International Journal of Research in Medical Sciences
Koentjorowibowo AA et al. Int J Res Med Sci. 2023 Oct;11(10):3837-3842
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20233043

Case Report

Gracilis tendon autograft for medial patellofemoral ligament reconstruction in a 47 years old female with recurrent patellar instability: a case report

Albertus A. Koentjorowibowo[1]*, Komang M. Laksana[2]

[1]Wangaya Regional General Hospital, Bali, Indonesia
[2]Department of Orthopaedics and Traumatology, Wangaya Regional General Hospital, Bali, Indonesia

Received: 09 August 2023
Accepted: 08 September 2023

***Correspondence:**
Dr. Albertus A. Koentjorowibowo,
E-mail: albert_kw@yahoo.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

The medial patellofemoral ligament (MPFL) is a static soft tissue structure that important to prevent subluxation and dislocation of the lateral patella. Chronic patellar instability and recurrent dislocation of patella may lead to further cartilage injury, limitation of daily living activities, limit return to sport and also can lead to severe patellofemoral arthritis of the knee. MPFL reconstruction has been suggested as a surgical treatment for chronic patellar instability. There are many techniques exist, the most important rules to avoid surgical failure and complications. Nowadays, there is no literature evidence for the best reconstruction technique. Many kind of graft choices and affordability of the implant are also become the defining factors, which trying to simulate the native function of MPFL precisely.

Keywords: MPFL reconstruction, Recurrent patellar dislocation, Loop patellar, Double tunnel patellar, Gracilis tendon

INTRODUCTION

Medial patellofemoral ligament (MPFL) is a static soft tissue structure that important to prevent subluxation and dislocation of the lateral patella, especially when the patella does not enter the trochlear groove within 30° in knee bending position. The MPFL also provide 50–80% medial mechanical stability in knee.[1,2] There are three mechanisms for maintaining patellofemoral joint stability.[3] Quadriceps and the gluteal muscles to a certain extent provide dynamic stability.[4] The static stability is provided by the bony anatomy and configuration of the patella and trochlear groove.[5] The local ligaments and retinacula provide passive joint restraint.[3,6]

Multifactorial disease with the combined effects of abnormality of bone anatomical and soft tissue structure that maintains the stability of the patellofemoral joint believed could cause patellar dislocation. Common bone anatomical abnormalities include dysplasia of the trochlear groove of the femur, patella alta, increased Q-angle (excessive tibial tubercle-trochlear groove TT-TG distance), tibial torsion, genu valgus, excessive latelar patellar tilt. The injuries of MPFL and medial patellar support band are mainly the soft tissue structure abnormalities.[1,2,6]

Patellar dislocation has been reported 3% incidence of all knee injuries, with an incidence of between 29 and 43 individuals per 100,000 reported.[6,7] Most patients with patellar disclocations are young and active athletes, adolescent female individuals have higher risk factor of patellar dislocation. Women has 33% more risk factor of acute patellar dislocation compared with men. After conservative treatment, the probability of recurrent patellar dislocation in these patients is 17–66%, and the

younger the patient, the higher the probability of recurrence.[8]

Chronic patellar instability definition is the existence of more than two episodes of true dislocation of patella, requiring manual reduction or one single episode of true dislocation followed by recurrent patellar subluxation episodes. Besides the painful aspect of patellofemoral dislocation, recurrent instability episodes may lead to further cartilage injury, limitation of daily living activities, limit return to sport and also can lead to patellofemoral arthritis of the knee.[9,10] The MPFL is mostly always injured with patellar dislocation and it is the main restraint to lateral patellar translation.[9] Nowadays, MPFL reconstruction has been suggested as a surgical treatment for chronic patellar instability.[8,9]

Anatomically, MPFL has length of 53 mm long. The width of MPFL at the femoral origin has been reported to range between 10 and 25 mm.[6,11] The MPFL can be found in the second layer below the deep fascia, superficial to the joint capsule. MPFL shares close relationship with the superficial and superior fibres of the medial collateral ligament (MCL) and adheres to the vastus medialis oblique muscle (VMO). In the medial aspect of the knee, showing the MPFL attachment between the medial epicondyle and the adductor tubercle, to the upper two third of the patella. VMO adheres to the MPFL (Figure 1).[11,12]

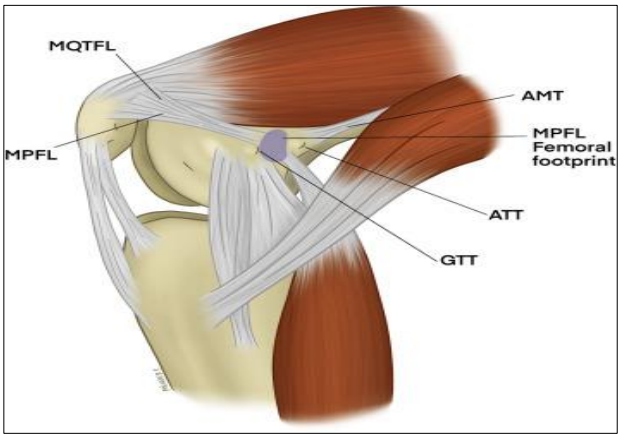

Figure 1: The anatomy of medial patellofemoral ligament.

At this time, there is no gold standard methods for MPFL reconstruction. There are many different techniques for MPFL reconstruction have been done by the experts. All techniques have purpose to reconstruct the ligament, supply tendon tissue from the medial aspect of the patella to the insertion site of the natural MPFL at the adductor tubercle of the medial femoral condyle, to produce a functional MPFL, avoid failure, and other complications.[10,13]

This case describes a MPFL reconstruction using gracilis tendon autograft with double tunnel patellar loop technique and bio-interference screw fixation. The purpose of the MPFL reconstruction is to restore the medial tether of the patella, to re-create a static medial restraint to lateral patellar translation while the knee is in extension and assist in guiding the patella into the trochlear groove.[13] Then, we evaluate post operatively with International Knee Documentation Committee (IKDC) score for three months to evaluate section on knee symptoms, sport activities, and functional.

CASE REPORT

A 47 years old female presented with a one-year history of pain in her left knee. She had a history of trauma several years ago, and after that, she experienced 15 times recurrent patellar dislocation occurring while doing daily activities. The pain was aggravated by short-distance walking, walking on stairs or bending of the knee. Knee examination showed slightly deformity with limited range of motion of flexion. The patient had lateral joint line tenderness.

From the magnetic resonance imaging (MRI) examination, we found trochlear joint surface flattened proximally and the concavity is less pronounced distally. On axial view, we also can see trochlear facet asymmetry. It was confirmed after physical examination and radiology examination were done, and MPFL reconstruction is the surgery of choice for this case (Figures 2 and 3).

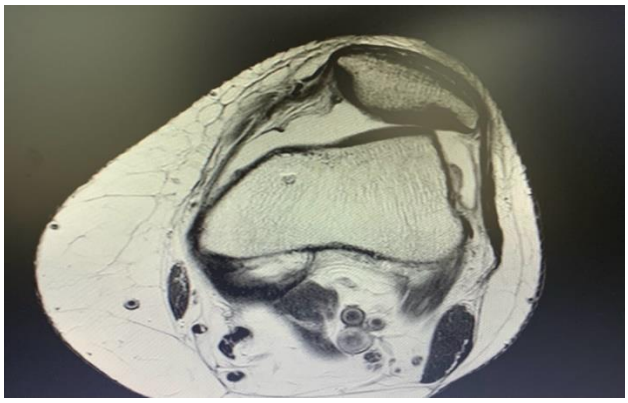

Figure 2: Radiograph knee AP view.

Figure 3: Knee MRI axial view.

First of all, the patient was in supine position. The surgery was started by performed the standard diagnostic knee arthroscopy by determine the sliding and tilting of the patella, cartilage star, and occurrence of any sign of a loose body was done by using arthroscopy. The gracilis tendon is more suitable for MPFL reconstruction procedure due to its strength and stiffness is closest to the native MPFL ligament. The surgeon perfomed 2- to 3-cm incision over the pes anserinus to harvest the gracilis tendon. Through the anserinus bursae, the gracilis tendon was exposed and released with a tendon stripper.[14,16] Moreover, to minimize the effect on hamstring function and to have a tendon that could easily pass through the patellar drill holes, the gracilis tendon was used. Muscle tissues were also removed from the tendon, and a whip stitch was placed at each end.[20]

After the graft is completed, longitudinal incision along the medial border of the patella was made. The surgeon exposed the medial aspect of the patella and proximal two-thirds of the medial border after dissect the three layers of the patellar soft tissues. Next step, by using two K-wires with parallel configuration all the way until the lateral side of the patella, surgeon mark the drill site on the patella, one on the upper third and the other at least 1 cm distally. Then, the surgeon creating double tunnel on the patella with 4.5 button drill is advanced from medial to lateral.[18-19] The gracilis tendon graft was passed using the Beath pin eyelet after both patellar tunnel established perfectly. The whipstitch suture is inserted into the eyelet, and the graft was also passed on the patellar tunnel like a loop. Then, the graft was passed through the medial femoral insertion site between the second and third layer using forceps (Figure 4).

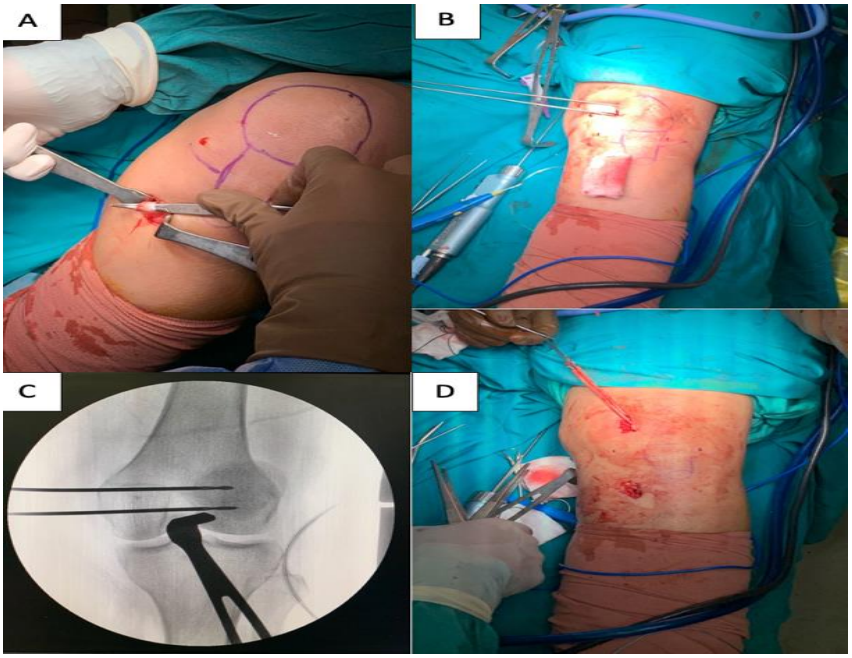

Figure 4: Approach of MPFL reconstruction using gracilis tendon autograft (A) detach the gracilis tendon, (B) K-wire parallel configuration, surgeon marked the drill site of the patella, (C) radiograph to determine the tunnel site, and (D) graft was passed through the medial femoral insertion.

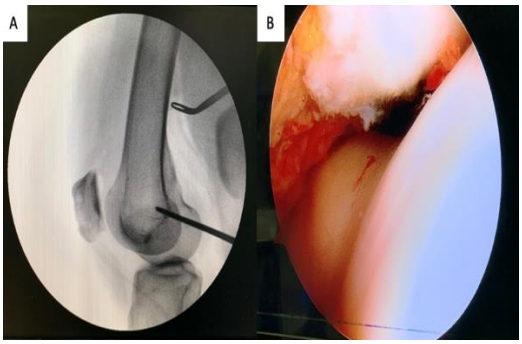

Figure 5: Femoral attachment site (A) under fluoroscopy determine the Schottle's point, and (B) the surgeon checked the final fixation arthroscopically.

From femoral insertion site, a fluoroscopy was used to determine Schottle's node. The surgeon us the beath pin to mark the insertion site. Advance to lateral femoral cortex, continue with the graft reamer that corresponds with the smallest interference screw. Nitinol wire was placed in the tunnel before graft passage into the femoral tunnel, aim to facilitate fixation after the graft was passed. The interference screw fixing the graft at the 30^{o} of flexion. The patella position also being checked during the final fixation arthroscopically. Final step, the layered closure was performed by the surgeon (Figure 5).[19]

Postoperatively, patients were not allowed to flexed her knee, leg locked in extension position. The brace is locked for ambulation and removed at night. After several weeks, patient start to achieve active and passive range of motion

exercises and isometric quadriceps strengthening. The brace is unlocked when quadriceps strength is regained. At six weeks post-operative, there is improvement in range of motion, at that time the brace was discarded, and closed chain quadriceps exercises are started. At 12 weeks, patients were allowed to start jogging, but return to sport was delayed for another four months.

Besides, we do observation and evaluation using International Knee Documentation Committee (IKDC) score for three months, which contains section to evaluate knee symptoms, sport activities, and functional with the result range from 0 to 100 with higher result has higher functional outcome. The IKDC score was design to access patients with a variety of knee disorders including ligamentous and meniscal injuries as well as patellofemoral pain (Figures 6 and 7).

Figure 6: Post-operative after 1-month follow-up. Post-operatively, patient was no able to achieve full range of motion.

Figure 7: Result post- operative after 3-months follow-up. There was improvement in symptoms and range of motion.

DISCUSSION

Abnormal twisting of the knee or atraumatic injury without any abnormalities of the bone can result in patellar dislocation and lead to rupture of the MPFL, which act as the primary soft tissue resistant to prevent patellar dislocation laterally.[1,2] Proximal shifting of the femoral attachment site will increase its tension, also the distance between the attachment points of the ligament during flexion. Later this condition will increase pressure and force to the medial aspect of the patellofemoral joint.[14]

According to some authors, the origin of femoral attachment is centred approximately 10 mm to the adductor tubercle distally. The MPFL is a non-isometric ligament, which function to restrain lateral patellar mobility.[11,12] Treatment for recurrent patellar instability and dislocation in patient under 18 years old result in 40% cases recurrent instability of the patella. There are many risk factors for re-dislocations cases included trochlear dysplasia, open physes in children and adolescence.[2] For the first time patellar dislocation with absence of significant osseous abnormalities, bracing and knee rehabilitation would be the first treatment of this condition. Failure of some conservative treatments resulted in recurrent patellar instability and lead to patellar dislocation, and within this condition, operative intervention is indicated to prevent for further instability episodes, severe osteoarthritis, and lead to loss of function.

Nowadays, MPFL reconstruction has become popular topic as a surgical treatment for chronic patellar instability, with many interest in anatomical insertions, operative techniques, restorations of optimal biomechanics. Multiple procedures have been done to treat patellar instability, including medial imbrication, lateral release, distal realignment procedure, medial patellofemoral ligament repair.[8-10] All techniques have purpose to reconstruct the ligament, supply tendon tissue from the medial aspect of the patella to the insertion site of the natural MPFL at the adductor tubercle of the medial femoral condyle, to produce a functional MPFL, avoid failure, and other complications. Reconstruction of medial patellofemoral ligament can be used as a successful primary procedure.

There are many methods of MPFL reconstruction have been described. Several terms of graft choice, graft tension for patellar and femoral fixation. Several studies show that a non-anatomical graft tends to over-constrain the patellofemoral joint, which this kind of pressure might result loss of knee motion and increase patellofemoral osteoarthritis. Furthermore, defining the optimal attachment points for the MPFL graft is still become controversy.[10,11]

In a recent cadaveric study by Philippot et al, ideal tension can significantly reduce the tilt angle and avoid hyper-correction.[21] The study confirmed that the ideal graft tension is 10 N. Besides, Burrus et al already highlight several techniques to evaluate and troubleshoot this issue, with 2 sayings of “high and tight” and “low and loose”.[19] In addition to femoral attachment, approriate tensioning is a must. According to Beck et al overcorrection of the patellar spatial parameters (patellar tilt, and patellar translation) could be happened if the graft is over-tensioning (>10 N), which increase the risk factor of stiffness in flexion and thus lead to early patellofemoral osteoarthritis.[22]

There are many kind of graft choices, including; autograft, allograft, or even synthetic graft. The focus of this technique is using the autograft. Besides, the described autograft tendon sources are also numerous; semitendinosus, gracilis, partial quadriceps, partial patella tendon, partial semimembranosus, vastus medialis retinaculum. The fixation techniques of grafts are variable, such as; patellar drill holes, sutures, suture anchors, and interference screws or staples at the femoral condyle.[13,14]

Based on Monllau et al, gracilis tendon was frequently used in current surgical technique.[14] The original MPFL was able to have a mean tensile strength of 208 N. The avegage of maximum load for 1 strand of a gracilis tendon was found to be 837±138 N and 2 strands of gracilis tendon had approximately twice the strength and stiffness as 1 strand. Theoritically, the gracilis tendon appears to have similar characteristics and value to the original MPFL. Besides, the technique is minimal invasive and tend to have low morbidity and good functional outcome in patellar stability. In a recent review, Shah et al complications after MPFL reconstruction was 26.1%.[23] From 629 patients included in the study, the percentage of patients suffered from recurrence of patellar instability was found to be 3.7%. A case series study from Csintalan et al conducted a clinical follow-up study on MPFL reconstruction for recurrent patellar instability in 56 knees (49 patients), with a mean follow-up of 4.3 years.[24] This study using IKDC score to evaluate patient outcomes. By the time follow-up, there were no recurrent dislocations reported, patella subluxation in 6 (11%) cases, and radiographic degenerative changes were none to mild in all patients. The IKDC scores' mean at follow-up was 76.3±19.2 (range, 30-99). Based on this case series study, MPFL reconstruction is an option for treating the symptoms of patellar instability, preventing recurrent dislocation, and returning patients near to their previous daily activities level.

In this case, we used gracilis tendon as a graft and evaluate post operatively with IKDC score to evaluate section on knee symptoms, sport activities, and functional with the result range from 0 to 100 with higher result has higher functional outcome. During first month post-operative, patient could perform light activities like walking, do the housework or yard work. During the physical examination, there were minimal tenderness and stiffness, patient could flex her knee 100°. The IKDC score was 49.4% at that time. After three months' follow-up, patient could perform moderate activities, patient is allowed to start jogging. During the physical examination, patient could flex her knee 125°. The IKDC score was 71.3%, patient was able to perform regular daily activity without pain and limitation of movement on her left knee. Patient was able to flex and extend her knee without pain. The score indicates there is no significant pain, joint stiffness, and difficulty on physical activity. Medial patellofemoral ligament reconstruction showed good outcome in our case without the presence of any harmful conditions

Limitation of this study is lack of follow-up time due to certain condition.

CONCLUSION

This study has shown that treatment of recurrent patellar instability and dislocation with medial patellofemoral ligament reconstruction using gracilis autograft is considered to produce satisfactory result with good functional outcome based on IKDC score.

ACKNOWLEDGEMENTS

Authors would like to thank Dr. Komang Mahendra Laksana, Sp. OT (K) Department of Orthopaedics and Traumatology, Wangaya Regional Hospital, Denpasar, Bali, Indonesia for reviewing the work and general support.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Jiang B, Qiao C, Shi Y, Ren Y. Evaluation of risk correlation between recurrence of patellar dislocation and damage to the medial patellofemoral ligament in different sites caused by primary patellar dislocation by MRI: a meta-analysis. J Orthop Surg Res. 2020;15:461.
2. Kepler CK, Bogner EA, Hammoud S, Malcolmson G, Potter HG, Green DW. Zone of injury of the medial patellofemoral ligament after acute patellar dislocation in children and adolescents. Am J Sports Med. 2011;39(7):1444-9.
3. Senavongse W, Farahmand F, Jones J, Andersen H, Bull AMJ, Amis AA. Quantitative measurement of patellofemoral joint stability: force-displacement behavior of the human patella in vitro. J Orthop Res. 2003;21(5):780e786.
4. Powers C, Ward S, Fredericson M, Guillet M, Shellock F. Patellofemoral kinematics during weight-bearing and non- weight-bearing kneeextension in persons with lateral subluxation of the patella: a preliminary study. J Orthop Sports Phys Ther. 2003;33(11):677e685.
5. Senavongse W, Amis AA. The effects of articular, retinacular, or muscular deficiencies on patellofemoral joint stability: a biomechanical study in vitro. J Bone Joint Surg Br. 2005;87-B(4):577e582.
6. Kader DF, Rajeev A. A review of functional anatomy and surgical reconstruction of medial patellofemoral ligament. J Arthrosc Joint Surg. 2014;5-10.
7. Stefancin JJ, Parker RD. First-time traumatic patellar dislocation: a systematic review. Clin Orthop Relat Res. 2007;455.

8. Amin NH, Sean Lynch T, Patel RM, Patel N, Saluan P. Medial patellofemoral ligament reconstruction. JBJS Rev. 2015;3.
9. Fithian DC, Neyret P, Servien E. Patellar instability: The Lyon experience. Tech Knee Surg. 2007;6:112-23.
10. Carnesecchi O, Neri T, Di Lorio A, Farizon F, Philippot R. Results of anatomic gracilis MPFL reconstruction with precise tensioning. The Knee. 2015;22(6):580-4.
11. Tuxøe J, Teir M, Winge S, Nielsen P. The medial patellofemoral ligament: a dissection study. Knee Surg Sports Traumatol Arthrosc. 2002;10(3):138-40.
12. Feller JA, Feagin JA, Garrett WE. The medial patellofemoral ligament revisited: an anatomical study. Knee Surg Sports Traumatol Arthrosc. 1993;1(3):184-6.
13. Lind M, Nielsen T, Miller L, Sorensen OG, Mygind-Klavsen B, Fauno P. No difference in outcome between femoral soft-tissue and screw graft fixation for reconstruction of the medial patellofemoral ligament: a randomized controlled trial. Arthroscopy. 2019;35(4):1130-7.
14. Monllau JC, Masferrer-Pino À, Ginovart G, Pérez Prieto D, Gelber PE, Sanchis-Alfonso V. Clinical and radiological outcomes after a quasi-anatomical recon- struction of medial patellofemoral ligament with gracilis autograft. Knee Surg Sports Traumatol Arthrosc. 2017;25:2453-9.
15. Moran TE, Burke JF, Diduch DR. Small (3.2-mm), short, oblique patellar tunnels for patellar fixation in MPFL reconstruction. Arthroscopy Techniques. 2020;9(10):e1613-7.
16. Christiansen SE, Jacobsen BW, Lund B, Lind M. Reconstruction of the medial patellofemoral ligament with gracilis tendon autograft in transverse patellar drill holes. Arthroscopy. 2009;24(1):82-7.
17. Ahmad R, Calciu M, Jayasekera N, Schranz P, Mandalia V. Combined medial patellofemoral ligament reconstruction and tibial tubercle transfer results at a follow-up of 2 years. J Knee Surg. 2017;30(1):42-6.
18. Bonazza NA, Lewis GS, Lukosius EZ, Roush EP, Black KP, Dhawan A. Effect of transosseous tunnels on patella fracture risk after medial patellofemoral ligament reconstruction: a cadaveric study. Arthroscopy. 2018;34(2):513-8.
19. Burrus MT, Werner BC, Conte EJ, Diduch DR. Troubleshooting the femoral attachment during medial patellofemoral ligament reconstruction. OJSM. 2015;3(1):1-8.
20. Kim TS, Kim HJ, Ra IH, Kyung HS. Medial patellofemoral ligament reconstruction for reccurent patellar instability using a gracilis autograft without bone tunnel. Clin Orthop Surg. 2015;7(4):457-64.
21. Philippot R, Boyer B, Testa R, Farizon F, Moyen B. Study of patellar kinematics after reconstruction of the medial patellofemoral ligament. Clin Biomech. 2012;27:22-6.
22. Beck P, Brown N, Greis B, Burks R. Patellofemoral contact pressures and lateral patellar translation after medial patellofemoral ligament reconstruction. Am J Sports Med. 2007;35:1557-63.
23. Shah JN, Howard JS, Flanigan DC, Brophy RH, Carey JL, Lat-termann C. A systematic review of complications and failures associated with medial patellofemoral ligament recon-struction for recurrent patellar dislocation. Am J Sports Med. 2012;40(8):1916-23.
24. Csintalan RP, Latt LD, Fornalski S. Medial patellofemoral ligament (MPFL) reconstruction for the treatment of patellofemoral instability. J Knee Surg. 2014;27(2):139-46.

Cite this article as: Koentjorowibowo AA, Laksana KM. Gracilis tendon autograft for medial patellofemoral ligament reconstruction in a 47 years old female with recurrent patellar instability: a case report. Int J Res Med Sci 2023;11:3837-42.