How to Cite:
Hussein, M. N., Samaka, M., Massoud, M., & Khedr, A. (2022). Operative management of Patello-Femoral instability in young athletes: A series study. *International Journal of Health Sciences*, *6*(S4), 2133–2143. https://doi.org/10.53730/ijhs.v6nS4.6803

Operative management of Patello-Femoral instability in young athletes: A series study

Mostafa Nabil Hussein, MD
Lecturer of Trauma & Orthopedics department, Egyptian Military Medical Academy, Egypt
Corresponding author email: mostafaibrahimnabil@gmail.com

Mohamed Samaka, MD
Lecturer of Trauma & Orthopedics department, Egyptian Military Medical Academy, Egypt
Email: mohamedsamaka78@gmail.com

Mahmoud Massoud, MD
Lecturer of Trauma & Orthopedics department, Egyptian Military Medical Academy, Egypt
Email: mmassoud7789@gmail.com

Ahmed Khedr, MD
Lecturer of Trauma & Orthopedics department, Kasr Al-Ainy Faculty of medicine, Cairo University, Egypt
Email: ahmedkhedr@kasralainy.edu.eg

***Abstract*---**Aim: we are assessing MPFL reconstruction whether isolated or accompanied by lateral release and / or tibial tubercle transfer in management of patellofemoral instability to achieve the best results in terms of stability and return to physical activity. Methodolgy: 25 patients suffering from patellofemoral instability were included in this study. They were all suffering from recurrent/habitual dislocations or first time dislocators with traumatic history and/or failed conservative management. Surgeries addressing their pathologies included MPFL reconstruction, whether isolated or accompanied by lateral patellar release and/or tibial tubercle transfer. The decision making process of the appropriate surgery depends on the aetiology of the instability whether it is a soft tissue such as MPFL tear or a bony aetiology such as shallow trochleas and bony malalignment. Results: Clinical Evaluation was performed via Kujala-Lysholm-Tegner scores which were used to compare their preoperative statuses with their postop results at 3, 6&9 months intervals, as well as their return to physical activity. There was a significant improvement in patients' scores evident by a Lysholm score P-value less than 0.05 with a preoperative mean score

of 44.60 and a postoperative score of 91.88. Kujala score as well showed significant improvement evident by a P-value less than 0.05 with a preoperative mean score of 45.53 and a postoperative score of 93.13. Complications included recurrent instability, paresthesia medial leg, flexion deficiency and superfiscial infection. All patients responded well to physiotherapy. Conclusions: Our approach evaluates the role of MPFL reconstruction in addressing patellofemoral instability in athletic population. Whether isolated or accompanied by lateral release and/or tibial tubercle transfer, MPFL reconstruction has proven to be an efficient method in treating recurrent instability resulting in preventing of further patellar subluxations/dislocations as well as improving overall knee functional outcomes.

***Keywords*---**Patellofemoral instability, MPFL reconstruction, Tibial tubercle transfer, Trochlear Dysplasia.

Introduction

Patellar dislocation is a common knee injury in the young, athletic patient population. With an incidence of 5.8 per 100,000 per year, patellar dislocations are commonly seen in the emergency department.[1] Patellar instability mainly affects young and active patients, with a peak incidence of 29 per 100 000 per year in adolescents. The medial patellofemoral ligament, a main passive restraint for lateral translation of the patella, is torn in lateral patellofemoral dislocations.[1] Conservative management is the preferred strategy after a'first-time' traumatic dislocation.[2] There are two options in conservative management of first-time patellar dislocation: immobilization using a cylinder cast or removable splint, or, functional mobilization after applying a brace or patellar tape.[1] Primary patellar dislocation, however, has the potential to result in poor clinical outcomes including recurrent dislocation/subluxation, patellofemoral pain/anterior knee pain, impaired function, and chondral lesions as well as patellofemoral osteoarthrosis. The total redislocation rate following primary dislocation has been reported as high as 26%, with a markedly increased risk of 52% in patients younger than 15 years. Given this high rate of recurrence, much effort has gone into determining the risk factors for recurrent instability.[3] The decision-making process guiding surgical re-alignment includes analysis with standard radiographs and MRI of the trochlear groove, joint cartilage and medial patello-femoral ligament (MPFL). Careful evaluation of dynamic and static stabilisers is essential; the medial patello-femoral ligament provides stability during the first 20° of flexion, and the trochlear groove thereafter.[2] Excessive femoral anteversion, general ligamentous laxity with increased femoro-tibial rotation, patella alta and increased distance between the tibial tuberosity and the trochlear groove(TT-TG) must also be taken into account and surgically corrected.[2] In cases with ongoing dislocations during skeletal immaturity, soft tissue procedures must suffice: reconstruction of the medial patello-femoral ligament as a standalone procedure or in conjuction with more complex distal realignment of the quadriceps mechanism may lead to a permanent stable result.[2] Current literature suggests that patients suffering from patellofemoral instability, ranging from recurrent patellar subluxation (apprehension) to dislocations, are the

primary indication for isolated MPFL reconstruction as it is the primary stabilizer of the patellofemoral joint.[3,4] However, there are certain scenarios in which isolated MPFL reconstruction is not recommended. Such scenarios noted in literature include situations of bony malalignment, trochlear dysplasia, and patella alta. They are addressed via Tibial Tuberosity transfer, Trochleoplasty, rotational osteotomies, lateral collateral ligament release in isolation or along with MPFL Reconstruction.[3]

Aim of Work

In this study, we are assessing MPFL reconstruction whether isolated or accompanied by lateral release and / or tibial tubercle transfer in management of patellofemoral instability to achieve the best results in terms of stability and return to physical activity.

Patients & methods

From January 2017to February 2019, a prospective randomized analytical clinical study was done to assess the role of MPFL reconstruction in management of patellofemoral instability in young athletes and its role in their return to their preoperative athletic level. The Study included twenty five patients all of whom are keen or professional athletes. *(Table 1).* They were selected according the following criteria:

- Young athlete with patellofemoral instability.
- Recurrent patellar dislocation.
- No other causes of knee instability.

Table 1
Showing demographic data of the patients.

	Number	Percent
Age		
Min.-Max.	18.00-32.00	
Mean	19.28	
Side		
Left	13.0	52.00
Right	12.0	48.00
Injury		
Recurrent Dislocations	3.0	12
Neglected dislocations	2.0	8
Traumatic dislocations	18.0	72
patella Alta	2.0	8

Analysis was carried according to Lysholm-Tegner and Kujala knee scores. They were calculated at 0,3,6,9 months postop. [5,6,7]

Operative Technique & Rehabilitation program

Surgeries included are isolated MPFL reconstruction (22 patient), MPFL reconstruction in addition to lateral release (2 patients), MPFL reconstruction as well as lateral release and tibial tubercle transfer (1 patient).
(Table 2).

Table 2
Showing side and type of surgeries

		Count	%
Side	Left	13	52%
	Right	12	48%
	MPFL Rec.	22	88%
	MPFL Rec.+LR	2	8%
	MPFL Rec.+LR+TTT	1	4%

(LR=Lateral Release / MPFL Rec.=Medial patellofemoral Ligament Reconstruction / TTT=Tibial Tubercle Transfer)

MPFL Reconstruction

MPFL reconstruction was performed through the double-bundle technique described by fixing metal anchors to the medial patellar border. [8,9,10] Arthroscopy was performed in the affected knee for identification of associated injuries or removal of intra-articular debris. The semitendinosus tendon was then harvested through a 2–3-cm incision over the insertion of the pes anserinus tendons. [8] A 2 cm anterior skin incision was made over the central part of the medial border of the patella.[8,12] A groove on the medial border of the patella was created above the transition with the posterior chondral face of the patella with the aid of a curette to accommodate the graft. [8,12] Two 5-mm metal anchors were introduced and positioned in the proximal two thirds of the patella,10–15 mm of the joint, with a distance of 15 mm between them. [8,12] The most distal bundle, the inferior-straight (IS), was first established with the patella at approximately 30◦of knee flexion; then, the most proximal bundle, the superior-oblique(SO), at about 60◦of flexion. The remaining medial retinaculum was sutured under the tendon. [8,13,14] The point of graft fixation in the femur was identified with radiographic assistance, according to the parameters described by Schöttle et al (Schottle point). [8,10] The folded semitendinosus tendon graft was inserted through the femoral tunnel and fixed with an interference screw. [8]

Lateral Release

In this study, four patients had MPFL reconstruction with lateral release, 1 patient had open lateral release& medial plication and one patient had MPFL reconstruction, lateral release and tibial tubercle medialization. Knee arthroscopy is performed via the classical anterolateral portal. A thorough evaluation of the suprapatellar pouch, patellofemoral joint, medial and lateral gutters, medial and lateral compartments, and the intercondylar notch. The operative indication is then confirmed and possible concomitant lesions are assessed.[15,16]The working

portal is created via administration of a needle medially to determine the optimal angle of inclination towards the lesion. [15,16] Using electrocautery unit or knife The release is carried through the synovium and lateral retinaculum only. It is safer to stay more posterior proximally to stay out of the vastus lateralis.[15,16] The release is started proximally and carried distally, staying a few millimeters lateral to the patella. Injuring Vastus Lateralis may lead to quadriceps weakness and medial subluxation of the patella, a well-described and potentially devastating complication.[15,16] With the knee drained of fluid, one should be able to manually elevate the patella perpendicular to the trochlea. If this amount of tilt can't be obtained, the release is inadequate and needs to be improved.[15,16] The most common reasons for failure of lateral release are poor indications, inadequate release, overzealous release (vastus lateralis), inadequate rehabilitation, and the surgeon missing concomitant pathology (mensicus tear, and so on). Most of these can be prevented with attention to detail preoperatively, intraoperatively, and postoperatively.[15,16]

Tibial Tubercle Transfer

In this study, one patient had tibial tubercle transfer in addition to MPFL reconstruction with and lateral release. Procedure: A longitudinal incision was made starting just medial to the tibial tubercle. The osteotomy site was marked on the medial aspect of the tibia, starting proximally next to the tubercle at a depth of 1.0 to 1.5 cm and continuing distal 5 cm. [26] As the mark was extended distally, the bony shingle was thinned until there was a thickness of 2 to 4 mm of bone at the most distal aspect to avoid creating a step cut. This allowed the shingle to hinge and rotate medially with minimal prominence. [26] After marking the medial side of the tibia, a bone cut was performed with a saw from medial to lateral, angling posteriorly. This allowed the tubercle to be translated anteriorly. [26] The osteotomy site was then translated anteromedially and affixed with two 4.5-mm fully threaded cortical screws. *[26]*

Results

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Data was summarized using mean and standard deviation in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. For comparison of serial measurements within each patient repeated measures ANOVA was used (Chan, 2004). P-values less than 0.05 were considered as statistically significant. [20]

Clinical outcome

Post-Operative evaluation of our candidates was performed according to the Lysholm and Kujala knee scores at three, six and nine months intervals. Their results were compared to their preoperative scores. *(Table 3).*

Table 3
Showing total Lysholm & Kujala scores at 0,3,6 and 9 months, as well as Mean & SD (L0,L3,L6,L9=Lysholm scores at 0,3,6&9 months). (K0,K3,K6,K9=Kujala scores at 0,3,6&9 months).

	Mean	Standard Deviation	Minimum	Maximum
L0	44.60	7.51	27.00	67.00
L3	80.03	6.41	69.00	90.00
L6	90.93	4.55	76.00	96.00
L9	91.88	6.58	76.00	96.00
K0	45.53	7.86	16.00	61.00
K3	77.43	7.79	59.00	88.00
K6	91.13	5.32	80.00	98.00
K9	93.13	5.28	83.00	98.00

Lysholm scores: Relative to preoperative results, there was a significant improvement in patients scores evident by a P-value less than 0.05 with preoperative mean score of 44.60 and postoperative score of 91.88 at 9 months. *(Table 4).*

Table 4
Showing Lysholm score Postoperative P-value results compared to Preoperative results. (L0,L3,L6,L9=Lysholm scores at 0,3,6&9 months). (P-value <0.05 is a significant finding)

	Mean	Standard Deviation	P value compared to pre
L0	44.60	7.51	---
L3	80.03	6.41	<0.001
L6	90.93	4.55	<0.001
L9	91.88	6.58	<0.001

Kujala scores: Relative to preoperative results, there was a significant improvement in patients scores evident by a P-value less than 0.05 with preoperative mean score of 45.53 and postoperative score of 93.13. *(Table 5)*

Table 5
Showing Kujala score Postoperative P-value results compared to Preoperative results

	Mean	Standard Deviation	P value compared to pre
K0	45.53	7.86	---
K3	77.43	7.79	<0.001
K6	91.13	5.32	<0.001
K9	93.13	5.28	<0.001

(K0,K3,K6,K9=Kujala scores at 0,3,6&9 months). (P-value <0.05 is a significant finding).

Complications

Complications were recorded in five patients. One patient had recurrent dislocation with a subsequent subluxed patella. He was managed conservatively as he declined surgery. One patient suffered from superficial infection at the six months interval which was managed by a course of Intramuscular antibiotics. Two patients were reluctant on PT rehabilitation programmes and suffered flexion deficits (90 degrees flexion). One patient suffered from medial leg paresthesia. (Table 6)

Table 6
Showing complications details

		Count	%
Comp.	Yes	5	20%
	No	20	80%
Comp. details	Flexion deficiency	2	8%
	Recurrent subluxation	1	4%
	Superfiscial Infection	1	4%
	Parasthesia medial leg	1	4%
	No	20	80%

Discussion

Patellofemoral instability is common in the young and active population with patellar dislocations commonly seen in emergency departments. Management of such injuries depends on their aetiologies. This study design aimed at evaluating different surgical techniques used in management of patellofemoral instability. Twenty five patients suffering from patellofemoral instability between eighteen and thirty two years old with a mean age of 19.28 years were included in this study. Twenty two patients had isolated MPFL reconstruction performed, while two had Lateral Release in addition. One patient had MPFL reconstruction, tibial tubercle transfer and lateral release.

Post Operative evaluation of our candidates was performed according to the Lysholm and Kujala knee scores at three, six and nine months intervals. Scores were compared to their preoperative results. There was significant improvement in patients' scores at the Nine months interval compared to their preoperative scores with sixteen patients obtaining a score of ninety five or more on both Lysholm and kujala scores. Complications included residual subluxation in one patient, which was addressed conservatively. One patient had superfiscial infection treated by a course of intramuscular antibiotics. One patient suffered from medial leg paresthesia while two patients suffered from flexion deficiency. *Sadigursky et al., (2016)* [8] described a method for MPFL reconstruction used in this study in which semitendinosus tendon is used and the point of graft fixation in the femur was identified with the aid of profile radioscopy, according to the parameters described by *Schöttle et al(2007).* [11] In our study, we used the same technique described by Sadigursky et al. During MPFL Reconstruction, the Semitendinosus graft was always utilized not the gracilis as it is larger, stronger and easier to harvest. The

remnants of the medial retinaculum were always sutured under the graft to give more stability to the fixation which agreed with *Stephen et al(2014).*[17] *Lenschow et al (2013)*[18] described that an advantage of the use of anchors is the possibility of using shorter graft, such as the gracilis tendon, although the semitendinosus tendon was chosen due to its greater length, which allows for a better handling and control of its strength, in addition to its larger volume, with better fixation in the femoral tunnel with interference screw. *Song et al (2014)* [19] explained furthermore, that the use of anchors allows for smaller incisions with improved cosmetic results. By not using bone tunnels in the patella, the risk of fractures or patellar cartilage injury is reduced which makes it a relatively simple technique, resulting in reduced surgical time. The fixation anchors also allow for the closest possible reproduction of the MPFL anatomy and independent fixation of the ligament bundles, at 30◦and 60◦of knee flexion.

Rosinski et al (2019) [21] described the same technique as Sadigursky publications but chose to use a cadaveric hamstring allograft instead of autografts. The study concluded that this method of reconstruction was safe, reproducible, and effective in the treatment of patients with patellar instability. *Puzzitiello et al (2019)* [22] retrospectively compared clinical outcomes and rates of recurrent instability in young patients with primary medial patellofemoral ligament (MPFL) repair or reconstruction. Fifty one knees were operated on with thirty two reconstructions and nineteen repairs. He concluded that MPFL reconstruction may provide improved midterm clinical outcomes and a decreased recurrence rate compared with MPFL repair. *Hilber et al (2019)* [23] studied the effect of early functional rehabilitation after patellar dislocation. The study aimed to analyze the current rehabilitation protocols of forty two orthopedic and trauma surgical institutions regarding their recommendations on weight bearing, range of motion (ROM), and use of movement devices and orthosis. Comparisons were drawn between all protocols for conservative treatment and postoperative rehabilitation after MPFL reconstruction. The rehab protocols showed a significant earlier full weight bearing after surgical MPFL reconstruction ($p > 0.001$) despite initial restrictions in weight bearing, ROM, and use of movement devices and orthosis at the beginning of rehabilitation. *Chian et al (2018)* [24] studied the outcomes of MPFL reconstruction in a systematic review with meta-analysis. A total of nineteen publications with 604 knees were included. Postoperative Patellofemoral instability, positive apprehension test, kujala and Lysholm results were compared to the preoperative scores. The study concluded that isolated MPFL reconstruction leads to significant decrease in the rates of patellofemoral instability and apprehension and a significant increase in functional outcomes as measured by Kujala and Lysholm scores, and the ability to return to pre-injury sporting activities. *Sherman et al (2019)* [25] analysed the clinical value of MPFL reconstruction in high BMI patients and questioned the negative effect of high BMI on postoperative results. A retrospective review of prospectively collected data between 2011 and 2018 was performed. Fifty seven knees were included with twenty six with high BMI (>30) and thirty one with average BMI. Initial impressions were that high BMI patients would have inferior results than their average BMI counterparts. However, the study concluded the contrary, MPFL reconstruction proved to be a safe and effective procedure for patients with high BMI demonstrating improvement in functional outcomes and low complication

rates. Our study showed the same results as Sherman et al where the postoperative outcomes were irrelevant to patients' BMI.

Conclusion

After comparing the results of the patients, it was evident that there was a significant improvement in the patients' conditions. P-value was statistically significant postoperatively. Only five patients were recorded to suffer from complications while sixteen patients (53.3%) scored 94 or more on lysholm scale and thirteen patients (43.3%) scored 94 or more on Kujala scale after 9 months. Hence, we concluded that the techniques used in the study are easily reproducible with satisfactory results regarding restoration of stability, function of patellofemoral joint and possibility of return to previous athletic activities.

Acknowledgments

The authors are grateful to all staff members who helped in this study for their content contributions, critical review of the manuscript and their continuous support during the development and writing of this manuscript.

Funding: "This research did not receive any specific grant from funding agencies in the public, commercial, or not –for- profit sectors.

Conflict of Interest: The authors have no proprietary, financial, or other personal interest of any nature or kind in any product,service and/or company that is presented in this article.

Regulatory Statement: This study was conducted by all the provisions of the local human subject's oversight committee guidelines and policies of the ethics committee of scientific research-kasr Al-ainy faculty of medicine-Cairo University.

References

1. Laurens Kaas , Mara Rosa van der Valk, Daan Vermeulen (2019); Plaster, splint, brace, tape or functional mobilization after first-time patellar dislocation: what's the evidence?:EOR,Vol.4,March 2019:110-4
2. Daniel Studer, Carol C. Hasler (2016); Patella instability in children and adolescents.EOR,vol.1,May 2016:160-6
3. Michael R. Baer, Jeffrey A. Macalena (2017); Medial patellofemoral ligament reconstruction: patient selection and perspectives: Dove Press Journal. Orthopaedic Research& Reviews,Sept.2017:83-91
4. Kopuri Ravi Kiran, Muni Srikanth, Lenin Chinnusamy, K Deepti (2015); Dynamic medial patellofemoral ligament reconstruction in recurrent patellar instability: A surgical technique, Indian J Orthop. 2015 Nov-Dec; 49(6): 630–6.
5. Lysholm J, Gillquist J.(1982); Evaluation of knee ligament surgery results with special emphasis on use of a scoring scale. Am J Sports Med 1982; 10:150–4.
6. Tegner Y, Lysholm J. (1985);Rating systems in the evaluation of knee ligament injuries. Clin Orthop Relat Res 1985;198:43–9.

7. UM Kujala , LH Jaakkola , SK Koskinen , S Taimela , M Hurme , O Nelimarkka(1993); Scoring of patellofemoral disorders. Arthroscopy: the journal of arthroscopic & related surgery: official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 1993; 9(2):159–63.Epub 1993/01/01. PMID: 8461073.
8. David Sadigursky, Matheus Simões de Melo Laranjeira, Marzo Nunes, Rogério Jamil Fernandes Caneiro, Paulo Oliveira Colavolpe (2016);Reconstruction of the medial patellofemoral ligament by means of the anatomical double-bundle technique using metal anchors Rev. Bras.Ortop. 2016; 51(3):290-7
9. Song SY, Kim IS, Chang HG, Shin JH, Kim HJ, Seo YJ. (2014);Anatomic medial patellofemoral ligament reconstruction using patellarsuture anchor fixation for recurrent patellar instability. Knee Surg Sports Traumatol Arthrosc. 2014; 22(10):2431–7.19.
10. Kang H, Cao J, Yu D, Zheng Z, Wang F. (2013); Comparison of 2 different techniques for anatomic reconstruction of the medial patellofemoral ligament: a prospective randomized study. Am J Sports Med. 2013; 41(5):1013–21.
11. Schöttle PB, Schmeling A, Rosenstiel N, Weiler A. (2007);Radiographic landmarks for femoral tunnel placement inmedial patellofemoral ligament reconstruction. Am J SportsMed. 2007; 35(5):801–4.29.
12. Kopuri Ravi Kiran, I Muni Srikanth, Lenin Chinnusamy, and K Deepti. (2015); Dynamic medial patellofemoral ligament reconstruction in recurrent patellar instability: A surgical technique Indian J Orthop. 2015 Nov-Dec; 49(6): 630–6.
13. Stephen JM, Kaider D, Lumpaopong P, Deehan DJ, Amis AA.(2014); The effect of femoral tunnel position and graft tension on patellar contact mechanics and kinematics after medial patellofemoral ligament reconstruction. Am J Sports Med.2014; 42(2):364–72.14.
14. Sadigursky D, Gobbi RG, Pereira CAM, Pécora JR, Camanho GL.(2012); Método de ensaio biomecânico para análise daisometricidade na reconstruc¸ão do ligamento patelofemoralmedial. Rev Bras Ortop. 2012; 47(5):598–605.31.
15. Patellofemoral Online Education (2010); Chapter 5: Arthroscopy of the patellofemoral joint.2010
16. Nonweiler DE, DeLee JC. (1994); The diagnosis and treatment of medial subluxation of the patella after lateral retinacular release. Arthroscopy 1994; 5:680-6.
17. Stephen JM, Kaider D, Lumpaopong P, Deehan DJ, Amis AA.(2014); The effect of femoral tunnel position and graft tension on patellar contact mechanics and kinematics after medial patellofemoral ligament reconstruction. Am J Sports Med.2014; 42(2):364–72.14.
18. Lenschow S, Schliemann B, Gestring J, Herbort M, Schulze M, Kösters C.(2013);. Medial patellofemoral ligament reconstruction: fixation strength of 5 different techniques for graft fixation at the patella. Arthroscopy. 2013; 29(4):766–73.18.
19. Song SY, Kim IS, Chang HG, Shin JH, Kim HJ, Seo YJ..(2014);. Anatomic medial patellofemoral ligament reconstruction using patellar suture anchor fixation for recurrent patellar instability. Knee Surg Sports Traumatol Arthrosc. 2014; 22(10):2431–7.19.
20. Biostatistics 301. Repeated measurement analysis.(2004);Singapore Med J 2004; 45(8): 354-69

21. Alexander Rosinsky ,Moyukh Chakrabarty, James Gwosdz, Patrick J McGahan, James L Chen.(2019); Double-Bundle Medial Patellofemoral Ligament Reconstruction With Allograft, Arthroscopy techniques,Vol.8,Issue 5,May 2019: pp e513-20.
22. Richard N. Puzzitiello, Brian Waterman, Avinesh Agarwalla, William Zuke, Brian J.Cole, Nikhil N.Verma, et al. (2019); Primary Medial Patellofemoral Ligament Repair Versus Reconstruction: Rates and Risk Factors for Instability Recurrence in a Young, Active Patient Population. The journal of arthroscopic and related surfgery.Vol.35, Issue 10, October 2019.
23. Franz Hilber, Christian Pfeifer, Clemens Memmel, Johannes Zellner, Peter Angele, Michael Nerlich, et al.(2019); Early functional rehabilitation after patellar dislocation. What procedures are daily routine in orthopedic surgery? ElSevier Ltd, Volume 50, Issue 3, March 2019. P:752-7
24. David Meng-Guang Chian, Si Heng Sharon Tan, Ken Lin Wong, James H.Hui (2018); The Outcomes of Medial Patellofemoral Ligament (MPFL) Reconstruction in Patellofemoral Instability: A Systematic Review and Meta-Analysis. Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology, Volume 13, July 2018.
25. Seth L. Sherman, John W. Welsh, Joseph M. Rund, John R. Worley (2019); The Influence of Body Mass Index (BMI) >30 on Outcomes and Complications Following Medial Patellofemoral Ligament (MPFL) Reconstruction. The Journal of arthroscopy and related surgery, Volume 35, Issue 12, December 2019.
26. Jonathan D. Hodax, Michael P. Leathers, David Y. Ding, Brian T. Feeley, Christina R. Allen, C. Benjamin Ma, et al. (2019); Tibial Tubercle Osteotomy and Medial Patellofemoral Ligament Imbrication for Patellar Instability Due to Trochlear Dysplasia. Orthopaedic Journal of sports medicine, August 2019.