

Original Research Article

Arthroscopically assisted medial plication combined with lateral retinaculum release in cases of lateral patellar instability in comparison with medial patellofemoral ligament reconstruction: a short term comparative study

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ABSTRACT

Background: The stability of patellofemoral joint in a healthy knee depends on bony structure of the joint and multiple static and dynamic soft tissue structures. Of them, the most important structure is the medial patellofemoral ligament (MPFL). The aim of this study is to evaluate the results of the arthroscopically assisted medial plication and lateral retinacular release in cases of lateral patellar instability in comparison to medial patellofemoral ligament reconstruction in a short term follow up study in patients with no or minimal bony deformities.

Methods: This prospective randomized comparative clinical study was conducted on 40 patients with lateral patellar instability attending the Orthopedic Clinic at Benha University Hospital. Patients were randomly divided into two equal groups: group I (n=20) underwent arthroscopic medial retinaculum plication with lateral retinaculum release, and group II (n=20) underwent open MPFL reconstruction using a gracilis tendon graft. All patients underwent standardized clinical, and radiological assessment. Outcomes included operative time, complications, hospital stay, time to mobilization and weight bearing, radiological patellar tracking, and functional outcomes assessed by western Ontario and McMaster universities osteoarthritis index (WOMAC) and Lysholm scores over 6-24 months.

Results: There were no significant differences between both groups regarding baseline or radiological data. However, group II showed significantly longer operative time, greater perioperative blood loss, and longer hospital stay. Although re-dislocation and patellar instability rates were higher in group I (10% and 20% versus 0% and 5% in group II), the differences were not significant, with a non-significant higher failure rate in group I ($p=0.091$). Postoperatively, group II demonstrated significantly greater radiological improvement, earlier mobilization, and superior functional outcomes with higher Lysholm and lower WOMAC scores at follow-up ($p<0.05$ to $p<0.001$).

Conclusions: MPFL reconstruction yields better patellar alignment and functional outcomes with lower re-dislocation and instability rates and greater radiological improvement than arthroscopic medial plication with lateral release, but it is associated with longer operative time and increased blood loss.

Keywords: Medial patellofemoral ligament reconstruction, Lateral patellar instability, Arthroscopic medial plication, Lateral retinacular release, Patellar instability, Patellofemoral joint

INTRODUCTION

The stability of patellofemoral joint in a healthy knee depends on bony structure of the joint and multiple static and dynamic soft tissue structures. Of them, the most important structure is the medial patellofemoral ligament

(MPFL), contributing to approximately 60% of the force that opposes lateral displacement of the patella. The other important structures include the muscles of the thigh, especially during loading and dynamic movements.¹ Recurrent patellar dislocation is defined as two or more episodes of dislocation, or symptoms of patellar instability

that last for more than three months after the first dislocation episode.²

The incidence of patellar dislocations ranges from 2.29 to 77.4 per 100,000 in the representative sample of emergency rooms across the United States queried from 2001 to 2020 for cases of patellar dislocation.³

The diagnosis of patellar instability is based on accurate history analysis and supported by examination and imaging studies. The single most important subjective report in patellar subluxation is the sudden unexpected giving out of the knee during daily activities with or without minimal trauma. This sudden patella giving way does cause a great deal of apprehension.⁴

Treatment aims to prevent re-dislocation, residual instability, osteoarthritis and allows return to activities.⁵

The non-operative modalities in recurrent patellar instability consist of physiotherapy, bracing or taping and hinged knee braces or lateral stabilization braces. However, most authors agree that the common indications for operative intervention are failure to improve with nonoperative treatment.⁶

Surgical treatments options that have been described for patellar dislocation include, MPFL reconstruction, MPFL repair, medial retinacular plication with or without lateral retinaculum release and other associated bone correction surgery. Currently, MPFL reconstruction, MPFL repair, and nonoperative treatment are the most popular techniques. The report showed that MPFL reconstruction was safe and effective in patients of all ages, without marked predisposing anatomic abnormalities and moderate/severe osteochondral lesions.⁷

The aim of this study is to evaluate the results of the arthroscopically assisted medial plication and lateral retinacular release in cases of lateral patellar instability in comparison to medial patellofemoral ligament reconstruction in a short term follow up study in patients with no or minimal bony deformities.

METHODS

This prospective randomized controlled clinical trial study was carried out on 40 patients with lateral patellar instability attending at orthopaedic clinic in Benha University Hospital.

An informed written consent was obtained from the patient. The study was done after approval from the Ethical Committee Benha University Hospital.

Patients were divided into two equal groups. Group I included 20 patients who underwent arthroscopic medial retinaculum plication combined with lateral retinaculum release, while group II included 20 patients who underwent medial patellofemoral ligament reconstruction.

Inclusion criteria included patients with lateral patellar instability who failed conservative treatment and physiotherapy, aged between 18 and 50 years, with a follow-up period ranging from 6 months to 2 years. Participants were required to have normal mentation, the ability to attend supervised physiotherapy rehabilitation sessions for 6 weeks, provide signed informed consent, have grade A or B trochlear dysplasia according to the Dejour classification, and a body mass index (BMI) <32. Exclusion criteria included patients with advanced patellofemoral arthritis, neurovascular injury of the lower limb, patellar fracture, neurological deficit, knee stiffness, active infection, generalized ligamentous laxity, or severe lower limb bony malalignment.

All patients underwent detailed history taking, clinical examination, and radiological assessment. Radiological evaluation included plain X-rays of the affected knee in anteroposterior, lateral, and Merchant views at 30°, 60°, and 90°, full-length limb scanography to exclude malalignment, and magnetic resonance imaging (MRI) of the knee with measurement of TT-TG and TT-PCL distances. All patients underwent routine preoperative assessment. Prophylactic antibiotic (third-generation cephalosporin 1 g) was administered one hour before induction and continued for one postoperative day. All patients were kept fasting overnight.

Group I: Arthroscopic medial retinaculum plication with lateral retinaculum release

Patients were operated under general or regional anesthesia in the supine position with tourniquet application. Patellar tracking was assessed intraoperatively, and the degree of medial plication was determined based on the contralateral side. Diagnostic arthroscopy was performed through standard portals, followed by medial retinaculum preparation and suture placement using ethibond sutures. A controlled medial plication was achieved arthroscopically with knot tying under visualization, while lateral retinacular release was performed using electrocautery or sharp dissection when indicated, preserving the superior lateral genicular artery when possible. Final patellar tracking was confirmed arthroscopically, and a drain was inserted before wound closure.

Group II: Open MPFL reconstruction using gracilis tendon graft

Patients were operated under general or regional anesthesia in the supine position with knee flexion and tourniquet application. The gracilis tendon was harvested through a small incision over the pes anserinus, prepared with whipstitch sutures, and doubled to an adequate length. Patellar tunnels were created using K-wires and reamers, and the femoral tunnel was positioned at the anatomic "Schöttle point" under fluoroscopic guidance. The graft was passed through the patellar and femoral tunnels and secured with interference screw fixation at approximately

45° of knee flexion, ensuring appropriate tension to avoid over-constraint. Postoperatively, all patients were monitored in the recovery room with standard vital observation and analgesia. Intravenous antibiotics were continued for 5 days, followed by oral antibiotics until suture removal at 14 days. Hemoglobin was checked on the first postoperative day, and wounds were regularly assessed.

Clinical and radiological evaluation included recording operative time, intraoperative and postoperative complications, radiological follow-up, hospital stay, time to mobilization and weight bearing, and initiation of physiotherapy. The primary outcome was restoration of normal patellar tracking with follow-up ranging from 6 months to 2 years. Functional assessment was performed using the WOMAC score, which evaluates pain, stiffness, and functional limitation (higher scores indicate worse outcomes), and the Lysholm knee scoring scale, which grades knee function from 0 to 100, categorized as excellent (95-100), good (84-94), fair (65-83), and poor (<65).

RESULTS

Group II showed a significantly longer operative time, greater perioperative blood loss, and longer hospital stay

compared with group I. Although group I had higher rates of re-dislocation (10%) and patellar instability episodes (20%) compared with group II (0% and 5%, respectively), these differences were not statistically significant. The overall failure rate was 30% in group I versus 5% in group II, also without statistical significance ($p=0.091$) (Table 1).

Both groups were comparable preoperatively with no significant differences in all radiological parameters ($p>0.05$). Postoperatively, group II showed significantly greater improvement than group I in congruence angle, lateral patellar angle, patellar tilt angle, and lateral patellar translation at 6 and 24 months ($p<0.05$ to $p<0.001$), with the most marked changes at 24 months. Within-group analysis demonstrated significant improvement over time in group II ($p<0.001$), while group I showed limited or non-significant changes ($p>0.05$) (Table 2).

Both groups were comparable preoperatively with no significant differences in Lysholm and WOMAC scores ($p>0.05$). Postoperatively, group II showed significantly earlier mobilization and full weight bearing compared with group I ($p<0.001$). Functional outcomes were significantly better in group II, with higher Lysholm scores and lower WOMAC scores at 6 and 24 months ($p=0.01$ to $p<0.001$), indicating superior recovery and functional improvement in group II (Table 3).

Table 1: Baseline characteristics, operative data, and postoperative complications of the studied group.

Age (years)		Group I (n=20)		Group II (n=20)		P value
		28.6±6.14		30.1±7.18		0.483 ^{NS}
BMI		24.5±3.22		25.4±4.33		0.604 ^{NS}
Duration of dislocation (months)		21.3±5.52		20.7±6.54		0.604 ^{NS}
Gender		N	%	N	%	0.920 ^{NS}
	Male	12	60	13	65.0	
	Female	8	40	7	35.0	
Side of dislocation	RT	10	50	12	60	0.322 ^{NS}
	LT	10	50	8	40	
Surgical duration (minutes)		71.5±5.11		106.5±15.7		0.002 ^S
Blood loss (ml) 24 hour drain production		53.4±10.6		157.4±34.6		<0.001 ^{HS}
Hospitalization length (days)		3.12±0.87		5.33±1.11		<0.001 ^{HS}
Wound infection		0 (0.0%)		3 (15%)		0.215 ^{NS}
Deep vein thrombosis		0 (0.0%)		2 (10%)		0.995 ^{NS}
Re-dislocation episode		2 (10%)		0 (0.0%)		0.111 ^{NS}
Patellar instability episodes		4 (20%)		1 (5%)		0.08 ^{NS}
Failure rate		6 (30%)		1 (5%)		0.091 ^{NS}

Data presented as mean±SD or frequency (%). NS: p value >0.05 is not significant, S: p value <0.05 is significant, HS: p value <0.001 is high significant

Table 2: CT examination data preoperative and on follow up time among both studied groups.

Parameters		Group I (n=20)		Group II (n=20)		P value
Congruence angel	Pre-	-24.2±3.22		-25.8±4.64		0.311 ^{NS}
	After 6 months	-22.4±2.45		-18.7±2.23		<0.001 ^{HS}
	After 24 months	-21.3±2.56		-11.6±2.14		<0.001 ^{HS}
P for the change within group		0.065 NS		<0.001 HS		

Continued.

Parameters		Group I (n=20)	Group II (n=20)	P value
Lateral patellar angel	Pre-	-18.2±10.4	-19.4±9.24	0.324 ^{NS}
	After 6 months	-16.3±9.52	-10.3±6.22	0.023 ^S
	After 24 months	-13.4±7.55	-6.56±4.33	0.001 ^S
P for the change within group		0.072 ^{NS}	<0.001 ^{HS}	
Patellar tilt angel	Pre-	25.6±6.77	24.3±7.43	0.566 ^{NS}
	After 6 months	21.3±5.44	19.2±5.33	0.225 ^{NS}
	After 24 months	20.6±6.43	9.56±5.25	<0.001 ^{HS}
P for the change within group		0.065 ^{NS}	<0.001 ^{HS}	
Lateral patellar translation	Pre-	15.4±4.55	13.2±5.32	0.168 ^{NS}
	After 6 months	11.7±3.24	9.45±3.61	0.044 ^S
	After 24 months	9.56±4.28	6.91±3.22	0.03 ^S
P for the change within group		<0.001 ^{HS}	<0.001 ^{HS}	

Data presented as mean±SD or frequency (%). NS: p value >0.05 is not significant, S: p value <0.05 is significant, HS: p value <0.001 is high significant

Table 3: Functional outcome and recovery parameters on follow-up among both studied groups.

Parameters	Group I (n=20)	Group II (n=20)	P value
Time to full weight bearing (weeks)	8.52±2.82	5.68±2.64	<0.001 ^{HS}
Mobilization starts (days)	14.3±4.45	21.7±3.23	<0.001 ^{HS}
Lysholm knee scoring scale			
Preoperative	51.1±6.31	50.2±5.57	0.424 ^{NS}
6 months	73.6±4.31	85.2±4.22	0.01 ^S
24 months	72.1±5.12	88.5±6.32	<0.001 ^{HS}
WOMAC scoring scale			
Preoperative	81.1±9.31	80.2±7.87	0.424 ^{NS}
6 months	53.6±4.31	55.2±6.22	0.01 ^S
24 months	42.1±7.42	22.5±6.89	<0.001 ^{HS}

Data presented as mean±SD or frequency (%). NS: p value >0.05 is not significant, S: p value <0.05 is significant, HS: p value <0.001 is high significant

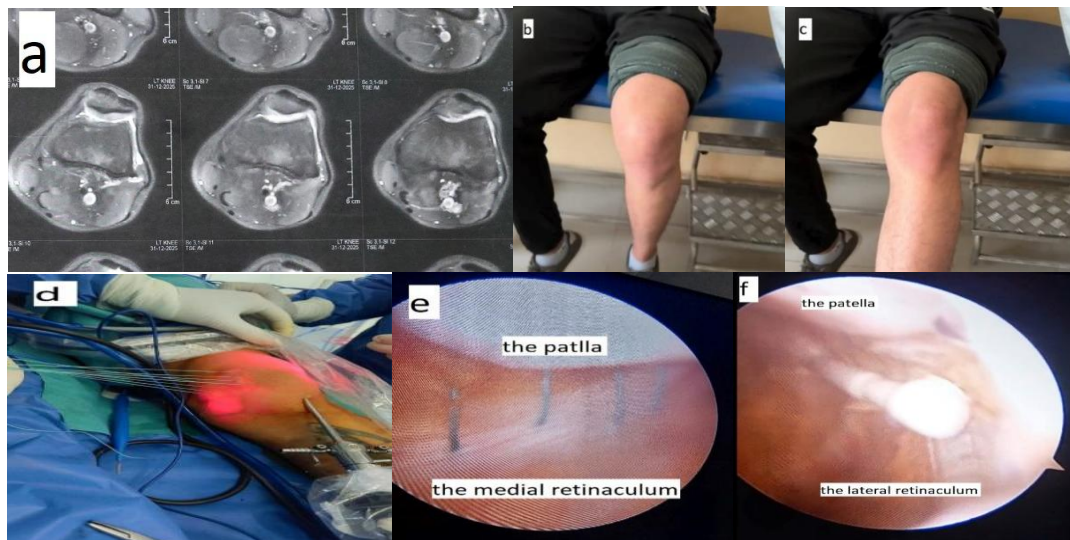


Figure 1: A 22-year-old male patient with a BMI of 27 presented with recurrent left patellar dislocation for 6 months and was treated by arthroscopically assisted medial plication with lateral retinacular release (group I): (a) MRI demonstrated MPFL tear with lateral patellar subluxation; (b and c) clinical examination images showed a positive J-sign, with the patella normally engaged within the trochlear groove during (b) knee flexion and (c) laterally subluxated during extension; (d-f) arthroscopic and operative images demonstrated medial plication using ethibond sutures under (d and e) arthroscopic visualization; and (f) lateral retinacular release performed using an electrocautery device.

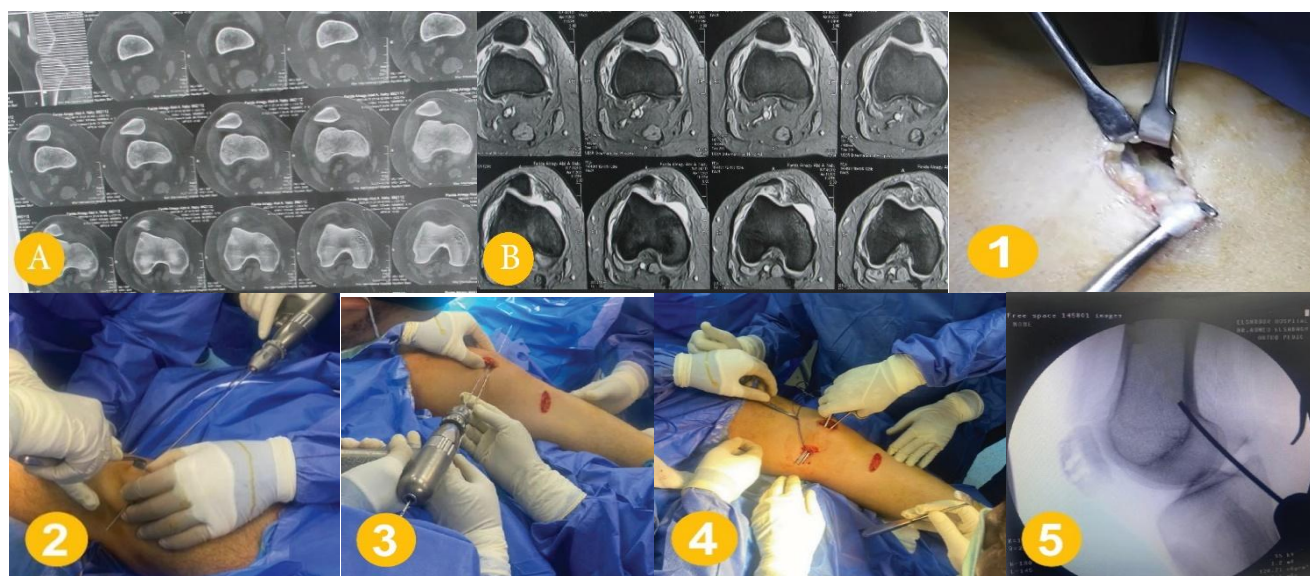


Figure 2: A 30-year-old male patient with a BMI of 28 presented with chronic right patellar instability of 18 months' duration and was treated by open MPFL reconstruction using a gracilis tendon autograft (group II): (A) CT scan demonstrated lateral patellar instability, while (B) MRI revealed a torn medial patellofemoral ligament; (1-5) operative images demonstrated (1) gracilis tendon graft harvesting, (2 and 3) patellar tunnel drilling, (4) graft fixation within the patella and passage toward the femoral insertion, and (5) identification of the Schöttle point with drilling for femoral graft fixation.

DISCUSSION

The impact of BMI at the time of surgery, several researchers have reported on an association between BMI and patient outcome following knee surgery. Enderlein et al reported on the results of a prospective series of 224 patients with recurrent patella dislocations undergoing MPFL reconstruction and found that patients with a BMI >30 had a worse functional outcome compared to patients with a lower BMI.⁸

There was a statistically significant longer surgical duration among studied group II, also total peri-operative blood loss and hospital stay were significantly higher among group II.

Regarding post-operative complications among both studied groups 2 patients (10%) in group I versus no one of group II experienced episodes of re-dislocation, and 4 patients (20%) in group I and 1 (5%) in group II experienced multiple episodes of patellar instability, albeit without re-dislocation. This resulted in a failure rate of 30% and 5% in group I and group II, respectively.

In the study by Zhao et al showed that 4 patients out of 37 patients (9.3%) in the MRP group and 1 (2.2%) in the MPFLR group experienced episodes of re-dislocation, and 7 patients (16.3%) in the MRP group and 3 (6.7%) in the MPFLR group experienced multiple episodes of patellar instability ($p=0.037$). this was in agreement with our results.⁹

Hurley et al found that MPFL reconstruction had the highest p score (0.9967) and resulted in a significantly lower recurrence rate than did MPFL repair (odds ratio [OR], 0.42; 95% CI 0.07-0.72) and nonoperative management (OR, 0.09; 95% CI 0.03-0.32).¹⁰ In addition, MPFL repair resulted in a significantly lower recurrence rate than did nonoperative management (OR, 0.42; 95% CI 0.25-0.70).

Yoo et al revealed that MPFL reconstruction showed statistically significantly better outcomes than MPFL repair, CPR, or conservative management in terms of the re-dislocation rate.¹¹

Jiang et al demonstrated that the MPFL reconstruction (1.8%, 95% CI 0.5-4.0%) had a significantly lower rate of postoperative re-dislocation and reoperation rate than the MPFL repair (15.4%, 95% CI 5.2-25.7%) and medial reefing (18.0%, 95% CI 9.3-26.7%).¹²

While Mackay et al illustrated that the pooled postoperative re-dislocation rate from all 17-case series showed a mean of 2.44%, and acceptable complication rate.¹³

However, Halbrecht reported no re-dislocation in 26 patients (29 knees) who underwent arthroscopic all-inside medial plication and lateral release for patellar instability. In a study with a 12- to 26-month follow-up, Haspl et al reported no recurrence of subluxation or luxation in 17 patients who underwent plication of the medial patellar retinaculum and release of the lateral patellar retinaculum for patellar instability, acute patellar luxation, or recurrent

patellar luxation. In a study with a 1- to 7-year follow-up. The discrepancy between the recurrence rate in this study and previous studies may be due to patient selection. The previous studies included patients in the acute stage, whereas the present study included only patients with recurrent dislocation or instability. The patients in this study may have had more severe predisposing conditions. Furthermore, the relatively short follow-up time in this study may reveal unsatisfied aspects of this procedure.

Nha et al indicated that one patient developed a re-dislocation after a traumatic event, and two patients showed patellofemoral osteoarthritis progression.¹⁴

Boddula et al demonstrated good functional outcomes with only one recurrent subluxation and no recurrent dislocations.¹⁵

Straume-Næsheim et al noted that in the MPFL group, the number of patients with recurrent dislocations more than doubled, from 2 at 1 year to 5 at 3 years, whereas the control group increased only slightly, from 13 to 15.¹⁶ Patients treated nonoperatively recover quickly, and the lack of a functional MPFL becomes apparent sooner.

A randomized controlled trial by Damasena et al compared the long-term results of patellar instability after tibial tubercle transfer (TTT) with and without MPFL reconstruction in 2 randomized groups.¹⁷ A total of 34 patients (36 knees) were randomized to 2 groups. The first group underwent lateral release (LR) and TTT for confirmed mal-tracking of the patella (control group). The second group underwent MPFL reconstruction in addition to TTT and LR (reconstruction group). They observed that one patient in the control group sustained a patellar re-dislocation 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 ($p=0.30$).

The measurement results of the congruence angle, lateral patellar angle, patellar tilt angle, and lateral patellar translation were similar before the operation. Group II cases exhibited statistically significant improvements in the 3 angles and lateral patellar translation at each follow-up point when compared with the group I. Group I cases showed a statistically significant difference between the preoperative and 24-month measurements of lateral translation.

Mobilization was started in group I on 9th day ± 1.45 days postoperatively whereas in group II mobilization was started at mean of 5.68 days. The mean time to independent full weight bearing was 8.52 weeks in group I and mean of 5.68 weeks in group II.

Before the operation, no significant differences were observed between the 2 groups Lysholm score. Significant differences were among the 2 groups 6 and 24 months after the operation. With respect to the preoperative and final

rating outcome of the score, statistically significant improvements were observed in both groups.

Before the operation, no significant differences were observed between the 2 groups in WOMAC score, 6 months postoperative there was improvement in the score among both groups with no significant difference between them. Significant differences were found among the 2 groups at 24 months after the operation. With respect to the preoperative and final rating outcome of the score, statistically significant improvements were observed in both groups.

A network meta-analysis by Hurley et al found that MPFL reconstruction had the highest p score (0.9651) and resulted in a significantly higher functional score than did nonoperative management (mean difference, 10.45; 95% CI 0.41-20.49) but not MPFL repair (mean difference, 0.15; 95% CI 0.03-0.68).¹⁰ They further concluded that MPFL reconstruction results in the lowest rate of recurrent patellar instability and best functional outcomes.

Yoo et al revealed that MPFL reconstruction was most likely the best treatment (with a SUCRA value of 72.9 and a mean rank of 1.3) in terms of functional outcomes, followed by MPFL repair (with a SUCRA value of 61.9 and a mean rank of 1.9) and conservative management (with a SUCRA value of 56.7 and a mean rank of 3.3), whereas CPR ranked last (with a SUCRA value of 57.2 and a mean rank of 3.4).¹¹

Xu et al highlighted that all 61 knees showed excellent or good results postoperatively.¹⁸ The Lysholm score increased significantly from 58.6 ± 8.1 to 91.9 ± 5.0 at the last follow-up postoperatively ($p < 0.001$). Congruence angle in 0° extension position was improved significantly from $19.8 \pm 2.1^\circ$ preoperatively to $-6.7 \pm 1.7^\circ$ at the last follow-up ($p < 0.001$), lateral patellar angle was increased from $-7.4 \pm 2.2^\circ$ to $5.7 \pm 1.8^\circ$ ($p < 0.001$), and patellar tilt angle was increased from $23.8 \pm 2.9^\circ$ to $12.3 \pm 2.3^\circ$ ($p < 0.001$).

While the systematic review by Mackay et al illustrated that the pooled preoperative functional scores from 12 case series showed a mean of 51.6 (95% CI 46.71-56.49).¹³ The pooled postoperative functional scores from 16 case series showed a mean of 87.77 (95% CI 85.15-90.39).

Straume-Næsheim et al noted that at 3-year follow-up, subjective persistent patellar instability was reported by 5 patients in the MPFL group (16.7%) versus 15 patients in the control group (53.6%), corresponding to an odds ratio of 5.8 (95% CI 1.7-19.4; $p=0.003$).¹⁶ Both groups reported significant improvements in all PROM scores from baseline to 3 years.

Schorn et al concluded that the combined arthroscopic lateral release with medial reefing does not appear to be an adequate treatment for patients with chronic patellar instability in long-term follow-up.¹⁹ Younger patients

might be at a higher risk for recurrent dislocations, while a higher BMI at surgery might be associated with residual complaints.

Nha et al indicated that the mean functional score was significantly improved from 54.7 ± 14.0 (range, 37-86) preoperatively to 91.0 ± 7.6 (range 63-99) at a mean follow-up period of 7 years ($p < 0.001$).¹⁴ The radiologic results also significantly improved from $17.8^\circ \pm 5.9^\circ$ to $6.8^\circ \pm 2.4^\circ$ ($p < 0.001$) in the congruence angle and from $17.5^\circ \pm 8.2^\circ$ to $5.6^\circ \pm 3.1^\circ$ ($p < 0.001$) after arthroscopy-controlled medial reefing and lateral release.

Kheir et al concluded that concomitant lateral retinaculum release with MPFL reconstruction results in decreased patellofemoral contact area, contact pressure and increased lateral patellar displacement with increased knee flexion, which may increase the risk of patellar instability.²⁰

Finally, we don't ignore that this study has a number of limitations that we acknowledge. As it has a small number of patients. This study short term follows up. A future study with a large sample size and long term follow up would provide a better evaluation for lateral patellar instability treatment.

CONCLUSION

MPFL reconstruction yields better patellar alignment and functional outcomes with lower re-dislocation and instability rates and greater radiological improvement than arthroscopic medial plication with lateral release, but it is associated with longer operative time and increased blood loss. There was no statistically significant difference among both studied groups as regard age, gender, BMI, or stage of arthritis of studied cases.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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