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# Minimal Invasive Medial Patellofemoral Ligament Reconstruction by Hamstring Tendon Auto-graft

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## Abstract

**Study design:** Retrospective study.

**Objective of the study:** The objective of this study was to evaluate the results of minimal invasive patellofemoral ligament reconstruction via two small incisions in cases of recurrent dislocation of the patella.

**Background:** Patellar dislocation is one of the problems encountered in orthopedic practice. The annual incidence is 78 in 100,000. Most of the patients are adolescents and young adults. The medial patellofemoral ligament is the most important static stabilizer of the patella in extension.

**Patients and methods:** This study included 8 patients who were consecutively operated on. Patients underwent surgery from May 2011 to June 2012. Mean follow-up was 24 months. The patients' median age was 22 years (range, 18 to 32 years). There were 5 males and 3 females patients. All patients had chronic patellar instability with a minimum of 2 times total patellar dislocations. Semitendinosus tendon was harvested and prepared. Patellar and femoral tunnels were drilled through two small skin incisions. The graft was fixed to the patella by interference screw then extra synovial passage of the graft was created between the patellar and femoral incisions. The graft was fixed to the femur by interference screw.

**Results:** The median follow-up was 24 months. The Kujala knee function score improved overall from 46 points (range, 12 to 67 points) to 84 points (range, 62 to 100 points) at 24 months follow-up.

**Conclusions:** Minimal invasive medial patellofemoral ligament reconstruction by semitendinosus tendon autograft and single patellar tunnel technique is effective, reproducible and reliable method for the treatment of lateral patellar instability.

**Keywords:** Minimal invasive; Medial patellofemoral ligament reconstruction; Lateral patellar instability

## Introduction

The incidence of patellar dislocation is up to 78 in 100,000, and 15% to 40% of first-time dislocations treated conservatively go on to repeat dislocation [1]. In this subset of patients, there are multiple causes of instability.

Anatomic abnormalities can lead to patellar instability. Valgus alignment at the knee leads to an increased Q angle and increased lateral tension on the patella. Similarly, rotational misalignment of the extremity specifically, increased femoral anteversion combined with external tibial torsion leads to increased lateral tension on the patella. With increased flexion at the knee, the bony constraints become more important and trochlear dysplasia can lead to insufficient constraint in flexion. Patients with patella alta engage their bony constraints at a deeper flexion angle and can therefore be more prone to subluxation and dislocation. In extension the important static constraint to lateral subluxation and dislocation is the medial patellofemoral ligament (MPFL). In this same range, the vastus medialis obliqus acts as a dynamic restraint to instability. In any single patient, several of these factors can act together, leading to his or her symptoms [2].

In patients with traumatic causes, there is always tearing of the MPFL that leads to loss of static medial stabilization. After these patients have recovered from their traumatic injury and undergone generalized reconditioning with specific physical therapy, including vastus medialis obliqus strengthening for instability, they may require surgical reconstruction of their MPFL for stabilization. The other causes highlighted earlier must be evaluated to determine the need for additional procedures [3].

This study describes reconstruction of the medial patellofemoral ligament with semitendinosus auto graft and the results obtained in 8 patients.

## Patients and Methods

This study included 8 patients who were consecutively operated on. Patients underwent surgery from May 2011 to June 2012. Mean follow-up was 24 months. The patients median age was 22 years (range, 18 to 32 years). There were 5 males and 3 females patients. The male patients were three students and two manual labors and the female patients were one student and two housewives. All patients had chronic patellar instability with a minimum of 2 times total patellar dislocations. The median period of preoperative patellar instability was nine months (range, six months to one year). None of the patients had previous surgical procedures. All patients had diagnostic arthroscopy which showed; torn MPFL in 5 patients, excessive stretching of the MPFL in 3 patients and patellar chondral lesions in 2 patients. Plain x-ray in the AP, lateral and axial views in addition to MRI were used in all patients preoperatively and postoperatively.

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**Figure 1:** Fluroscopic picture of the patellar guidewire.

**Figure 2:** Passing shuttling suture thrrough the patellar tunnel.

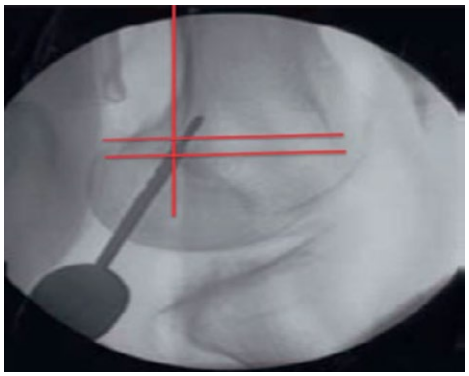

**Figure 3:** Intraoperative view by fluoroscope at the correct position. The insertion point is identified at the point, where the cannulated drill is attaching the bone (anterior to the posterior condyle line, distal to the perpendicular through the insertion of the medial condyle and proximal to the most posterior point of the Blumensaat line).

## Surgical technique

Under spinal anesthesia, the patient is placed in a supine position on a standard operating table. A tourniquet is then placed on the proximal thigh. One gram of Cefoperazone was given intravenous immediately before tourniquet inflation and continued once daily postoperatively for three days. The C-arm fluoroscopy unit is positioned on the operative side. The patient is examined under anesthesia to confirm patellar instability. A diagnostic arthroscopy is then completed by the surgeon, noting trochlear morphology and the ability to displace the patella laterally. The semitendinosus is harvested through a 3-cm longitudinal incision made along the medial aspect of the upper one-third of the tibia. The graft is approximately 10 cm in length and 5 mm in width. The graft is prepared on a side table. The free end of the graft is whip stitched with a No. 2 Vicryl suture and soaked in an antibiotic solution.

A 3cm skin incision is made on the upper medial aspect of the patella and it was taken down to the periosteum. A guide wire with the C-arm positioned for a lateral view of the knee is used to localize the junction between the proximal and middle third of the medial patella (Figure 1). It is then drilled till it exits the lateral border of the patella. C-arm fluoroscopy is used to confirm that the guide wire is centered in the anterior-to-posterior direction so that reaming will not violate either cortex. A 5-mm cannulated reamer is then used to ream the patella by approximately 20 to 25 mm. A suture loop through the guide wire is shuttled through the patellar socket and is stored in place for later graft passage (Figure 2).

Attention is then brought to the femur. The method of Schöttle is used to obtain the anatomic femoral MPFL attachment. The knee is flexed 30°, and a perfect lateral view of the knee is obtained with the C-arm (Figure 3). A radiopaque clamp is used to visualize the Schöttle point [4]. The radiographic landmark of the femoral attachment is determined by 3 lines: an elongation of the posterior femoral cortex and two lines perpendicular to that line one passing through the origin of the medial condyle and the other passing through the most posterior aspect of the Blumensaat line. The anatomic point of MPFL attachment is located anterior to the posterior condyle line, distal to the perpendicular through the insertion of the medial condyle and proximal to the most posterior point of the Blumensaat line. This is the natural anatomic insertion of the MPFL and it is the isometric location of the ligament. This site is marked on the skin, a 3cm. longitudinal incision is made, and the soft tissues are dissected down to the femur. A Beath pin is then advanced in a proximal and anterior direction through the femur above the intercondylar notch. The C-arm is used to confirm the position of the pin. A 5-mm cannulated reamer according to graft size is introduced over the pin and reaming to a distance of 35 mm into the femur is performed. The Beath pin is used to pass an Ethibond passing suture (Ethicon) through the femur and exit through the distal lateral femur.

An extra synovial passage is created by blunt dissection between the anterior incision on the patella and the posterior incision on the femur. The graft is now passed into the patellar bone socket by withdrawing the suture loop connected to one end of the graft. Tension is applied to the Vicryl suture at the end of the graft, interference screw of the same diameter is inserted into the patellar bone socket until is flushed with the bone. The graft is then passed through the femoral socket through traction on the passing suture on the distal lateral femur. The slack is taken out of the graft with the knee at 50 to 60 of flexion, with care taken not to over tension it, and fixed by interference screw. Physical examination of the patella is then completed to confirm stability of the patella without overconstraint. The arthroscope is placed back in the knee, and patellar tracking is observed and the graft is visualized medially in its extra-articular position. The arthroscope is then removed. The periosteum over the patella is closed, and the subcutaneous tissue is closed with No. 2-0 Vicryl. The skin is then closed with No. 3-0 Prolene (Ethicon). The patient is placed in a knee immobilizer. The patient is allowed to bear weight as tolerated in the knee immobilizer.

## Rehabilitation

All patients were subjected to rehabilitation program for at least 6 months before surgery. A knee ranger adjusted to allow 0° to 90° of

knee flexion was used for the first 3 weeks, with full weight-bearing on a straight knee. From 3 to 6 weeks, no brace was allowed and range of motion beyond 90° of flexion was encouraged and free weight-bearing during standing and walking. After 6 weeks, free activity was allowed. Controlled sports activities after 3 months and contact sports after 6 months were allowed.

## Results

The median follow-up was 24 months. Patients were evaluated by preoperative and follow-up Kujala score [5], also known as the anterior knee pain score, which is a 13-item questionnaire including different items on pain related to function and activities. The categories within each item are weighted and item scores summed to provide an overall index scored from 0 to 100 where the maximum score of 100 represents no disability. This score has been used widely in evaluating patellofemoral disorders in scientific studies. According to the Kujala knee function score the study results were as follow, no patient had limping or had to walk with support after completion of rehabilitation program. Walking was unlimited but two patients reported slight pain when descending stairs. The same two patients reported that repeated squatting was painful. They reported also slight and occasional pain during prolonged sitting with the knees flexed. These patients had associated chondral lesions of the patella during arthroscopic examination. All patients reported that running and jumping was not painful except the two housewives that were not able to perform this kind of activity even before injury. None of the patients had knee swelling or thigh atrophy. Palpable pain was found at the medial patellar edge in 3 patients and at the medial femoral condyle in 2 patients. One patient had flexion deficiency of 20°. One patient reported occasional patellar subluxation during sports activities. This patient was further treated with a brace and was not interested in additional treatment. Two patients had persistent chronic anterior knee pain due to cartilage injury to the patella or trochlea.

The Kujala knee function score improved overall from 46 points (range, 12 to 67 points) to 84 points (range, 62 to 96 points) at 24 months follow-up.

## Complications

A positive apprehension sign with patellar lateralization was found in one patient. One patient had a loss of flexion of 20°. We had no cases of patellar fracture during follow up period.

## Discussion

Lateral dislocation of the patella is a common injury in adolescents and young adults. The treatment remains controversial and challenging because of the complexity and the broad variety of factors associated with patellar instability and the concern of persistent patellofemoral complaints [6].

Stability of the patellofemoral joint is maintained by a complex interplay of active, passive, and static stabilizers represented particularly by the quadriceps muscle, the retinacula, and the joint geometry. In normal knees these stabilizers act in harmony during knee motion. Abnormalities in these factors caused by pathology or trauma lead to alterations from normal patellofemoral behavior. However, the great individual variability in trochlear groove anatomy, muscle insufficiency, injury to the medial ligamentous stabilizers, limb alignment, and patellar height makes it difficult to accurately isolate their roles and contributions to patellar instability and has led to a wide range of surgical procedures that address joint geometry, limb alignment, and the soft tissues [6].

The optimal surgical treatment for chronic patellar instability is controversial. Numerous techniques have been used with varying success. Proximal realignment procedures, which cover medial capsule plication and lateral capsule release, have been investigated in a few studies. Scuderi et al. [7] reported a low redislocation rate of 3% with isolated proximal realignment. A similar finding was reported by Aglietti et al. [8].

Medial transfer of the tibial tuberosity, called distal realignment, has been used in isolation, with unsatisfactory results in approximately 20% to25% of patients [9].

The usage of additional procedures combined with MPFL reconstruction is controversial. Some authors advocated a medial tibial tuberosity transfer in patients who had abnormal tibial tubercle- tibial groove (TT-TG) ratio of more than 15° for male patients and more than 20° for female patients. In the study by Brown et al., [9] a tibial tuberosity transfer was performed when the distance between the center of the trochlear sulcus and tibial tuberosity was greater than 15 mm.

Also, significant trochlear dysplasia with a completely flattened trochlea (Dejour type B) or an absent or severely dysplastic medial femoral condyle (Dejour type C) also indicated a medial tibial tuberosity transfer. The dysplasia was thought to lead to excessive load on the MPFL reconstruction, and tibial tuberosity transfer would, in theory, reduce the load to the reconstruction. One study, however, did not find poorer results in patients with dysplasia when performing isolated MPFL reconstruction. This could indicate that the additional procedure might be unnecessary [10].

In this study we tried to fix these variables so that to stay focused to one variable for better understanding of its effect on pathology correction. We excluded cases with high TT-TG ratio, cases with higher degrees of trochlear dysplasia and cases with patella Alta from the study. We had no case of redislocation. This is consistent with other MPFL reconstruction studies that report no redislocation or a very low incidence of redislocation after the procedure [11,12].

Our follow-up Kujala score of 84 points is slightly lower than that in other studies using this score, ranging from 87 to 92 points. One study had poorer outcomes in patients with cartilage damage at the time of surgery [13].

Analysis of patients with lower Kujala scores in our study showed that it is not due to a technique problem but rather due to patient causes as these two cases had advanced patellar chondral lesions seen during preoperative arthroscopy.

In this study, we had no case of postoperative patellar fracture during follow up. Because of the risk of patellar fracture, some surgeons advocate no drilling of the patella. When we drill the patella using this technique, the socket is small (5 mm in diameter) and short (20 to25 mm in length) and the lateral patella is not violated by the drill bit. The drilling is performed under fluoroscopic guidance to make sure not to violate the subchondral bone or anterior cortex. The literature is full of studies that mentioned this complication. In a recent study by Alfredo et al., [14] they reported that one patient suffered a transverse displaced fracture of the patella after direct trauma 4 months after the index operation. The post–MPFL reconstruction radiographs showed that the distance between the 2 tunnels at the medial patellar border was less than 10 mm. They claim that the 2-tunnel technique has been described to provide a more anatomic insertion of the MPFL reconstruction, as

the intact MPFL expands as it passes from the femur to the proximal half of the medial patella, although it does show variability in width. To further replicate this, they used divergent tunnels.

The issue of using single or double patellar tunnels during MPFL reconstruction remains controversial and proponents of the two schools have strong argues. The satisfactory results achieved by other researchers and the statistically insignificant difference in results between the two techniques have convinced us that single tunnel technique is less traumatizing to the patella, has satisfactory results, consumes less operative time and less operative cost.

We had no cases of post-operative patellar mal-tracking due to over-tightening of the graft because all tightening and fixation are performed in 50° to 60°of flexion. This provides bony constraint to over-tightening of the graft because the patella is constrained in the trochlea at this range of flexion. Lateral release was not performed in all of our cases as it was shown by Desio et al. [15] and others that it increases patellar instability.

Advantages of the described technique are that it is minimally invasive, the two small skin incisions were cosmetic, it restores the main anatomic restraint to lateral patellar displacement, and the secure fixation technique allows for early motion and rehabilitation. Other procedures may be needed along with this technique to address lower-limb malignment, including valgus, rotational, and patellar malalignment. The overall patient satisfaction with the procedure was encouraging and all of our patients returned back to their pre-injury activity level with very minimal complications. The operative scar was very limited compared to the old techniques.

## Conclusions

Minimal invasive medial patellofemoral ligament reconstruction by semitendinosus tendon autograft and single patellar tunnel technique is effective, reproducible and reliable method for the treatment of lateral patellar instability.

### References

1. Mehta VM, Inoue M, Nomura E, Fithian DC (2007) An algorithm guiding the evaluation and treatment of acute primary patellar dislocations. Sports Med Arthrosc 15: 78-81.
2. Bollier M, Fulkerson JP (2011) The role of trochlear dysplasia in patellofemoral instability. J Am Acad Orthop Surg 19: 8-16.
3. McConnell J1 (2007) Rehabilitation and nonoperative treatment of patellar instability. Sports Med Arthrosc 15: 95-104.
4. Schöttle PB, Schmeling A, Rosenstiel N, Weiler A (2007) Radiographic landmarks for femoral tunnel placement in medial patellofemoral ligament reconstruction. Am J Sports Med 35: 801-804.
5. Kujala UM, Jaakkola LH, Koskinen SK, Taimela S, Hurme M, et al. (1993) Scoring of patellofemoral disorders. Arthroscopy 9: 159-163.
6. Amis AA, Senavongse W, Bull AM (2006) Patellofemoral kinematics during knee flexion-extension: an in vitro study. J Orthop Res 24: 2201-2211.
7. Scuderi G, Cuomo F, Scott WN (1988) Lateral release and proximal realignment for patellar subluxation and dislocation. A long-term follow-up. J Bone Joint Surg Am 70: 856-861.
8. Aglietti P, Buzzi R, De Biase P, Giron F (1994) Surgical treatment of recurrent dislocation of the patella. Clin Orthop Relat Res : 8-17.
9. Brown DE, Alexander AH, Lichtman DM (1984) The Elmslie-Trillat procedure: evaluation in patellar dislocation and subluxation. Am J Sports Med 12: 104-109.
10. Schöttle PB, Fucentese SF, Romero J (2005) Clinical and radiological outcome of medial patellofemoral ligament reconstruction with a semitendinosus autograft for patella instability. Knee Surg Sports Traumatol Arthrosc 13: 516-521.
11. Steiner TM, Torga-Spak R, Teitge RA (2006) Medial patellofemoral ligament reconstruction in patients with lateral patellar instability and trochlear dysplasia. Am J Sports Med 34: 1254-1261.
12. Cossey AJ, Paterson R (2005) A new technique for reconstructing the medial patellofemoral ligament. Knee 12: 93-98.
13. Svend Erik Christiansen, Bent W Jacobsen, Bent Lund, Martin Lind (2008) Reconstruction of the Medial Patellofemoral Ligament With Gracilis Tendon Autograft in Transverse Patellar Drill Holes. Arthroscopy: The Journal of Arthroscopic and Related Surgery, Vol 24, No 1 (January), 82-87.
14. Alfredo Schiavone Panni, Mahbub Alam, Simone Cerciello, Michele Vasso and Nicola Maffulli. (2011) Medial Patellofemoral Ligament Reconstruction With a Divergent Patellar Transverse 2-Tunnel technique. The American Journal of Sports Medicine 39: 12.
15. Desio SM, Burks RT, Bachus KN (1998) Soft tissue restraints to lateral patellar translation in the human knee. Am J Sports Med 26: 59-65.