acute patellar dislocation when combined with MPFLR. Conversely, Malatray et al[23] and Waters et al[37] reported no significant clinical benefit when adding a lateral release to MPFLR, highlighting the limited value of systematic LRR in this context.[23,37] These findings support the need for further high-level evidence to clarify the indications for LRR in MPFL procedures.

The study aimed to assess the effect of routine LRR on outcomes after MPFLR. The hypothesis was that isolated MPFLR would not be inferior to MPFLR combined with LRR regarding subjective IKDC score, PT, and complication risk.

METHODS

Patients

Patients were consecutively recruited into this prospective, single-blinded, randomized controlled trial study conducted between 2011 and 2022. The inclusion criteria were patients aged between 18 and 45 years with patellofemoral instability (>1 lateral patellar dislocation) undergoing MPFLR without additional bony procedures. At our institution, indications for tibial tubercle osteotomy were patella alta with a Caton-Deschamps index of >1.2 before 2020 and >1.4 after 2020, regardless of the TT-TG distance.[22] Trochleoplasty was performed for high-grade trochlear dysplasia (types B and D).[9] This was a single-institution study. Surgeries were performed by 2 senior orthopaedic surgeons (E.S., S.L.), each with >10 years of experience in patellofemoral surgery, following the same standardized operative protocol.

The exclusion criteria included previous ipsilateral knee surgery, concomitant bony procedures, or previous contralateral MPFLR. Patients with previous contralateral MPFLR were excluded to ensure independent outcome assessment without confounding factors related to bilateral instability or altered gait mechanics. Patients <18 years were excluded because minors cannot be enrolled in randomized clinical trials, according to national ethical and legal regulations. Patients provided both oral and written consent according to institutional review board protocols before enrollment. Once the patients signed the consent form, they were randomized using a randomization list. An investigator conducted subsequent patient evaluations who remained blinded to the surgical procedure performed. Patients received information regarding both surgical procedures, and after surgery, they were informed about the procedure performed.

Ethical approval was obtained before the inclusions began, and a study protocol was established in 2011. The study received approval from the Ethical Committee CPP Sud-Est III, was registered as number 2011-030 B, and was assigned the declaration number NCT01719666 on clinicaltrials.gov. Follow-up assessments were scheduled at 1.5, 3, and 12 months initially, followed by evaluations at 24 months and thereafter as indicated.

Surgical Technique

First, an arthroscopic examination was performed to assess any associated intra-articular pathology, such as chondral or meniscal tears, which were treated if necessary. Then, MPFLR was performed using a gracilis autograft. A 7-mm femoral tunnel was drilled at the Schottle point under fluoroscopy assistance, and fixation was performed with an absorbable interference screw. For patellar fixation, two 4.5-mm tunnels were drilled from the medial border to the anterior surface of the patella, without crossing the entire width of the bone. The 2 strands of the graft were passed through these tunnels and sutured to each other on the medial aspect of the patella, ensuring stable fixation and allowing for appropriate graft tensioning while avoiding overconstraint.[26,31,32]

For patients randomized to the LRR group, the LRR was conducted during the arthroscopic stage of the procedure, before the MPFLR. This order of operations was chosen to avoid the risk of alterations to graft tension after LRR.[5] The release was performed along the entire length of the lateral retinaculum using electrocautery through an accessory superolateral portal. Care was taken to maintain the integrity of the synovial membrane of the joint capsule, preserving the overall structure of the knee capsule. The range of the release extended from the distal end of the vastus lateralis oblique proximally to the inferior pole of the patella distally. A release was performed

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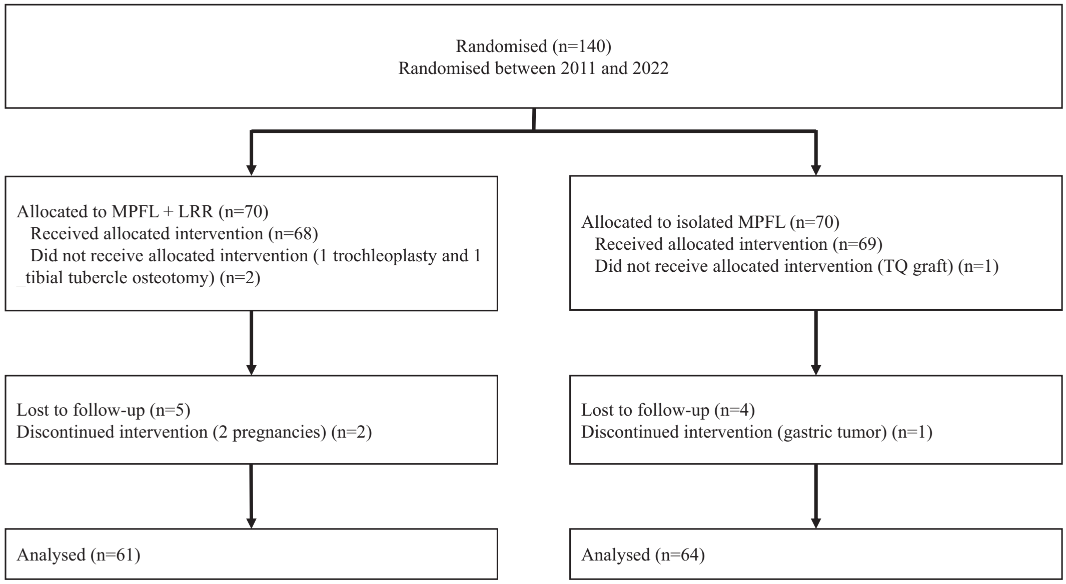

Figure 1. Flow chart. LLR, lateral retinacular release; MPFL, medial patella femoral ligament; TQ, quadriceps autograft.

along the entire length of the lateral retinaculum, extending up to 37 mm, as described by Merican and Amis.[24]

Data Collection and Follow-up

Preoperatively, each patient underwent a standard physical examination and completed the subjective International Knee Documentation Committee (IKDC) form.[17] The radiological assessment included anteroposterior view, lateral view, and patellar axial plain radiographs as well as computed tomography (CT) scans. Lateral and patellar axial radiographs were obtained at 30° of knee flexion. CT scans were performed with the knee in extension to assess PT with the quadriceps relaxed (PTQR) and contracted (PTQC), and measure the TT-TG distance. CT scans were chosen because of their superior accuracy in assessing PT and alignment, as previously validated in the literature. Studies have demonstrated that CT imaging provides more precise and reliable measurements of patellar tracking abnormalities compared with standard radiographs.[2] In our institution, CT scans were systematically performed for all patients as part of the preoperative assessment. The assessment of PTQR and PTQC was conducted to capture the dynamic behavior of the patella under different muscle activation states, offering a more comprehensive evaluation of patellofemoral joint biomechanics. The patellar height was assessed using the Caton-Deschamps index on lateral radiographs, and trochlear dysplasia was classified with the Dejour classification.[7] All patients underwent the same clinical and radiological (including CT scans) assessment at a minimum follow-up of 24 months.

The primary outcome was the subjective IKDC score at 24 months after surgery. The change in subjective IKDC score from preoperative to 24 months postoperative (ΔIKDC) was also calculated. Secondary outcomes included postoperative PTQR and PTQC measured on CT scans and complications. The normal value for the PT has been previously defined as <20° for the PTQR and <25° for the PTQC.[11,40]

Statistical Analysis

Descriptive statistics—including the mean, standard deviation, and extreme values—were computed. The Shapiro-Wilk test was used to assess whether or not the cohort followed a normal distribution. Group comparisons utilized Mann-Whitney tests for continuous variables and the Fisher exact tests for categorical variables. Statistical significance was set as $P < .05$. The Monte Carlo procedure was employed to determine the statistical power of our effective sample size. Given the asymmetric distribution of the primary outcome measure (the IKDC subjective score), a predicted difference of 6.5 points between the 2 treatment groups was used for the resampling process. Using a 2-tailed, 2-sample t test with a power of 80% (1–β) and a significance level of 5% (α), the sample size calculation indicated that 140 patients (70 in each treatment arm) were required to detect the minimum clinically significant difference, accounting for an anticipated 10% dropout rate. Statistical analysis was performed with EasyMedStat (Version 3.36) (www.easymedstat.com).

RESULTS

A total of 140 patients were enrolled in the study and randomized between 2011 and 2022. Two patients were subsequently excluded because they underwent unplanned bony procedures before the inclusion (1 tibial tubercle osteotomy and 1 trochleoplasty), and 1 patient was excluded because a graft other than a gracilis autograft (quadriceps autograft) was used. Nine patients were lost to follow-up (6.4%), and 3

TABLE 1
Demographic Characteristics of the 2 Groups[a]

	LRR Group (n = 61)	Isolated MPFL Group (n = 64)
Age, years	27 ± 6.4 [18-44]	26.3 ± 6.7 [18-43]
Weight, kg	69.2 ± 14.5 [49-115]	70.9 ±15.9 [48-120]
Height, cm	170 ± 9 [141-187]	168 ± 20 [155-193]
BMI, kg/m^2	23.9 ± 4.9 [17.4-39.8]	24.2 ± 4.6 [17.2-41.5]
Female sex	41 (62)	42 (60)
Caton-Deschamps index	1.29 ± 0.16 [0.9-1.4]	1.26 ± 0.18 [0.85-1.4]
TT-TG, mm	16.3 ±4.3 [6-26]	15.7 ± 3.7 [8-24]
Dejour classification		
0	1 (2)	2 (3)
A	51 (83)	53 (83)
B	2 (3)	1 (1)
C	6 (10)	8 (13)
D	1 (2)	0

[a]Data are presented as mean ± SD [range] or n (%). BMI, body mass index; LRR, lateral retinacular release; MPFL, medial patella femoral ligament; TT-TG, tibial tubercle-trochlear groove.

patients (2.3%) did not complete the follow-up due to medical reasons (2 pregnancies and 1 gastric tumor). The final analysis included 125 patients (89%): 61 patients in the LRR group and 64 patients in the isolated MPFL group (Figure 1), with a complete clinical follow-up of 24 months. Among them, 90 patients had undergone a CT scan (67%) at the last follow-up (47 in the LRR group and 43 in the isolated MPFL group). Demographic characteristics were comparable between groups (Table 1). Four patients with type B or D trochlear dysplasia were included because the trochlear spur was <5 mm and patellar tracking was normal without a J sign. In accordance with our institutional algorithm, trochleoplasty was not indicated in these cases. There was no difference in preoperative TT-TG distance, PTQR, PTQC, trochlear dysplasia, or subjective IKDC scores between groups (Tables 1 and 2). The median follow-up was 36 months (range, 24-144 months).

At a minimum follow-up of 24 months, there were no significant differences in subjective IKDC scores between the isolated MPFL group (80.7 ± 15) and the LRR group (78.1 ± 16) (P = .309).

A total of 90 CT scans were analyzed (67%), with a minimum follow-up of 24 months, 47 in the LRR group and 43 in the isolated MPFL group. The preoperative PTQR values were 21.2 ± 10.9 for the LRR group and 21.5 ± 9.8 for the isolated MPFL group (P = .59) and 23.9 ± 12.9 for the LRR group and 26.6 ± 11.6 for the isolated MPFL group with PTQC (P = .43). The postoperative PTQR values were 20.9 ± 9.1 for the LRR group and 17.3 ± 7.2 for the isolated MPFL group (P = .097) and 24.4 ± 10 for the LRR group and 21.5 ± 8.9 for the isolated MPFL group with PTQC (P = .15).

TABLE 2
Results on Principal and Secondary Judgment Criteria: Subjective IKDC Score, PTQR, and PTQC[a]

	LRR Group	Isolated MPFL Group	P
Preop IKDC	55 ± 15 [22 to 95]	55 ± 15 [23 to 96]	.845
Postop IKDC	78.1 ± 16 [29 to 98]	80.7 ± 15 [33 to 100]	.309
Δ IKDC	23 ± 17 [–20 to 69]	24 ± 19 [–37 to 72]	.713
Preop PTQR, deg	21.2 ± 10.9 [1 to 47]	21.5 ± 9.8 [4 to 45]	.591
Preop PTQC, deg	23.9 ± 12.9 [4 to 49]	26.6 ± 11.6 [5 to 60]	.433
Postop PTQR, deg	20.9 ± 9.1 [4-39]	17.3 ± 7.2 [2 to 43]	.097
Postop PTQC, deg	24.4 ± 10 [5 to 45]	21.5 ± 8.9 [7 to 43]	.149

[a]Data are presented as mean ± SD or n (%). IKDC, International Knee Documentation Committee; Postop, postoperative; Preop, preoperative; PTQC, patellar tilt quadriceps contracted; PTQR, patellar tilt quadriceps relaxed.

The overall complication rate in this study was 4.8% and no recurrent patellar dislocations were reported. Three complications were reported in the LRR group (4.9%): 3 stiffness cases, 2 of which underwent arthroscopic arthrolysis. There were also 3 complications in the isolated MPFL group (4.6%): 1 stiffness, 1 neuroma, and 1 scar dehiscence.

DISCUSSION

The most important finding of this study was that at a minimum follow-up of 2 years, there was no difference in subjective IKDC scores between the isolated MPFL group and the MPFL and LRR group. This finding suggests that the addition of LRR did not confer a significant advantage in terms of subjective knee function as measured by the IKDC score. These results are consistent with the findings of our pilot study, although with only 1 year of follow-up.[23] Satisfactory outcomes of MPFLR along with LRR have been observed in various previous case series.[1,20] However, the combined procedure's superiority over isolated MPFLR has not been demonstrated.[35,36] A recent retrospective comparative study on 18 patients found no significant difference between the 2 groups in clinical outcomes at a minimum of 1 year. Still, the authors noted a lack of power due to the small sample size.[37]

No recurrent patellar dislocations were noted in either group in this randomized controlled trial. While the study is underpowered to assess the effect of LRR on failure risk, the results of this study are similar to those seen in the published literature. Jackson et al[16] evaluated the failure and revision rates for isolated MPFLR and combined MPFL and LRR in a meta-analysis. They analyzed 1521 knees and found a failure rate ranging from 0% to 10.7% of cases.

The effectiveness of LRR in relieving pain due to a tight lateral retinaculum has been demonstrated in patients without patellar instability.[4,14,25] However, its application in patellar instability remains debated, as the PT can result from multiple factors, including trochlear dysplasia and medial soft tissue insufficiency.[15]

While LRR may have theoretical advantages in MPFLR, it also carries risks. Releasing a normally tensioned lateral retinaculum may increase lateral patellar translation and compromise stability, as it provides approximately 10% of the restraining force against lateral displacement between 0° and 20° of flexion.[5,11] In addition, LRR may lead to postoperative laxity, as shown in cadaveric studies where LRR significantly decreased patellofemoral joint pressure in knees with overtightened MPFL grafts.[13]

MPFL overtensioning, particularly with femoral malpositioning, can increase medial patellofemoral joint pressure.[19] Performing LRR concomitantly may exacerbate this risk by reducing the patella's resistance to medial translation. Proper graft fixation and patellar centering within the trochlear groove are crucial to mitigating this complication.[34]

No definitive guidelines exist for when to release the lateral retinaculum during MPFLR. Migliorini et al[25] conducted a systematic review indicating that while some surgeons advocate for concurrent LRR in all MPFLR cases, others have varying criteria. Their review suggested that patients who underwent lateral release tended to report somewhat higher patient-reported outcome measures (PROMs), although this difference was not clinically significant. They concluded that there is no evidence supporting LRR to improve MPFLR. Migliorini et al[25] proposed that the unloading effect of lateral release on the lateral patellar compartment, commonly injured in acute patellar dislocations,[27] may contribute to the observed increase in PROMs. This assertion aligns with the finite element model findings of Kheir et al,[18] showing that lateral release during MPFLR reduces the contact area and pressure between the patella and trochlear groove with increasing knee flexion. Any potential unloading effect of LRR does not appear to affect osteoarthritis development or progression, as reported by Nomura et al,[28] who found no difference in osteoarthritis rates between patients undergoing MPFLR with and without lateral release at a mean follow-up of 11.9 years.

Importantly, the findings of this study do not allow for any conclusions regarding the potential influence of LRR in the context of a stabilization procedure involving bony procedures such as tibial tubercle osteotomy or trochleoplasty. Potential changes to patellar tracking and position as a result of these bony procedures may lead to differential effects on the lateral retinaculum in different patients. A recent systematic review found that patients undergoing these bony procedures may benefit from an LRR.[6]

In this study, the addition of an LRR during MPFL surgery did not seem to influence the PT. Although statistical power was not determined for scannographic analysis, this study found no significant difference in PT when the quadriceps were relaxed or contracted. These results should be interpreted with caution, as the CT analyses were conducted under unloaded conditions. These findings likely do not reflect the biomechanics of the patellofemoral joint during walking or sports activities. Few studies specifically analyze the influence of LRR on the PT. One study shows an increase in the PT (12° to 15° postoperatively) in conjunction with MPFLR.[40] According to Pohlig et al,[29] performing LRR alone significantly decreases PT at 30° of flexion.[29]

This study has several strengths, including its randomized controlled prospective design and comprehensive evaluation of outcomes, which include subjective knee function, PT, and complications. The statistical power was sufficient for the primary outcome, and the loss to follow-up was low (6.4%). The final sample size of 125 patients was slightly below the initially planned number of 140 because 6 patients were excluded for other reasons (medical reasons, associated bony procedures, or intraoperative change of autograft) in addition to those lost to follow-up, bringing the number of patients excluded from the analysis to 10.7%, which was slightly more than expected (10%). However, this study has some limitations. Not all patients underwent postoperative CT scans, which lowered the power of the PT analysis and risk of selection bias. In addition, longer-term follow-ups would be valuable to assess potential long-term effects of the addition of LRR on outcomes and the development of osteoarthritis. A limitation of our study is the use of the subjective IKDC score as the primary outcome measure, rather than employing patellofemoral instability-specific instruments such as the Banff Patella Instability Instrument or the Norwich Patellar Instability score. Notably, these specialized instruments were introduced after the initiation of our study. Future research should consider incorporating these disease-specific measures to enhance the evaluation of treatment outcomes in patients with patellofemoral instability. Furthermore, our study exclusively evaluated LRR without considering lateral retinacular lengthening, which has been proposed as an alternative technique to address lateral patellar hypercompression. Some studies suggest that LRL may offer benefits such as reduced medial instability and better clinical outcomes compared with LRR.[21,30]

Finally, the methodology of this study does not fully evaluate the efficacy of the addition of LRR in all potential situations. There may be some patients who potentially benefit from LRR and some who may not, based on specific criteria. The present study only allows for the evaluation of the effect of routine use of the LRR in conjunction with MPFLR. Nonetheless, the addition of LRR did not lead to worse clinical outcomes or higher complication rates in this cohort.

CONCLUSION

Routine performance of LRR in association with MPFLR in the absence of bony procedures does not lead to improved patient-reported outcomes or significant alteration of the PT.

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