Is Diagnostic Arthroscopy at the Time of Medial Patellofemoral Ligament Reconstruction Necessary?

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Background: Although medial patellofemoral ligament (MPFL) reconstruction is well described for patellar instability, the utility of arthroscopy at the time of stabilization has not been fully defined.

Purpose: To determine whether diagnostic arthroscopy in conjunction with MPFL reconstruction is associated with improvement in functional outcome, pain, and stability or a decrease in perioperative complications.

Study Design: Cohort study; Level of evidence, 3.

Methods: Patients who underwent primary MPFL reconstruction without tibial tubercle osteotomy were reviewed (96 patients, 101 knees). Knees were divided into MPFL reconstruction without arthroscopy (n = 37), MPFL reconstruction with diagnostic arthroscopy (n = 41), and MPFL reconstruction with a targeted arthroscopic procedure (n = 23). Postoperative pain, motion, imaging, operative findings, perioperative complications, need for revision procedure, and postoperative Kujala scores were recorded.

Results: Pain at 2 weeks and 3 months postoperatively was similar between groups. Significantly improved knee flexion at 2 weeks was seen after MPFL reconstruction without arthroscopy versus reconstruction with diagnostic and reconstruction with targeted arthroscopic procedures (58° vs 42° and 48°, respectively; $P = .02$). Significantly longer tourniquet times were seen for targeted arthroscopic procedures versus the diagnostic and no arthroscopic procedures (73 vs 57 and 58 min, respectively; $P = .0002$), and significantly higher Kujala scores at follow-up were recorded after MPFL reconstruction without arthroscopy versus reconstruction with diagnostic and targeted arthroscopic procedures (87.8 vs 80.2 and 70.1, respectively; $P = .05$; 42% response rate). There was no difference between groups in knee flexion, recurrent instability, or perioperative complications at 3 months. Diagnostic arthroscopy yielded findings not previously appreciated on magnetic resonance imaging (MRI) in 35% of patients, usually resulting in partial meniscectomy.

Conclusion: Diagnostic arthroscopy with MPFL reconstruction may result in findings not previously appreciated on MRI. Postoperative pain, range of motion, and risk of complications were equal at 3 months postoperatively with or without arthroscopy. Despite higher Kujala scores in MPFL reconstruction without arthroscopy, the relationship between arthroscopy and patient-reported outcomes remains unclear. Surgeons can consider diagnostic arthroscopy but should be aware of no clear benefits in patient outcomes.

Keywords: arthroscopy; patellar instability; medial patellofemoral ligament; MPFL reconstruction

Patellar dislocations are estimated to account for 2% to 3% of all traumatic knee injuries.[1,11,16] Several risk factors for recurrent patellar dislocation have been identified. These risk factors include patella alta, trochlear dysplasia, increased tibial tubercle–trochlear grove (TT-TG) distance, lateral patellar tilt, patellar hypermobility, variations of medial patellofemoral ligament (MPFL) anatomy, hypoplasia of the vastus medialis, increased Q angle, increased femoral anteversion, valgus alignment, and generalized ligament laxity.[2,9,17] Historically, patellar dislocations were treated nonoperatively, with operative treatment reserved for unsuccessful nonoperative measures; however, nonoperative management may lead to redislocation rates as high as 44%.[7] Some authors[19] have advocated for more prompt surgical treatment, which may provide lower redislocation rates and better short- and medium-term clinical outcomes. Others prefer to defer surgical treatment until recurrent patellar instability occurs.

In either case, the aim of the operative treatment is to address anatomic pathological features contributing to recurrent instability. This may include medial soft tissue procedures, distal and/or medial tibial tubercle transfer, distal femur osteotomy for valgus malalignment, and in rare circumstances, trochleoplasty. Because the MPFL is

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the primary soft issue restraint to lateral displacement,[13] it is always injured to some extent in recurrent instability and thus nearly always treated surgically with either repair or reconstruction. Several studies[1,3,4,6,10,18,21,26,28] have shown the superiority of MPFL reconstruction over repair; as such, MPFL reconstruction has become a mainstay for treatment of recurrent patellar instability, and various surgical techniques have been described.

There is a paucity of data regarding whether arthroscopy at the time of MPFL reconstruction provides any added diagnostic value or influences treatment outcomes. Although the risks and complications of arthroscopy have been well described,[25] these risks in association with MPFL reconstruction are poorly understood. The purpose of this study was to determine whether diagnostic arthroscopy during MPFL reconstruction provides any supplementary clinical information not previously appreciated on physical examination or imaging, improves outcomes, or increases the risk of complications.

We hypothesized that there would be no difference in postoperative pain, range of motion, recurrent instability, complications, or patient-reported outcomes when performing MPFL reconstruction with versus without arthroscopy.

METHODS

This retrospective cohort study was performed after obtaining approval from our ethics committee. Between 2012 and 2017, patients undergoing primary MPFL reconstruction at our institution were queried in our billing database by Current Procedural Terminology (CPT) codes 27420, 27422, 27425, 27427, and 27429 (n = 139). CPT codes 27420, 27422, 27425, and 27429 are nonprimary MPFL reconstruction procedures but were included in the query to account for any error in CPT coding. A total of 139 patient charts were reviewed; patients undergoing concomitant tibial tubercle osteotomy (TTO), associated multiple ligament reconstruction (ie, anterior cruciate, posterior cruciate, and medial collateral ligaments), revision MPFL reconstruction, or those without at least 3 months of clinical follow-up were excluded. In total, 96 patients (101 knees) met the inclusion criteria.

Medical records were reviewed for characteristic information, radiographic parameters including Caton-Deschamps (CD) ratio and TT-TG distance, preoperative imaging findings, intraoperative findings, postoperative pain and range of motion, perioperative complications, and recurrent instability at 3 months postoperatively. The CD ratios were retrospectively measured on weightbearing lateral knee radiographs taken with the knee flexed to approximately 30°. The TT-TG distances were measured retrospectively on magnetic resonance imaging (MRI) axial T2 sequences. Patients were contacted by telephone to complete a postoperative Kujala score assessment[15] (also known as Anterior Knee Pain Scale) during the fall of 2018. The average follow-up time from surgical procedure to telephone interview for Kujala score assessment was 40 months, and there was a 42% response rate. Chi-square analysis of telephone follow-up response rates demonstrated no statistically significant differences between study groups (P = .12). Reconstructions were performed in a standard fashion using hamstring tendon autograft with suture anchor fixation on the patella and interference screw fixation on the femur. A standardized MPFL reconstruction rehabilitation protocol was used for all patients.

Knees were divided into 3 groups based on the intervention performed: MPFL reconstruction without arthroscopy, MPFL reconstruction with diagnostic arthroscopy, or MPFL reconstruction with a preoperatively planned targeted arthroscopic procedure. Targeted procedures included partial meniscectomy, chondroplasty, loose body removal, microfracture, arthroscopic lateral retinacular release, and arthroscopic synovectomy. It is the practice of some of our surgeons (G.P.T. and D.L.R.) to choose to perform arthroscopy at the time of MPFL reconstruction only in those patients with identifiable pathology on MRI, while other surgeons routinely complete a diagnostic arthroscopy regardless of imaging findings. Patients received their particular intervention based on the standard treatment strategy of their treating physician.

"Diagnostic arthroscopy" was defined as arthroscopy performed without the intent of addressing a specific intra-articular pathological feature visualized on MRI. A "targeted arthroscopic procedure" was defined as a planned arthroscopic procedure to address chondral pathology, meniscal pathology, or loose bodies identified on preoperative MRI by the attending surgeon (G.P.T., D.L.R., or D.C.W.). Modified Outerbridge scores[23] on preoperative MRI were retrospectively scored by a senior surgeon (G.P.T.) blinded to patient identifiers. Complications were defined as wound dehiscence, wound infection defined by the Centers for Disease Control and Prevention guidelines,[12] persistent pain requiring revision procedure, deep-vein thrombosis, nerve palsy, and arthrofibrosis.

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TABLE 1
Characteristics of the Study Groups[a]

Characteristic	No Arthroscopy (n = 37 Knees)	Diagnostic Arthroscopy (n = 41 Knees)	Targeted Arthroscopic Procedure (n = 23 Knees)	*P*
Age, y, mean ± SD	20 ± 7.7	23 ± 7.4	25 ± 7.0	**.04**
Sex, n				.88
Male	9	14	10	
Female	28	27	13	
Laterality, n				.25
Right	13	24	12	
Left	24	17	11	
CD ratio, mean ± SD	1.18 ± 0.32	1.11 ± 0.4	1.13 ± 0.6	.16
TT-TG distance, mm, mean ± SD	10.86 ± 4.1	11.67 ± 5.3	13.67 ± 3.7	**.03**
Patellar modified Outerbridge, %				**<.01**
0	31	50	9	
I	34	25	5	
II	22	17	27	
III	13	8	27	
IV	0	0	32	
Trochlear modified Outerbridge, %				**<.01**
0	66	89	46	
I	19	6	18	
II	6	3	14	
III	9	2	4	
IV	0	0	18	

[a]Bolded *P* values indicate statistically significant difference among the 3 groups. CD, Caton-Deschamps; TT-TG, tibial tubercle–trochlear groove distance.

Homogeneity among the 3 intervention groups was assessed. Age, CD ratio, and TT-TG distance were analyzed using 1-way analysis of variance (ANOVA) test. Sex and laterality were analyzed using Fisher exact test. Patellar and trochlear modified Outerbridge scores were analyzed using chi-square test. Continuous outcome variables, including tourniquet time, range of motion, and Kujala scores, were analyzed using 1-way ANOVA. Ordinal outcome data, including visual analog scale scores, occurrence of complications, return to operating room (OR), and recurrent instability, were statistically analyzed with chi-square test. Statistical significance was set at alpha = .05.

RESULTS

There were 37 knees in the group without arthroscopy, 41 in the group with diagnostic arthroscopy, and 23 in the group with targeted arthroscopic procedure. The average clinical follow-up time was 6.9 months. There was no statistical difference between groups with respect to sex, laterality, or CD ratio. There was a statistically significant difference in age and TT-TG distance among the 3 groups (Table 1).

Outcomes

Table 2 shows treatment outcomes between the groups at 3-month follow-up. Among the 3 groups, there were no differences in postoperative pain, knee extension, or postoperative complications. Significantly longer tourniquet times were seen for MPFL reconstruction with targeted arthroscopic procedures versus diagnostic arthroscopy and no arthroscopy (73 vs 57 and 58 min, respectively; P = .0002); there was no difference in tourniquet times between the no arthroscopy and diagnostic arthroscopy groups. Significantly improved knee flexion at 2 weeks was seen after reconstruction without arthroscopy versus reconstruction with diagnostic and reconstruction with targeted arthroscopic procedures (58° vs 42° and 48°, respectively; P = .02). No difference in pain was observed at 12 weeks. At 40 ± 20 months postoperatively, significantly higher Kujala scores at follow-up were recorded for MPFL reconstruction without arthroscopy versus reconstruction with diagnostic and targeted arthroscopic procedures (Table 3) (87.8 vs 80.2 and 70.1, respectively; P = .05).

Arthroscopic Procedures Performed

A total of 13 knees (31.7%) in the diagnostic arthroscopy group underwent an additional arthroscopic procedure at the time of their MPFL reconstruction (Table 4). Meniscal injury was the most common pathological feature not previously identified on MRI. The most common targeted arthroscopic procedure performed was loose body removal and patellar chondroplasty. All meniscectomies were small radial tears.

Complications

The overall complication rate in our cohort was 4.9%. Complication rates among each group are listed in Table 2. Two patients in the no arthroscopy group developed recurrent instability at 9 months postoperatively, 1 secondary to

TABLE 2
Outcomes at 3 Months After MPFL Reconstruction[a]

Outcome	No Arthroscopy (n = 37)	Diagnostic Arthroscopy (n = 41)	Targeted Arthroscopic Procedure (n = 23)	*P*
Tourniquet time, min, mean ± SD	58 ± 9.7	57 ± 14.2	73 ± 22.6	**.0002**
VAS for pain (0-10), median (range)				
2 weeks	2.5 (0-8)	3 (0-9)	4 (0-10)	.80
12 weeks	0 (0-7)	0 (0-8)	0.5 (0-9)	.46
Range of motion, deg, mean ± SD				
2-week flexion	57.7 ± 30	42 ± 20	48 ± 23	**.02**
2-week extension	0.2 ± 0.8	0.1 ± 0.7	0 ± 0.1	.72
12-week flexion	129.8 ± 23.6	129.2 ± 40	129.0 ± 46.1	.97
12-week extension	0 ± 0.2	0.1 ± 0.8	0 ± 0.1	.47
Complications, n				
Arthrofibrosis	0	1	0	≥.999
Infection/wound dehiscence	1	1	0	≥.999
Persistent pain	0	1	0	≥.999
Peroneal palsy	0	1	0	≥.999
Complication rate, %	2.7	9.7	0	.17
Return to operating room, n	3	3	1	≥.999

[a]Bolded *P* values indicate statistically significant difference among the 3 groups. MPFL, medial patellofemoral ligament; VAS, visual analog scale.

TABLE 3
Outcomes at Telephone Follow-up at Average 40 Months[a]

Outcome	No Arthroscopy (n = 37)	Diagnostic Arthroscopy (n = 41)	Targeted Arthroscopic Procedure (n = 23)	*P*
Recurrent instability	2	1	3	.18
Kujala score, mean ± SD	87.8 ± 10.7	80.2 ± 15.8	70.1 ± 20.3	**.05**

[a]Average telephone follow-up time was 40 ± 20 months, with a 42% response rate. Bolded *P* values indicate statistically significant difference among the 3 groups.

TABLE 4
Arthroscopic Procedures Performed in Conjunction With Medial Patellofemoral Ligament Reconstruction

Procedure	Diagnostic Arthroscopy (n = 41)	Targeted Procedure (n = 23)
Partial medial meniscectomy	2	2
Partial lateral meniscectomy	7	5
Loose body removal	1	10
Patellar chondroplasty	2	10
Patellar microfracture	0	1
Lateral femoral condyle chondroplasty	1	0
Lateral femoral condyle microfracture	0	2
Medial femoral condyle chondroplasty	0	1
Lateral retinacular release	0	3
Synovectomy	0	1
Total	13 (31.7%)	35

trauma and the other after returning to basketball. Both underwent revision MPFL reconstructions with uneventful postoperative courses. Another patient in the no arthroscopy group returned to the OR after a postoperative wound dehiscence at the 3-week mark.

In the diagnostic arthroscopy group, 1 patient sustained recurrent instability and returned to the OR for revision MPFL reconstruction with TTO at 3 years postoperatively. His CD ratio was 1.5 and TT-TG distance was 21 mm. One patient's postoperative course was complicated by wound dehiscence at the 4-week mark, which granulated and healed without need for surgical intervention. One patient in this group returned to the OR because of persistent pain and underwent lateral facet chondroplasty and lateral retinacular release. One patient developed arthrofibrosis and returned to full motion after arthroscopic lysis of adhesions. One patient sustained a common peroneal nerve palsy, which has gradually improved with observation.

In the targeted arthroscopic procedure group, 3 patients developed recurrent instability. Only 1 returned to the OR and was treated with repeat MPFL reconstruction and TTO. Revision MPFL reconstruction was offered to the other 2 patients, but they elected to continue nonoperative treatment of their instability. As this is the first study to compare MPFL reconstruction with and without arthroscopy, we were unable to identify an appropriately similar study to perform a pre hoc power analysis. A post hoc analysis revealed that we would need to include 688 patients for 80% power in detecting postoperative complications.

DISCUSSION

Currently, few studies support or refute whether diagnostic arthroscopy with MPFL reconstruction provides any supplementary information, improvements in pain or motion, increased tourniquet time or complication rate, or differences in postoperative Kujala score or recurrent patellar instability. Proponents of routine arthroscopy cite the ability to address concurrent intra-articular pathological features, remove loose bodies, accurately evaluate the patellofemoral articular surface, and assess patellar tracking.[22] Physicians in support of only targeted arthroscopy question the ability to change outcomes by performing diagnostic arthroscopy in order to identify additional pathological features, as well as the efficacy of assessing dynamic tracking in a patient under anesthesia with an insufflated joint and possibly a tourniquet in place. Additional costs to the patient and the health care system also remain a concern.

In our study, diagnostic arthroscopy identified pathological features not previously noted on MRI in 31.7% of cases; these features were primarily meniscal in nature. This is in line with previous findings of the variability of MRI in diagnosing meniscal pathology,[5,20] which has shown sensitivities and specificities ranging from 50% to 90% and 66% to 84%, respectively. Furthermore, MRI has been shown to have between 76% and 78% interobserver reliability when compared with arthroscopy (the gold standard) for treatment of intra-articular knee pathology.[29]

Despite diagnostic arthroscopy addressing intra-articular pathological features in 31.7% of cases, there were no statistically significant differences in pain scores between patients undergoing MPFL reconstruction with versus without arthroscopy. This leads us to question whether the pathological features addressed after diagnostic arthroscopy, mainly partial meniscectomy of small radial tears in conjunction with MPFL reconstruction, result in any clinically meaningful benefit. We acknowledge that associated chondral injury and resultant loose bodies from patellar instability can affect knee pain and function, and this was accordingly addressed in our targeted arthroscopic procedure group. This may highlight the usefulness of preoperative MRI in identifying clinically notable chondral injury and loose bodies over meniscal pathology. This finding is congruent with the study by Kita et al,[14] which found 97% of patellar dislocations to have some chondral lesion at time of MPFL reconstruction, although the lesions did not provide considerable discomfort, were not addressed with a procedure, and did not result in notable deterioration.

In the 42% of patients responding to final telephone interview follow-up, postoperative Kujala scores were significantly higher in the group that underwent MPFL reconstruction without arthroscopy. The average score in this group was 87.8, compared with a score of 70.1 observed in the group that underwent reconstruction with targeted arthroscopic procedure, which exceeded the minimal clinically important difference previously described as 10.[8] The causality of this finding is likely multifactorial and may be attributable to preoperative intra-articular pathology, duration of instability, patient expectations, recall bias, and/or iatrogenic injury related to arthroscopy. Slightly older age and greater TT-TG distance in the arthroscopy groups may have also contributed to this finding. It is unclear if there is a direct link between arthroscopy in conjunction with MPFL reconstruction and patient-reported outcomes.

There were no statistically significant differences between the arthroscopy and no arthroscopy groups with respect to complications, wound infections, or recurrent instability. This finding was expected, given the brief nature and relatively low risk of knee arthroscopy. Although there was significantly increased knee flexion at 2 weeks in the no arthroscopy group, there were no between-group differences observed at the 3-month mark. We also observed significantly longer tourniquet times for targeted arthroscopic procedure, which was expected given the preoperative planning to address intra-articular pathology. Interestingly, we did not observe a difference in tourniquet time between the no arthroscopy and diagnostic arthroscopy groups, suggesting that diagnostic arthroscopy may be performed without the adverse effects associated with longer tourniquet times.[24] The overall complication rate in our cohort was 4.9%, which is similar to the previously reported overall complication rates of 4.7% for arthroscopy[25] and 26.1% for MPFL reconstruction.[27]

Although there were no significant differences in complications of MPFL reconstruction with and without arthroscopy, there remain considerable costs associated with additional procedures. Although absolute cost varies with procedure type, number of procedures performed, and payer-specific agreements, these added procedures increase the cost to the patient and payer. Adding an arthroscopic setup increases the overall procedure cost as well. This is a noteworthy factor in light of increasing health care costs and the transition to bundled payments. Further studies, including prospective randomized controlled trials, would be helpful to determine when surgeons should perform diagnostic arthroscopy at the time of MPFL reconstruction.

Our study has several limitations. The decision to proceed with diagnostic arthroscopy at time of MPFL reconstruction was not based on any particular algorithm or randomization and was a shared decision-making process between patient and surgeon. This may have imparted selection bias into the different arthroscopy groups. These data may also be confounded by the older age and greater TT-TG distances observed in the MPFL reconstruction groups undergoing arthroscopy. Furthermore, we did not account for the time between MRI and surgical procedure, which may have affected the pathological features appreciated on arthroscopy but not MRI. Despite similar procedure technique and rehabilitation protocol, we did not account for individual variations in rehabilitation or bracing protocols, which may have confounded pain and motion results. In addition, no specific protocol was utilized to track postoperative complications, which may have imparted recording bias. Performance bias may also have been imparted into the data, as each group was variable with regard to senior surgeon case mixture (G.P.T., D.L.R., and D.C.W.).

Because this is the first study to compare MPFL reconstruction with and without arthroscopy, we were unable to identify an appropriately similar study to perform a pre hoc power analysis. A post hoc analysis revealed that we would need to include 688 patients for 80% power in detecting postoperative complications. Therefore, despite observing statistically significant differences in tourniquet time, postoperative motion, and Kujala scores, this study may have been underpowered, with sample sizes too small to find true differences in complication rates. Our study also did not quantify percentage of meniscectomy, which would aid in determining the magnitude of an intervention performed. The telephone follow-up response rate of 42% may also have imparted transfer bias into the Kujala score analysis. Last, our comparison groups were not homogeneous with respect to patellar and trochlear cartilage injury. The targeted arthroscopy group had significantly higher preoperative modified Outerbridge scores, likely contributing to the lower patient-reported outcome scores. However, this disparity in cartilage injury is rational, considering the most common procedure performed for the targeted arthroscopy group was loose body removal. Interestingly, the diagnostic arthroscopy group had lower Kujala scores despite lower preoperative patellar and trochlear Outerbridge scores, suggesting that diagnostic arthroscopy even in the setting of more preserved cartilage does not improve patient-reported outcomes.

CONCLUSION

Diagnostic arthroscopy at the time of MPFL reconstruction may result in findings not previously appreciated on MRI. The clinical benefit of addressing these findings remains unclear despite the increased cost. Postoperative pain, range of motion, and risk of complications were not significantly different among the study groups at 3 months postoperatively. Patient-reported outcomes at 40 months postoperatively were higher in patients undergoing MPFL reconstruction without arthroscopy. Surgeons performing MPFL reconstruction should consider diagnostic arthroscopy a safe adjunct but one without clear benefits in improving pain or patellar stability.

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