

CASE STUDY**Medial patellofemoral ligament reconstruction with Gracilis tendon in traumatic recurrent dislocation of patella: A prospective clinical study of 30 cases****Authors**

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Abstract**Background**

Recurrent dislocation of the patella is a challenging problem due to complex biomechanics of patellar stability. Reconstruction of Medial patellofemoral ligament (MPFL) is becoming a common surgical procedure in treating patellar instability. Patella apprehension test, q angle and Insall index are various parameters which helps in deciding the line of treatment..

Material and method

MPFL reconstruction was performed using gracilis graft and fixed on patella by making a loop using two tunnels in 30 patients. The femoral side was fixed with bio screw. Patients were evaluated for pain relief, functional improvement and radiographic analysis The patients were followed on an average mean of 28 (16-40) months Patient function measures included:with subjective criteria of Kujala score and Lysholm score.

Result

The mean preoperative mean Kujala score was 33.93 and Lysholm score was 36.92. The mean postoperative mean Kujala score was 83.22 and Lysholm score was 84.88. No patient had reported with redislocation till date.

Conclusion

There was no episode of recurrent dislocation and range of motion was normal in all cases. This method gives rigid fixation on both sides and provides adequate stability.

Keywords: MPFL; q angle; Insall index; apprehension test.

1. Introduction

Patellar dislocation can occur following major trauma in a normal knee or minor trauma in a bio-mechanical unbalanced knee. This dislocation is mostly lateral and seen during sports activity [1].

Conservative therapy is always the first line of management in acute patellar dislocation [2] which includes close reduction and early

mobilization with a dynamic knee brace for 6 weeks. The rate of recurrent dislocation is approximately 40% after the first episode [3]. Most of the literature recommends surgical intervention after the second episode of dislocation [4-6]. There are more than 100 procedures described in the literature for managing patella-femoral instability like Lateral release, trochleoplasty, and proximal or distal realignment or combination of these procedures (Table 1).

Table 1: Various techniques described in literature for management of recurrent dislocation of patella

<p>LOW RISK—LOW REWARD</p> <p>Medial repair/imbrication</p> <p>Lateral release</p>	<p>30% failure rate, approximately the same as conservative treatment Indication: first dislocation + repairable chondral defect Instability in skeletally mature In combination with distal realignment</p> <p>Excessive lateral pressure syndrome In combination with realignment procedure when excessive tightness prevents patellar centring May increase risk for both medial and lateral patellar subluxation</p>
<p>LOW RISK—HIGH REWARD</p> <p>MPFL reconstruction</p> <p>Elmslie-Trillat</p>	<p>Indicated for recurrent MPFL deficiency ± trochlear dysplasia Proximal or anterior femoral placement or overtightening results in medial facet overload May combine with distal realignment procedure</p> <p>Indicated for instability, TT-TG >20 mm + strong repairable medial structures Healing time and risk for stress or contact fracture of proximal tibia much less than Fulkerson procedure</p>
<p>HIGH RISK—HIGH REWARD*</p> <p>Fulkerson distal Rotational realignment</p>	<p>Indicated for symptomatic lateral facet or distal pole arthritis + TT-TG >20 mm Contraindicated with proximal/medial facet arthritis Long healing time, increased risk of proximal tibial fracture with sports</p>

High tibial osteotomy	Indicated for instability + severe rotational deformity More normalized gait compared with distal realignment
Trochleoplasty	Indicated for dysplastic trochlea Low recurrence rate Increased risk for osteonecrosis, DJD, arthro fibrosis Lateral condyle: increased pressure;
Grooveplasty	increased DJD of lateral facet Increased DJD Good results with less risk reported with MPFL reconstruction

Treatment is required not only for pain and discomfort during dislocation but also to avoid damage to the patellar articular surface (chondromalacia. The Choice of management depends upon various factors such as age, Insall index, the shape of trochlea and status of patellar articular surface. The key for successful surgical intervention is correctly identifying and treating the pathologic anatomy producing the instability, which can be intercepted by physical examination and various biomechanical parameters.

Medial patella-femoralligament(MPFL)is the structure which always gets injured in patellar dislocation^[7]. The MPFL is an extra-synovial ligament in the second layer of knee^[8]. Nowadays MPFL reconstruction is one of the most commonly done procedures for the management of recurrent patellar dislocation. Advancement in the knowledge of biomechanics and surgical anatomy has led to various methods of MPFL reconstruction^[9].

In this prospective cohort study, we present 30 cases of recurrent patella dislocation, in which gracilis hamstring autograft tendon

was used in the reconstruction of the MPFL. It was looped via two transverse tunnels in the patella and then fixed at the natural site of MPFL footprint on the medial femoral epicondyle with an interference screw. It was hypothesized that in recurrent dislocation of patella, reconstruction of MPFL with gracilis graft tendon was appropriate procedure if the tibial tubercle and the centre of the trochlear groove (TT-TG) value was less than 20 mm and without a dysplastic trochlea.

Aims and Objective:

To assess

1. Dislocation rate after MPFL reconstruction with Gracilis graft
2. Improvement in knee pain using KUJALA and LYSHOLM scoring system

2. Material and methods

This clinical trial was conducted in the department of orthopaedics in MMMCH, Kumarhatti Solan. 30 patients (22 female and 8 male with mean age 23 years) of recurrent lateral patella dislocation with involvement of right knee in 24 cases and left knee in 6 cases were included between the years of May, 2015 to 2018. All patients had

traumatic dislocation of patella with instability and fear of dislocation after exertional activity. All patients had a minimum of two episodes of dislocation. Patients with insal index >1.20 and tibial tubercle- trochlear groove (TT-TG) Value > 20 mm were excluded from study.

The patients were reviewed with respect to improvement in activities and subsequent redislocation. Surgeries were performed by one trained surgeon. Patients were evaluated in follow-up with KUJALA Score and LYSHOLM Score. Full subjective data was assessed in all patients with no defaulter in this study

Inclusion criteria:

1. Single or multiple episode of major trauma
2. Apprehension test positivity
3. Insall index (1- 1.20)
4. Normal anatomy of the trochlea, tibial tubercle and trochlear groove (TT-TG) Value < 20 mm
5. Recurrent dislocation with minimum two episodes of dislocation.

Exclusion Criteria:

1. Insall index >1.25
2. Trochlear dysplasia with TT-TG distance >20 mm
3. Severe patellofemoral arthritis

Investigations included Pre and Postoperative X-RAY of both knee AP, lateral and axillary view. MRI was done to check MPFL and another associated injury or pathologies.

2.1 Surgical procedure

MPFL reconstruction was planned with ipsilateral gracilis graft. The entire procedure was done under combined spinal/epidural anesthesia with tourniquet. Patients were positioned supine with support at GT [greater trochanter]. Diagnostic arthroscopy was done through the standard portal to assess crucial ligaments, menisci and tracking of the patella. In a bloodless field, a 4 cm incision was made over the pesanserinus site. The saphenous nerve and interpatellar branches were protected if located and sartorius fascia incised. The common insertion of the semitendinous and gracilis tendon was located and the gracilis was identified as anterior of two, Adhesion was bluntly dissected and the tendon was then harvested. Gracilis graft was prepared with ethibond no 2 (web stitch suture) at both ends (figure 1).

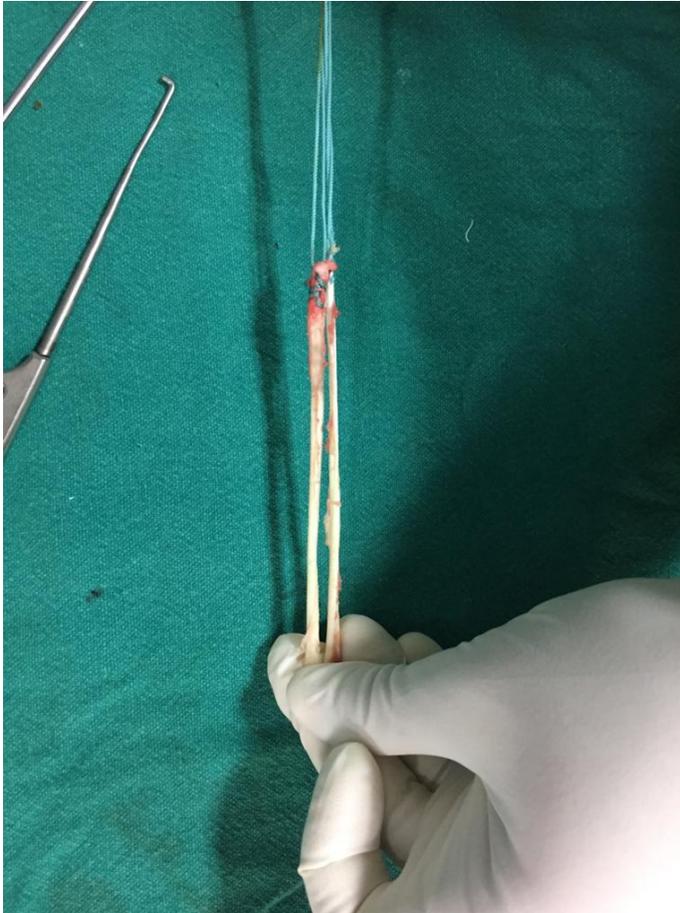


Figure 1

Patella tunnelling procedure

The patellar MPFL insertion goes from the superior medial corner of the patella to the middle point of the medial edge of the patella [8]. A longitudinal 2 to 3 cm incision was given beside medial margin of the patella. A point is taken at the upper third of the inner margin of the patella with the knee straight. Another point is marked at distal to the midpoint of patella. There should be minimum

of 2.5 cm distance between two points to prevent collision of the tunnel. After soft tissue dissection, the two 2.5 mm guide wires were passed through patella at these points and retrieved laterally (fig 2). The two tunnels were prepared in patella transversally with 4 mm cannulated bits. Fluoroscopy was done to avoid any aberrant injury to the patella. Now graft was tunnelled through holes in the patella and both ends of graft retrieved medially (fig 3).



Figure 2

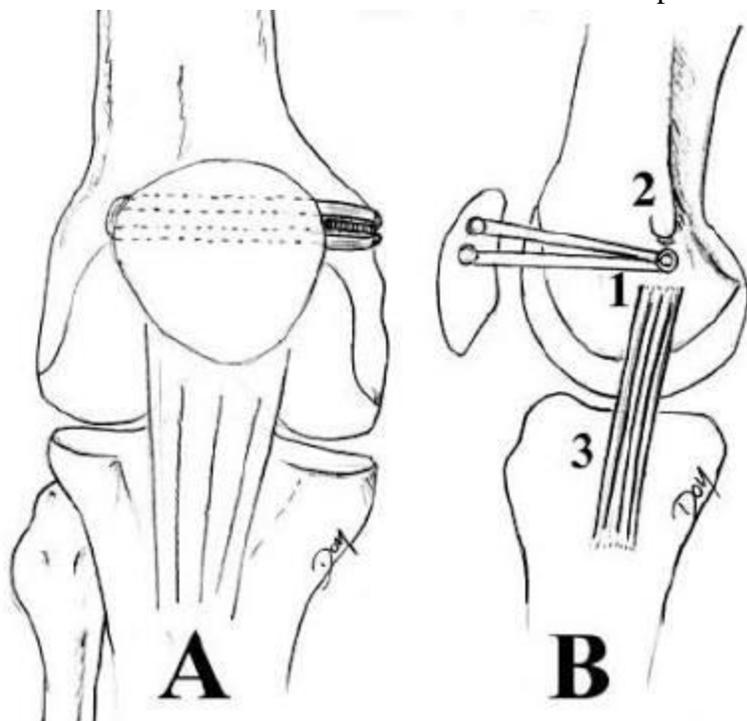


Figure 3

Femoral fixation

The MPFL is attached just distal to the adductor tubercle and superior posterior to the medial femoral epicondyle [9,10]. Approximately 1-2 cm small incision was given at this point and medial retinaculum was exposed after dissection of subcutaneous tissue. Now prepared ends of graft were passed below vastusmedialis in between 2nd and 3rd layer of retinaculum and retrieved at the femoral fixation point. But before final fixation, stability and range of motion (ROM)

was checked. The graft must maintain adequate tension throughout the whole range of knee flexion. Other important aspects are patellar tracking and lateral patellar stability. The Patellar tracking should be good through a full range of motion of knee while paying special attention to the stability at 0° to 45° of knee flexion. After ensuring all the above factors, the graft should be fixed at isometric point at 30 degrees of knee flexion (fig 4). Fluoroscopy was utilized only to locate femoral fixation point in an obese patient.



Rehabilitation

Knee was immobilized in hinged knee immobilizer after closure. 5 to 10 degree of ROM was started from next postoperative day with quadriceps strengthening. ROM was restricted to 45 degrees till 3 weeks and 90 degrees till 6 weeks. Partial weight-bearing was started from next postoperativeday and full weight-bearing

after three weeks. Knee immobilizer was advised for 6 weeks.

4. Results

Patients were evaluated from 2015 to 2018. The preoperative and postoperative Kujala and Lysholm scores of patients were recorded and evaluated. Patients were also evaluated for improvement in apprehension.

The mean age of patients included in this study was 23 years (range 11-50 years). Primary wound healing was uneventful. All

patients were followed for a period of average mean of 28 (16-40) months.

Table 2

Age	Sex		Side	Etiology	Episodes	Insal Index	Kujala scoring (Pre-Operative)	Kujala scoring (Post-Operative)	lysholm (pre-operative)	lysholm (post-operative)
17	M		Rt	RSA	4	1.2	28	80	32	88
26	F		Lt	SPORTS	3	1.2	40	70	35	78
36	F		Rt	RSA	2	1.2	44	88	29	90
18	M		Lt	RSA	3	1.15	29	87	31	0
23	F		Rt	SPORTS	3	1.15	30	84	29	88
31	F		Rt	RSA	3	1.2	40	70	33	79
27	F		Rt	SPORTS	2	1.1	40	88	37	89
19	M		Rt	RSA	2	1.1	40	76	45	79
30	F		Rt	SPORTS	2	1.2	30	77	42	80
21	F		Rt	RSA	3	1.15	50	80	31	88
24	F		Rt	RSA	4	1.1	30	70	34	77
25	M		Rt	RSA	5	1.1	32	80	30	89
19	F		Rt	RSA	4	1.2	24	80	28	88
24	F		Lt	DANCING	2	1.2	30	82	34	85
23	M		Rt	SPORTS	3	1	24	81	29	83
27	M		Rt	RSA	2	1	48	84	48	85
29	M		Rt	SPORTS	3	1	28	86	31	90
24	F		Rt	RSA	2	1	42	79	45	83
27	F		Lt	SPORTS	4	1.1	27	81	31	85
25	F		Rt	DANCING	2	1.2	40	85	42	88
21	F		lt	RSA	2	1	43	87	48	90
23	F		Rt	SPORTS	2	1	31	79	34	81
27	M		Rt	SPORTS	2	1	37	82	39	85
18	F		Lt	SPORTS	2	1	42	81	45	87
26	M		Rt	RSA	3	1.1	33	80	35	85
20	F		Rt	DANCING	3	1	29	86	31	90
19	M		lt	SPORTS	2	1	37	80	45	85
30	F		Rt	SPORTS	2	1.1	46	79	48	82
29	F		Rt	SPORTS	2	1	35	88	37	90
17	F		lt	RSA	2	1	31	84	33	85

KUJALA knee scoring was evaluated in all the patients during follow up visits which have shown that significant improvement (Table 2) in the scoring on an average mean of 33.93 preoperatively (24-40) to postoperatively 83.22 (76-88).

LYSHOLM score also has shown trend towards improvement with Preoperative average mean of 38.92(29-48) to Postoperative 84.88 (77-90). The mean improvement in Kujala score was 49.3 (range 24-88) and that of Lysholm score was a mean of 45.96 (range 38-90). Student T test was applied for both scoring (Table 3).

Table 3: Shows Result of Significance with the P value <0.01 in both **KUJALA** and **LYSHOLM** Score

Scores	Pre Op Mean Score	Post Op Mean Score	Difference in Mean Score	St deviation	T-value	P Value Result
KUJALA	33.93	83.22	49.3	1.64	28.01	P<0.01
LYSHOLM	38.22	84.88	45.96	1.58	30.72	P<0.01

No re-dislocation was seen in any of the cases. There was neither pain nor instability in any of case during follow up. 2 patients had apprehension test positive postoperatively. Subjective improvement was seen in all of the cases. Everyone resumed their routine activity after 2 to 3 months. Sixteen patients were actively involved in sports and dance activity after 8 to 9 months. Remaining patients were office employee, security personal and farmer by occupation.

4. Discussion

There are various static and dynamic factors responsible for patellar stability. Static factors include shape of the patella, femoral sulcus, a patellar tendon of proper length and appropriate tensioned medial capsule strengthened by the patellofemoral and patellotibial ligaments. The dynamic

stabilization of the patella is given by vastus medialis obliquus. The primary function of the vastus medialis obliquus muscle is to balance the patella against the lateral pull of the vastus lateralis. Brattstrom has suggested a parameter known as q angle that describes the strength of vastus medialis obliquus to prevent patellar dislocation laterally. Any factors that increase the q angle can be a contributing factor in recurrent patellar dislocation. In males, the q angle is 8 to 10 degrees but in females, the normal angle ranges 15 degrees \pm 5 degrees. It is one of the reasons that females have high chances of recurrent dislocation of patella and MPFL injury.

MPFL acts as a primary constraint for lateral patellar translation in 0 to 30 flexion and plays a crucial role in normal biomechanics of knee movement [3,11-14]. Several studies suggested that MPFL is always damaged in

recurrent dislocation of the patella. Firstly, it was reported by Song et al that MPFL is deficient in 50% to 96% patients during open surgery who has a history of recurrent dislocation of the patella [15]. According to Amis et al., a rupture of MPFL always occurs because it can undergo maximal elongation of 20% to 30% (range 18mm to 20mm) which is very less than the patellar width (often exceeds 40mm) [16]. Taking into consideration of anatomic and biomechanical predisposition of MPFL Injury, reconstruction of this ligament is usually indicated in all cases of recurrent dislocation of the patella

There are various techniques described in the literature for MPFL reconstruction. Reconstruction can be done using both autograft [17-23], allograft [24] and synthetic graft [25]. The various autogenous grafts for MPFL reconstruction are part of the adductor magnus tendon, semitendinosus, part of the quadriceps tendon and part of the patellar tendon. Semitendinous and gracilis are commonly harvested graft for ACL reconstruction, But nowadays various studies recommend gracilis tendon as graft option for MPFL reconstruction due to its biomechanical properties closely resemble MPFL. [19-20] Gracilis graft is easy to harvest and causes less morbidity. After looking at all these factors, we used gracilis tendon as a graft option for MPFL reconstruction. Regarding fixation technique, the bioabsorbable interference screw has been used because of its good fixation strength.

The landmark for MPFL fixation on both patella and femur were taken as per literature and anatomy [8]. In our study, the two tunnels

were prepared in patella transversally with 4mm cannulated bit and two 2.5 mm guide wires, which were passed through patella at the junction of anterior 1/3 and posterior 2/3rd. The further graft was passed through tunnels in the patella and both ends of graft retrieved medially.

There are various methods in the literature for passing and fixation of graft in MPFL reconstruction. Muneta et al used a single button in patella and staple in femoral epicondyle for fixation of the graft [20]. Schock et al described MPFL reconstruction using semitendinosus graft. They used a button and cancellous screw for fixation in patella and femur respectively [21]. Fernandez used single strand semitendinous graft and fixed with two 2.5 mm drill holes at the end of a 4.5 mm tunnel [22]. Faar et al describe his method using double-strand semitendinous graft, with medial end sutured at the medial epicondyle and lateral ends individually attached in a V-shaped manner onto the medial side patella [23].

There were 30 patients in our study, who underwent MPFL reconstruction procedure and followed for average mean 28 months. The average post operative Kujala was 83.22 and and LYSHOLM score was 84.88. There is eminent improvement in Mean Kujala score (49.3) and LYSHOLM score (45.96) and was statistically significant with $P < 0.01$. These results goes with the scores of other studies on MPFL reconstruction [27,28,29,30]. There was no significant cartilage lesion in any case, when examined arthroscopically. Cases with TT-TG distance > 20 and INSAL INDEX > 1.2 were excluded as they needed distal realignment procedures

for management ^[31]. Patellar fracture has been described as a complication, but we did not encounter this in any patient. ^[26]

Our technique of MPFL reconstruction is very convenient for surgeons when it is reviewed in concern the above mentioned surgical procedures ^[22,23]. As all the anatomical structure are quite superficial and little dissection is required, making this technique a very efficient, less dexterous and minimally invasive procedure. Furthermore, this technique has very little chance of arthrofibrosis.

In conclusion, MPFL reconstruction was done with **ipsilateral** gracilis graft by creating

a tunnel in patella in 30 cases of recurrent dislocation. After follow up of more than one year, there was no episode of dislocation and range of motion was normal in all cases. Most importantly this method gives a rigid fixation on femur and patella. Hence in accordance with the results achieved in this study and above discussion, this innovative minimally invasive surgical procedure for MPFL reconstruction in cases of recurrent episodes is strongly recommended.

Declaration

Conflict of interest

There was no conflict of interest in this study.

5. Reference

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