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Original Research Article

Assessment of the Medial Patellofemoral Ligament Reconstruction Outcomes for Recurrent Patellar Instability Using Hamstring Autograft and the Dual Patella Docking Technique: A Prospective study

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Abstract

Background: The quality of life for a patient can be greatly impacted by recurrent patellar instability. This study used the dual patellar docking approach to assess the outcomes of medial patellofemoral ligament (MPFL) restoration in the treatment of recurrent patellar instability utilizing hamstring autograft.

Methods: Twenty individuals with recurrent patellar instability participated in this prospective study. Computed tomography scans and magnetic resonance imaging were used to measure the distance between the tibial tubercle and trochlear groove and to confirm the MPFL tear. A number of radiological and clinical assessments were carried out prior to surgery. Diagnostic arthroscopy, graft preparation, patellar preparation, graft passage, femoral tunnel preparation, and graft fixation were all part of the surgical procedure.

Results: The International Knee Documentation Committee score, Kujala score, Cincinnati score, and Lysholm score all showed significant improvement after surgery when compared to preoperative values ($P < 0.001$). Furthermore, there was a substantial decrease in the preoperative values of the patellar tilt angle and patellar congruence angle compared to the postoperative assessments ($P < 0.001$). The post-apprehension test revealed negative results for all 20 (100%) patients, suggesting increased stability. Three patients (15%) had positive results in the post-compression test, while seventeen patients (85%) had negative results. Two patients (10%) reported having patellofemoral pain, one patient (5%) had limited flexion, one patient (5%) had residual patellar translation without dislocation, and the majority of patients (16,80%) had no problems.

Conclusion: For the majority of patients, MPFL reconstruction with patellar docking produced acceptable, satisfactory congruence angles along with good Kujala and Lysholm outcomes. The success rate of this surgery in treating patellofemoral instability has been high.

Keywords: Docking, Hamstring Autograft, Medial Patellofemoral Ligament, Patellofemoral, Reconstruction, Recurrent Patellar Instability.

Introduction

Recurrent subluxation or dislocation of the patellar from its normal position in the femoral groove is a difficult issue known as recurrent patellar instability. For those who are impacted, this illness frequently results in discomfort, functional difficulties, and a lower quality of life.[1]

Surgery may be necessary to restore stability and prevent further episodes of instability when the medial patellofemoral ligament (MPFL), which is crucial for stabilizing the patella during knee motion, is injured or inadequate.[2] Numerous surgical techniques have been devised to manage recurring patellar instability and repair the MPFL. The dual patella docking approach for hamstring autograft is one such method that has drawn interest.[3] This method entails stabilizing the patella and reconstructing the MPFL using a graft from the patient's own hamstring tendons. By fixing the graft at both the patellar and femoral ends, the dual patella docking procedure creates a stable and safe structure.[4]

The use of hamstring autograft for MPFL repair is based on its advantageous qualities, such as strength, low donor site morbidity, and wide availability. Because of their similar size and biomechanical characteristics to the native MPFL, the hamstring tendons—more especially, the semitendinosus and gracilis tendons—provide

appropriate graft material. This autograft eliminates the possibility of disease transmission or graft rejection.[5,6] The effects of MPFL reconstruction using various graft materials and procedures have been examined in earlier research.[5, 7, 8]

However, only a small amount of literature has explicitly examined how the dual patella docking technique evaluates the outcomes of MPFL restoration using hamstring autograft. Thus, it is necessary to evaluate how well this method works to achieve stable patellar realignment and lower the likelihood that patellar instability would reoccur. There are important clinical ramifications when evaluating MPFL reconstruction outcomes with hamstring autograft employing the twin patella docking approach.

The purpose of this study was to assess the outcomes of MPFL reconstruction in treating recurrent patellar instability with hamstring autograft using the patellar docking technique.

Materials and Methods

Between February 2025 and July 2025, 20 patients participated in this prospective trial. Individuals aged 11 to 35 who had undergone conservative treatment for at least three months after suffering two or more patellar dislocations. Patients were also required to have a computed tomography (CT) scan to assess the tibial tubercle-trochlear groove (TT-TG) distance, which had to be less than 20 mm, and a magnetic resonance imaging (MRI) to confirm a torn MPFL.

Exclusion criteria for isolated MPFL reconstruction were as follows: presence of osteoarthritis greater than Grade 1, focal cartilage defects exceeding Grade 3 according to the Outerbridge classification, Trochlear Sulcus Angle of 145° or greater on the Merchant view, Dejour classification Grade B, C, or D, TT-TG distance exceeding 20 mm, Patella Alta with a Blackburne-Peel ratio >1, Q angle over 20° in females or 170 in males, and any injury to the knee's cruciate ligaments or medial collateral ligament. Each patient underwent a comprehensive evaluation, which included obtaining informed consent, conducting a general examination, and performing a detailed local examination of the knee. The local examination included the assessment of tenderness around the medial epicondyle, the evaluation of patellar mobility in full extension, a comparison with the contralateral side, and the determination of lateral patellar quadrant translation. Patellar tracking was assessed by evaluating the J sign and performing various tests such as the patellar compression test (patellar grind test), patellar tilt test, and patellar apprehension test. In addition, the limb alignment was evaluated for genu valgum, femoral anteversion, and external tibial torsion. We measured the strengths of the quadriceps and hip muscles while also assessing the presence of generalized ligamentous laxity. This assessment involved examining the elbow for hyperextension and assessing metacarpal hyperextension and knee recurvatum.

Knee radiographic examination includes typical lateral, axial, and anteroposterior weight-bearing scans. Pictures were carefully examined for osteochondral fractures and intra-articular bodies.

Lateral radiograph was utilized to evaluate femoral trochlea depth and patellar height. On the axial radiograph, congruence angle, femoral sulcus angle, lateral shift ratio, lateral patellofemoral tilt angle, and absolute lateral patellar displacement were measured. In addition, TT-TG distance was calculated with CT scan, and MRI was used to assess other patellar dislocation-related injuries, as bone contusions on the medial patella, lateral femoral condyle MPFL tears, and articular cartilage injuries.

Statistical analysis was carried out using SPSS version 25 software (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY, USA: IBM Corp.). Qualitative presentation was done using frequency and percentage of variables. Quantitative presentation was done using mean and standard deviation. Comparison of means in the same group was done using paired Student's t-test.

Results

Table 1 shows the demographic details of the study participants.

Table 1: Demographic characteristics of the study participants (n=20)

Parameter	Mean±SD/n(%)
Age(years), Mean±SD	25.2±5.91
Sex	
• Male	7(35%)
• Female	13 (65%)
Profession	
• Student	6(30%)
• Worker	3(15%)
• Driver	1(5%)
• Carpenter	1(5%)

• Housewife	6(30%)
• Athlete	1(5%)
• Nurse	1(5%)
• Employee	1(5%)
Athletic activity	
• Football	5(25%)

Four (20%) individuals experienced patellar instability as a result of atraumatic reasons, while 16 (80%) patients experienced trauma. Fifty-five percent (55%) of patients had left-sided effects, whereas forty-five percent (45%) had right-sided effects. In terms of graft type, 8 (40%) patients received a semi-T graft, whereas 12 (60%) received a gracilis transplant. Table 2 shows the patients follow-up.

Table 2: Follow-up of the patients (n=20)

	Mean±SD(range)
Follow-up(months)	15.9±5.5(6–24)
Full weight-bearing (weeks)	5.1±0.83(4–6)
ROM(weeks)	7±0.89(6–8)

SD: Standard deviation, ROM: Range of motion

While the patellar tilt angle and patellar congruence angle were significantly lower after surgery than before [P < 0.001, Table 3], the International Knee Documentation Committee (IKDC) score, Kujala score, Cincinnati score, and Lysholm score were significantly higher after surgery than before (P < 0.001).

Table 3: Knee Documentation Committee score, Kujala score, Cincinnati score, Lysholm score, Patellar tilt angle, and patellar congruence angle of the study patients pre and postoperatively

	Preoperative	**Postoperative**	**P**
IKDC score, mean±SD	43.1±12.74	68.4±15.71	<0.001*
Kujala score, mean±SD	49.6±14.95	74.4±14.22	<0.001*
Kujala score, mean±SD	48±15.4	76.5±14.82	<0.001*
Lysholm score, mean±SD	57.8±14.37	83.6±12.42	<0.001*
Patellar tilt angle, mean±SD(range)	24.1±2.23(18–27.5)	9.3±1.39(7–12)	<0.001*
Patellar congruence angle, mean±SD	26.4±5.36	−7.4±1.27	<0.001*

Twenty (100%) of the patients had negative results on the post-apprehension test. Three patients (15%) had positive results from the post-compression test, while seventeen patients (85%) had negative results. In terms of complications, 16 patients (80%) had no problems, 1 patient (5%) had limited flexion, 1 patient (5%) had residual subluxation, and 2 patients (10%) experienced patellofemoral pain.

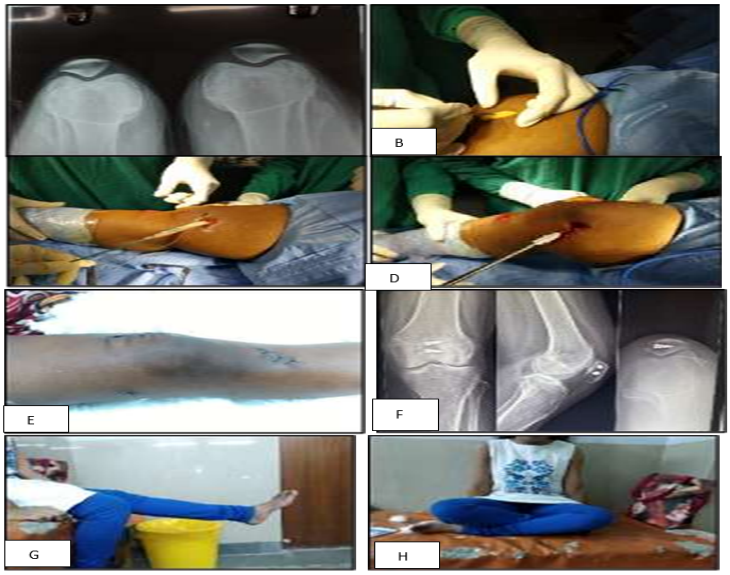

Figure 1: (A) Pre-op X-ray; (B) Incision along medial border of patella; (C) Passage of semitendinosus graft; (D) Fixation with bio-composite interference screw; (E)Post-op wound dressing; (F) Post-op X-ray; (G) Follow-up knee extension; (H) Cross legged sitting.

Discussion

According to our results, the postoperative IKDC score was substantially higher compared to the preoperative score ($P < 0.001$).

Supporting our findings, Lee et al.[9] demonstrated positive outcomes in 9 cases where soft tissue was sutured onto the patella and femur, resulting in an IKDC score of 81.1. In addition, Carnesecchi et al.[10] reported an increase in the mean raw IKDC score from 51.5 preoperatively to 71.7 at the last follow-up. Moreover, the mean overall IKDC score improved from 38.5 to 61.7, and the Kujala score increased from 48.3 to 82.4, further supporting our findings. In this study, the postoperative Kujala score was substantially greater than the preoperative score ($P < 0.001$). This finding is supported by a recent study conducted by Migliorini et al.,[11] which also reported improved postoperative Kujala scores (mean change ± 12.76; $P = 0.0003$) as well as improved Lysholm scores (mean change ± 15.69; $P < 0.0001$). Similarly, Kim et al.[12] observed a significant development in Kujala scores, with the average score increasing

from 42.7 ± 8.4 before surgery to 79.6 ± 13.6 ($P = 0.008$) at the final follow-up.

In this study, the postoperative Cincinnati score was significantly higher compared to the preoperative score ($P < 0.001$). This finding is consistent with the results reported by Han et al.,[13] who found substantial changes between the mean preoperative modified Cincinnati scores and the scores at 12, 36, 60, and 84 months following MPFL reconstruction surgery ($P < 0.01$). Following surgery, the patients' ratings were much higher than their prior values.

In this study, results demonstrated that the postoperative lysholm score was substantially greater compared to the preoperative score ($P <0.001$). This finding is supported by the study conducted by Kim et al.,[12] which revealed a significant improvement in the Lysholm score from 45.8 ± 5.7 to 82.0 ± 10.5 ($P = 0.008$). In addition, Lee et al.[9] reported a considerable rise in the Lysholm score from 47.8 points to 84.9 points ($P <0.001$).

In the present study, we found that the postoperative patellar tilt angle and patellar congruence angle were significantly lower compared to the preoperative measurements ($P <0.001$). These results align with those reported by Kim et al.,[12] who observed a significant improvement in the congruence angle from 26.5° ± 10.6° (range: 12° to 43°) before surgery to −4.0° ±4.3° (range: −12° to 5; $P = 0.008$) at the final follow-up. Regarding the post apprehension test, all 20 (100%) patients yielded negative results. As for the post compression test, 3 (15%) patients tested positive, whereas 17 (85%) patients tested negative. These findings are consistent with the results documented by Ballal et al.,[14] who reported no cases of apprehension, maltracking, facet tenderness, or positive patellar quadrant tests postoperatively.

However, in contrast to the findings in this study, Christiansen et al.[15] reported that 50% of their patients exhibited positive apprehension and pain with palpation. The differences observed may be attributed to the changes in patellar anatomy resulting from the reconstruction procedure and the influence of previous surgeries in some patients.

In our study, we propose a procedure, in which an anatomical reconstruction of the MPFL at both the femoral and patellar attachments is recreated. Our fixation approach employs a dual docking strategy, which provides potential advantages. By creating two incomplete transverse tunnels, we eliminate the need for implants for fixation, reducing surgical time, and lowering the risk of patellar fracture. In addition, this technique increases the surface area available for graft-to-bone healing.

A systematic review conducted by Jackson et al.[16] focused on the incidence of complications following primary MPFL reconstruction for recurrent patellar instability. The review analyzed data from 28 studies involving 1478 patients (1521 knees), with a mean age of 23.3 years (range: 19–34.3 years). The findings indicated that patellar fractures occurred in 0% to 8.3% of knees, primarily in patients who underwent full-length transverse tunnel reconstruction.

Another analysis and survey by Wierer et al.,[17] conducted within the International Patellofemoral Study Group, concluded that Patellar fracture risk after reconstruction of the MPFL relies on the drilling method and placement of the patellar bone tunnels. The study found that violating the anterior or lateral patellar cortex increased the likelihood of postoperative patellar fracture.

Compared to hardware-free fixation procedures, the use of screws and anchors for patella fixation is considered to be less time-consuming and easier to implement. However, it has been linked to possible side effects, including discomfort and inflammation at the insertion site. However, implant-free patellar fixation procedures have the benefit of being less expensive. As stress risers, thorough reaming and the use of entire transverse bone tunnels may enhance the likelihood of patellar fractures or collapse of the bone bridge.[18]

This technique has several advantages. First, it avoids breaching the anterior cortex of the patella, minimizing the need for extensive bone tunnels. Instead, blind transverse tunnels (not transpatellar tunnels) are utilized, which helps prevent the

devascularization of the superior pole of the patella due to the use of a small incision and minimal exposure.

Furthermore, our technique enables the assessment of graft isometry before finalizing the tunnel location on the femur. Using small guide pins during drilling across the patella, we ensure accurate isometric placement of the graft while minimizing the risk of chondral surface injury. Proper graft placement and isometry are crucial for the success of MPFL reconstruction.[19]

In this study, the graft was fixed to the femur with the knee flexed to 30°–60°, as this position has been reported to provide optimal graft length without over tightening. Furthermore, due to passive tension in the quadriceps and the patellofemoral articulation, the patella adopts its typical and repeatable position at this flexion angle.

McCarthy et al.[20] emphasized the importance of anatomically placing the MPFL femoral tunnel to maximize outcomes. Proximally placed tunnels have been associated with increased stress and contact pressure on the medial patellar facet cartilage, potentially leading to medial overload, arthritis, pain, and disability. Malpositioned femoral tunnels can also increase stress on the nonisometric MPFL graft, resulting in reconstruction failure and recurrent lateral patellofemoral instability or iatrogenic medial patella subluxation.

Regarding complications in this study, two patients (10%) experienced patellofemoral pain, with one having a pre-existing mild degree of patellofemoral arthrosis and the other presenting a small osteochondral lesion from the initial injury. In both cases, postoperative pain was mild and did not significantly affect their daily activities.

One patient (5%) exhibited residual instability with increased patellar translation, but since they did not experience the same apprehension and recurrent dislocation episodes as before, they opted for quadriceps strengthening exercises instead of revision surgery. Another patient (5%) had limited flexion (up to 100°) without interference in daily activities, and postoperative CT scan confirmed satisfactory femoral tunnel placement.

Sixteen patients (80%) had no complications. Shah et al.[21] reported that after surgery, 3.7% of patients suffered new subluxations/dislocations, and 8.3% of knees displayed fear, patellar hypermobility, or episodic instability, which could be attributed to underlying pathologies and the reliance on the reconstructed MPFL for patellar stability.A systematic review by Jackson et al.[16] concluded that complications after initial reconstruction of the MPFL ranged from 0% to 32.3% of knees and consisted mostly of persistent anterior knee discomfort. Failure rates varied between 0% and 10.7%, whereas patellar fractures were observed in between 0% and 8.3% of knees.It is important to acknowledge the limitations of our study. This is a single-center study with a relatively small sample size and a relatively short follow-up duration. The clinical evaluations were not blinded, and there was a lack of a control group and long-term follow-up.

Conclusion

Kujala and Lysholm ratings have improved, and most patients have achieved appropriate congruence angles, indicating that MPFL reconstruction with patellar docking has produced positive results. In treating patellofemoral instability and successfully averting further bouts of patellar subluxations or dislocations, this surgical method has demonstrated a high success rate. MPFL repair is a cost-effective treatment that greatly improves patients' quality of life by enhancing postoperative patellar stability.

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