



Lateral Lengthening and Lateral Release

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The lateral retinaculum of the knee plays an important role in balancing the forces on the patella. The lateral retinaculum is a complex structure with elements coursing from with quadriceps tendon, iliotibial band as well as dedicated fibers from the patella to the femur. This complex can provide stability and restraint to both medial and lateral translation in the knee, but in patients with patellofemoral pain or arthritis it can be overly tight and contribute to discomfort. Surgical treatments of the lateral retinaculum include lateral release as well as lateral lengthening. After an exhaustive trial of physical therapy, bracing, medication, or injections, this cohort of patients may also benefit from surgical intervention. Therefore, a thorough understanding of the indications, technique, and outcomes of these procedures is important in the clinical decision-making when treating this subset of patients. Oper Tech Sports Med 27:150685 © 2019 Elsevier Inc. All rights reserved.

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Introduction

The patella is stabilized through a combination of dynamic and static restraints.^{1,2} Disruption of the balance of these stabilizers can lead to patellofemoral pain or instability. The native lateral retinaculum aids in normal patellar tracking; however, an excessively tight retinaculum may lead to increased lateral force on the patella resulting in maltracking of the patella within the trochlear groove and potentially increased lateral patellar contact pressures. Malalignment increased lateral patellar tilt, and lateral patellar displacement due to tight lateral retinacular structures can increase the risk of patellar chondrosis and subsequent osteoarthritis due to the overloading of forces onto the lateral patella as first described by Ficat and Hungerford, known as excessive lateral pressure syndrome.³⁻⁵ In addition, the combination of incompetency of the medial patellofemoral ligament (MPFL) and tight lateral retinacular structures can result in lateral patellar instability and pain.

Lateral retinacular lengthening and lateral release are procedures that can be used to treat a range of conditions

including patellofemoral pain due to lateral restraint pathologies, such as malalignment from significant patellar tilt, or lateral patellar hypercompression syndrome.⁶⁻⁹ It can also be used as an adjunct procedure in treating chronic lateral patellar maltracking.¹⁰ This chapter will explore the indications, surgical techniques, and outcomes of lateral lengthening and lateral release procedures in the presence and absence of lateral patellar instability.

Diagnosis

The surgical indication for lateral retinacular lengthening or release procedure is still debated and attitudes toward these surgeries have changed over the past decade. A survey study conducted by Fithian et al found that members of the International Patellofemoral Study Group rarely perform lateral releases, with most surgeons only performing 1-5 of these surgeries per year.¹¹ In addition, there were mixed opinions on the appropriate indications for performing a release or lengthening procedure, with the most common indications being instability, malalignment, and patellofemoral pain.

Patient History

There are several factors that are important to review potentially indicating a patient for lateral retinacular procedures.

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Determining if the patient suffers from medial or lateral instability is paramount at the outset. If instability is present, it should be clarified if this occurs only during events or also between them. The latter suggests there is an underlying cause of pain separate from the instability symptoms. If there is pain only with instability, typically there is resolution of the pain with resolution of the instability. Patients with primary pain complaints typically mention issues with stairs, particularly descending stairs, as well as after prolonged sitting. Reports of swelling may denote cartilage damage leading to synovitis. The physician should also obtain a clear history of prior surgical procedures including lateral release, chondroplasty, and debridement.

Physical Exam

The physical exam should begin with inspection which includes evaluation of the skin for prior surgical scars along with evaluating the patient's gait. Specifically, the clinician should evaluate for the thigh-foot progression angle, signs of an antalgic gait, as well as coronal plane and rotational stability and control with a single-leg squat. The Q-angle can be evaluated in both extensions as well as throughout range of motion. The Q angle, which is defined as the angle from the anterior superior iliac spine to the center of the (reduced/central positioned) patella to the tibial tubercle (TT). Evaluating the dynamic Q-angle can allow for visualization of the J-sign. This sign occurs due to the patella disengaging from the trochlear groove during extension and translating laterally in full extension. The source of a J-sign can be multifactorial and include osseous deformity such as trochlear dysplasia, femoral anteversion, or valgus. A Q-angle greater than 15° is associated with an increase in lateral patellar contact pressures and has been shown to increase a patient's risk of developing patellofemoral pain and subluxation.¹² Some potential causes of increased Q-angle can be due to an excessively lateral TT, tight lateral retinaculum, external tibial torsion, and valgus deformity. The single-leg squat can be very beneficial in determining the patient's ability to control coronal and axial plane stability with dynamic stabilizers including the gluteus medius and abductors. This maneuver can also be used to evaluate for Trendelenburg hip drop during squatting. Before beginning with palpation, an evaluation of hyperlaxity should be performed by determining the patient's Beighton criteria.

Palpation should start with evaluation for effusion through ballottement, followed by range of motion including active and passive hyperextension and during flexion evaluation of crepitus, popping, or clicking.¹³ Patients who present with focal lateral facet or lateral retinacular pain may have lateral patellar hypercompression syndrome, these patients often present with inferomedial patella pain and pain along the anterior-medial joint line during palpation of the joint. In addition, lateral patellar hypercompression syndrome can be specifically evaluated by evoking pain relief when centering the patella within the trochlea at 45° of flexion. Patellar grind is performed in extension with distal and posterior pressure to elicit pain due to

patellofemoral cartilage damage. This should be checked bilaterally as typically the patient will find the exam uncomfortable but not painful in the asymptomatic knee.

When evaluating patients with patellofemoral pain, it is crucial to determine their patellar mobility. Similarly, performing this exam on patients with nonpatellofemoral complaints can aid the clinician in determining normal findings. Patellar tilt is tested with the knee in 0°-20° of flexion. The examiner first attempts to evert the patella both medially and laterally. If the patella is unable to be everted on the lateral side to neutral this may be due to an overly tight lateral retinaculum. Patients with a prior limited lateral release can be everted to neutral while those with an excessive lateral release may evert 30°-90° and should be tested for medial apprehension/instability. Medial and lateral displacement of the patella can be tested with a patellar glide test, which utilizes a quadrant system between 1 and 4. Scoring ranges from 1, which suggests lateral retinacular tightness, and 4 which suggests hypermobility. In addition, there are "A" and "B" modifiers where "A" represents a firm endpoint and "B" represents a soft endpoint. Asymptomatic patients typically have 1-2A of lateral displacement and 2B of medial displacement. Finally, an apprehension test is critical to evaluate in patients with perceived patellar instability. The lateral and medial apprehension tests are performed with the knee in throughout range of motion including full extension and moving through flexion. The test is considered positive when the patient feels a reproduction of their symptoms of instability during patellar translation.

Imaging

Knee imaging is useful in gathering clinical evidence of lateral retinacular tightness or patellar malalignment. Initial imaging typically consists of standard conventional anteroposterior, Rosenberg posteroanterior (45° of flexion), lateral, and Merchant views. The lateral view can be used to calculate patellar height using the Caton-Deschamp, Insall-Salvati, or Blackburn-Peel methods.¹⁴ Caton-Deschamp has been suggested to be a more reliable method due to its low interobserver variability and that it is unaffected by TT movement unlike the Insall-Salvati.¹⁵ The lateral radiograph is more useful for evaluation of trochlear dysplasia than the Merchant view and is typically classified using the Dejour classification.¹² The merchant view may suggest patellar tilt (but true tilt needs referencing to the posterior condylar plane) and tracking (yet tracking is most abnormal in early flexion, not the 45° of most Merchant views) (Fig. 1). Obtaining a true lateral is crucial as measurements of patellar tilt, as described by Mardague and Malghem in 1985, patellar height, a and trochlear dysplasia can be affected by a poor radiograph (Fig. 2).¹⁶ AP and PA views can help rule out tibiofemoral arthritis while also demonstrating changes associated with femoral anteversion. Hip to ankle radiographs are used to measure the mechanical axis and anatomical axis, in order to determine varus or valgus deformity of the limb.

Magnetic resonance imaging allows assessment of the soft tissues surrounding the patella, such as the proximal

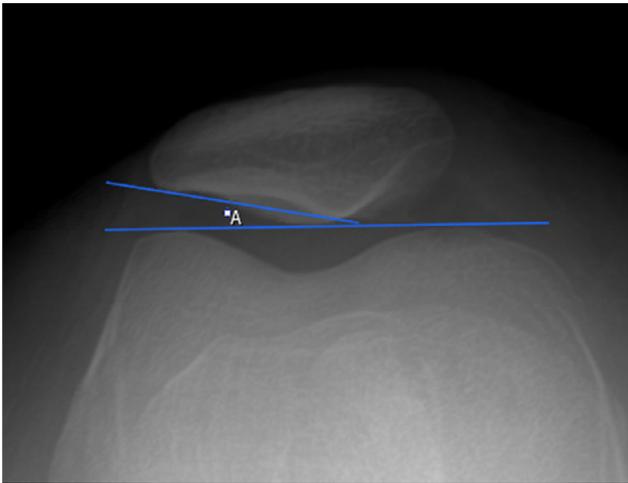


Figure 1 Lateral patellofemoral angle.

and distal patellar restraints and lateral retinaculum with extensions to the IT band. Axial and sagittal views are useful in assessing patellofemoral cartilage pathology, dysplasia and/or maltracking. Measurements of TT-tibial groove and TT-posterior cruciate ligament distances help assess the TT position that may contribute to patellar maltracking.

Anatomical Basis of Lateral Retinacular Surgery

The lateral retinaculum is a complex structure with multiple attachments. Merican and Amis reported their anatomical dissections of the lateral retinaculum in 35 cadavers and described multiple layers.¹⁷ Several of these layers merge and change as the dissection courses from proximal to distal. Fulkerson and others have simplified the approach to these layers by labeling 2 key layers: the superficial oblique and the deep transverse (Fig. 3).¹⁸ The superficial layer consists of the iliotibial band, the patellar tendon, and the vastus lateralis. While, the deep layer consists of the lateral patellofemoral ligament (LPFL), lateral patellotibial ligament, and the patellotibial band.¹⁷ The anatomy of the LPFL is poorly understood but it acts analogously to the MPFL in maintaining patellar tracking and alignment. A recent study by Capkin et al described the fan like nature of the femoral and patellar osseous attachment sites of the LPFL.¹⁹ Furthermore, they identified the insertion site on the femur to be along the superior or middle aspect of the vertical axis and along the middle aspect on the sagittal axis. Further studies are needed to further characterize the exact location and size of the LPFL attachment sites and their relationship to anatomical landmarks for surgeries of the lateral retinaculum.

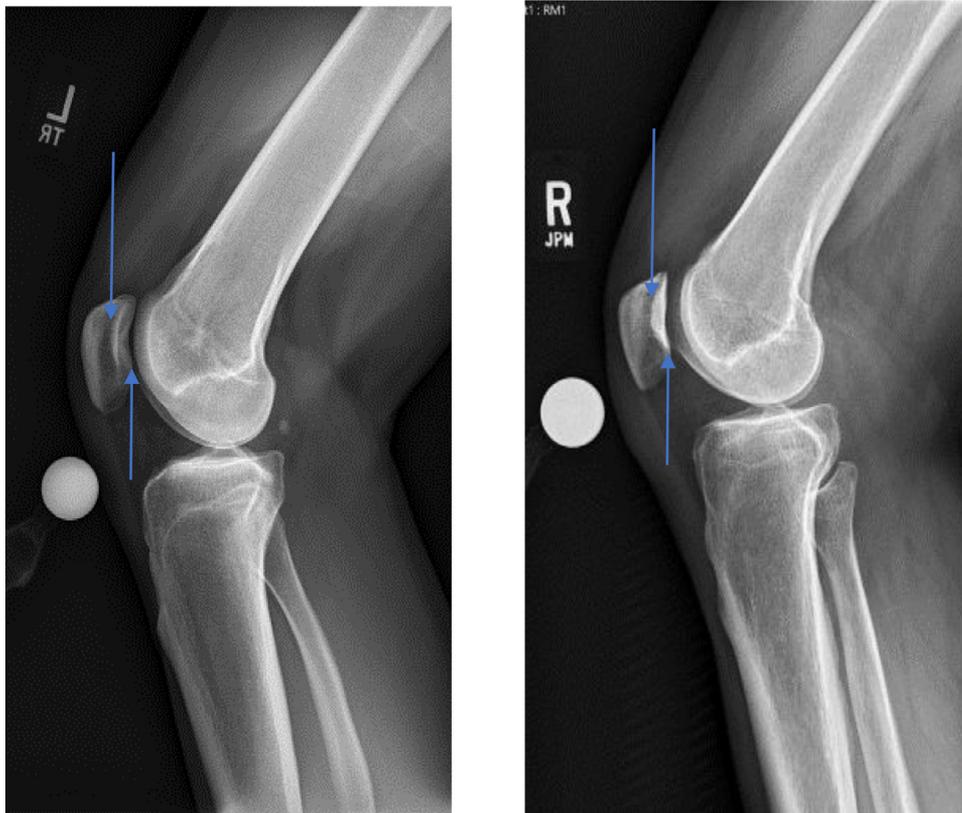


Figure 2 Analysis of normal (left) and increased (left) patellar tilt on lateral radiograph.

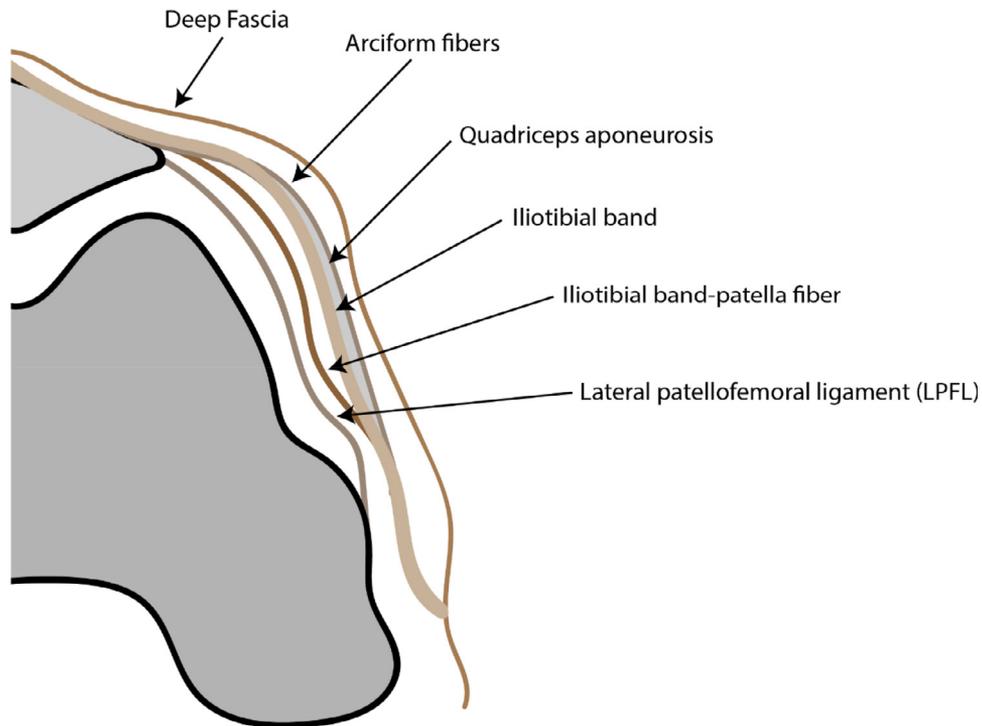


Figure 3 Anatomy of the lateral retinaculum.

Lateral Lengthening

Indication

Lateral retinacular lengthening may be indicated in patients who present with patellar lateral facet/lateral retinacular pain with a clinical and imaging findings (true lateral or magnetic resonance imaging) of a tight retinaculum that fails extensive conservative treatment including physical therapy and mobilization. In recent years, lateral lengthening has taken the place of lateral release when used in conjunction with medial patellar restraint reconstruction and for chronic lateral patellar maltracking.

Surgical Technique

The patient is positioned supine on a regular operating room table and a tourniquet is placed on the operative leg and the nonoperative leg is padded appropriately. An examination under anesthesia is conducted to evaluate medial and lateral patellar translation as well as hip internal and external rotation. Standard inferolateral and medial portals are established, and diagnostic arthroscopy is performed, with particular attention being paid to the mobility of the patella and integrity of the cartilage surfaces.

After arthroscopy, a lateral incision approximately 3 cm in length is made from the proximal to distal border of the patella about 2-3 cm posterior to the patella. Subcutaneous tissues are then dissected, and the lateral retinaculum is identified. The superficial oblique fibers of the lateral retinaculum are carefully identified and then sectioned from the deep transverse fibers. This is performed through a longitudinal incision 1 cm posterior to the patellar border, the superficial oblique fibers are then elevated from deep transverse fibers

posteriorly for a distance of 1-2 cm to allow for adequate lengthening. At this level, the transverse fibers are easily palpated as a separate robust structure and are transected in parallel (2 cm posteriorly) with the original incision through the oblique fibers. Depending on the indication, the cut ends of the superficial oblique and deep transverse fibers can then be closed either at this time or at the end of the procedure. Typically, the length can be set with the patella centrally engaged in the trochlea and should be checked through a full range of motion to ensure that there is no significant tension on the repair. (Figs. 4 and 5). Displacement and tilt of the patella should be examined after repair to ensure the patient does not have pathologic tilt and that displacement is normalized.

Lateral Release

Indications

Similar to lateral lengthening, precise indications for a lateral release procedure remain unclear. Historically, lateral release was commonly utilized in a variety of situations including patellofemoral pain, retropatellar crepitus, patellar instability, and lower extremity malalignment.²⁰ A common indication was patellar instability and it was performed in conjunction with MPFL reconstructive surgeries in patients with lateral patellar instability. However, as our understanding of the importance of the lateral patellar stabilizers grows, using lateral release as an adjunct procedure for instability is falling out of favor. Current indications for lateral release include patients with a tight lateral retinaculum and lateral patellar hypercompression syndrome that has failed conservative

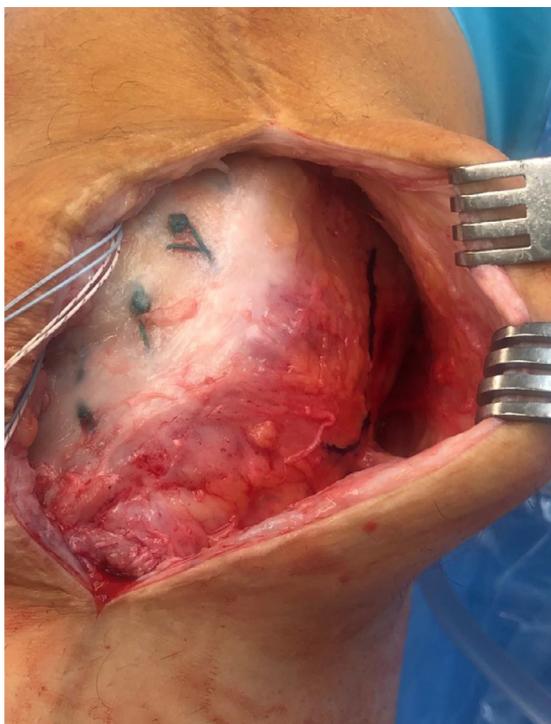


Figure 4 Lateral lengthening.



Figure 5 Lateral lengthening.

management, consisting of physical therapy and bracing or taping.²¹ Lateral release is also performed in patients undergoing total and partial knee replacement to improve tracking. However, even in this setting patients can develop iatrogenic medial instability and care should be taken to determine if a lengthening procedure is more appropriate. While the procedure was historically performed in an open fashion, most surgeons currently perform lateral release through an arthroscopic approach. It should be noted that even patients with an arthroscopic release can still have a functionally significant release even though the incisions will appear smaller.

Surgical Technique

The initial steps of the procedure are identical to that described in the lateral lengthening technique section. Lateral release can be performed arthroscopically or open depending on the severity of the contracture. Historically, the open procedure involved release from the tibia distally to the vastus proximally. More commonly, the procedure is performed arthroscopically to allow for a more limited approach. The lateral retinaculum is visualized arthroscopically, and manual lateral translation is performed while viewing the patellofemoral joint arthroscopically to determine the degree of tightness. If the lateral retinaculum appears tightened, it will be sectioned approximately 1 cm lateral to the patella layer by layer until the patella releases to neutral (Fig. 6). Typically, the surgeon can visually and through palpation determine the specific location of the LPFL which is the main structural component that is sectioned during release. The transection is approximately the length of the patella, about 3 cm and

should not enter the vastus lateralis tendon.²² It is essential to achieve hemostasis with the tourniquet deflated.

Complications

The use of lateral release still remains controversial, largely in part due to the complications associated with this procedure. The most commonly cited complication is postoperative iatrogenic medial patellar instability, however, other complications such as hemarthrosis have also been noted in the literature.²³ A meta-analysis found the complication rate of medial instability to be 57%.²⁴ Furthermore, a patient is more likely to develop this complication if the vastus lateralis is also sectioned (OR = 16.49) or if there was no preoperative clinical evidence of tight lateral retinaculum (OR = 14.37). Medial patellar instability often presents as anterior knee pain with a positive medial apprehension test on physical exam and can be associated with medial dislocation or subluxation events. Treatment for this complication begins with conservative management, and surgery may be indicated if conservative management fails. Procedure options include lateral retinacular repair or reconstruction and LPFL reconstruction.²⁵⁻²⁷

Outcomes

Outcomes of lateral retinacular lengthening procedures have been mixed, which may be due to the heterogeneity of the underlying indication for the procedure. This is illustrated by a study conducted by Panni et al, which retrospectively reviewed outcomes of patients who underwent lateral release for either



Figure 6 Lateral release.

pain ($n = 50$) or instability ($n = 50$).²⁸ The pain group had significantly greater satisfaction with the surgery ($P < 0.05$), suggesting outcomes may be related to preoperative diagnosis.

Lateral Release vs Lateral Lengthening

The outcomes of both lateral patellar retinacular lengthening and lateral retinacular release have also been compared. An early randomized control study by O'Neill et al evaluated differences in this procedure in a cohort of 86 patients who had increased lateral patellar tilt and symptomatic anterior knee pain.²⁹ No differences were seen at the final follow-up at an average of 46 months in terms of return to sport, range of motion, quadriceps circumference, or postoperative complications. However, the lateral release group reported inferior Lysholm and Tegner scores ($P = 0.028$). In addition, a randomized control study by Pagenstert et al compared these 2 operations in 28 patients with lateral patellar hypercompression syndrome.³⁰ At an average of 2-year follow-up, medial patellar stability, quadriceps atrophy, and patient reported outcomes were compared. LR release had a higher likelihood of medial subluxation as tested with the patellar glide test ($P = 0.041$), quadriceps atrophy (release: 1.8 cm, lengthening: 0.2 cm, $P = 0.001$), and Kujala scores (release: 77.2, lengthening 88.4, $P = 0.035$).³⁰ Based on these studies, lateral retinacular release may produce inferior outcomes compared to lengthening procedures.

Lateral Release Outcomes

As mentioned, lateral retinacular release can be used in patients with lateral patellar compression syndrome or in cases of patellofemoral pain that fail conservative

management options. Outcomes in both scenarios have been investigated. For example, in a retrospective study by Kramer et al, they found that at a mean follow-up of 4.4 years, 36% of patients no longer reported having any pain with an 87% return to sport rate, suggesting the modest success of the surgery in this population.³¹

Long-term failure of the lateral release procedure has also been investigated. A retrospective study by Gerbino et al of 140 knees evaluated long-term outcomes, with follow-up between 5 and 22 years after surgery.³² They found that the Kaplan-Meier survival, where failure was defined as reoperation, was 78% at 15 years. No risk factors that increased risk of failure were identified. This suggests a positive success of the procedure, however, risk factors that increase risk of failure still need to be investigated.

Lateral release outcomes have been explored in patients with recurrent lateral dislocation. As many as 43.7% of patients who undergo medial restraint surgery have been reported to undergo lateral retinacular release.³³ One study by Malatray et al investigated the clinical effect of lateral retinacular release in 43 patients.³⁴ No significant differences were seen in IKDC score or patellar tilt 12 months postoperatively. Generally, lateral release is not to be used in isolation to treat lateral patellar dislocation but can be used in association with an MPFL procedure in patients with patellar tilt over 20°. A study by Richetti et al conducted a systematic review of 14 studies with 247 knees evaluating the outcomes of patients who underwent lateral release compared to those who underwent lateral release with medial soft-tissue realignment.³⁵ Patients who underwent isolated lateral retinacular release had significantly inferior results: success with isolated release was 77.3% compared to 93.6% in lateral release with medial soft-tissue realignment. Furthermore, patients who underwent isolated lateral release were more likely to have postoperative instability ($P < 0.001$). This study supports that isolated lateral release should not be utilized in isolation for patellar instability.

Future Directions

There remains ambiguity in the literature regarding a consensus on the proper indications for lateral release and lateral lengthening surgery and this is exacerbated by the lack of studies in the past decade. High-level evidence is needed to support the use of lateral retinacular lengthening in patients with patellofemoral pain that fail conservative management. Furthermore, future research is needed to address the lack of outcome studies in these patients.

Conclusion

Lateral release and lateral lengthening have been utilized in patients with patellofemoral pain and a tight retinaculum. The main conclusions from this chapter include:

- The lateral retinaculum is an important lateral stabilizer of the patella

- Lateral release is rarely performed but may be utilized in severe cases of lateral patellar hypercompression syndrome and patients with maltracking after a TKA
- Lateral lengthening is preferred when treating a symptomatic, tight lateral retinaculum or patellar instability
- Limited lateral lengthening outcome studies exist, but the few that do have shown that lateral lengthening provides superior outcomes and decreases the risk for iatrogenic medial instability compared to lateral release.

References

1. Hautamaa PV, Fithian DC, Kaufman KR, et al: Medial soft tissue restraints in lateral patellar instability and repair. *Clin Orthop Relat R* 349:174-182, 1998
2. Elias DA, White LM, Fithian DC: Acute lateral patellar dislocation at MR imaging: Injury patterns of medial patellar soft-tissue restraints and osteochondral injuries of the inferomedial patella. *Radiology* 225:736-743, 2002
3. Desio SM, Burks RT, Bachus KN: Soft tissue restraints to lateral patellar translation in the human knee. *Am J Sports Med* 26:59-65, 1998
4. Hunter DJ, Zhang YQ, Niu JB, et al: Patella malalignment, pain and patellofemoral progression: The Health ABC study. *Osteoarthr Cartilage* 15:1120-1127, 2007
5. Sebro R, Weintraub S: Association between lateral patellar osteoarthritis and knee morphology and alignment in young adults. *Clin Radiol* 72:793.e11-793.e18, 2017
6. Krompinger JW, Fulkerson JP: Lateral retinacular release for intractable lateral retinacular pain. *Clin Orthop Relat R* 179:191-193, 1983
7. Miller R, Bartlett J: Recurrent patella dislocation treated by closed lateral retinacular release. *Aust Nz J Surg* 63:200-202, 1993
8. Schonholtz GJ, Zahn MG, Magee CM: Lateral retinacular release of the patella. *Arthrosc J Arthrosc Relat Surg* 3:269-272, 1987
9. Larson RL, Cabaud HE, Slocum DB, et al: The patellar compression syndrome: Surgical treatment by lateral retinacular release. *Clin Orthop Relat R* 1978: 158-67
10. Sanders TL, Pareek A, Hewett TE, et al: Incidence of first-time lateral patellar dislocation: A 21-year population-based study. *Sports Heal Multidiscip Approach* 10:146-151, 2018
11. Fithian DC, Paxton EW, Post WR, et al: Lateral retinacular release: A survey of the international patellofemoral study group. *Arthrosc J Arthrosc Relat Surg* 20:463-468, 2004
12. Dejour H, Walch G, Neyret P, et al: [Dysplasia of the femoral trochlea]. *Revue De Chir Orthopédique Et Réparatrice De L'appareil Moteur* 76:45-54, 1990
13. Dixit S, DiFiori JP, Burton M, et al: Management of patellofemoral pain syndrome. *Am Fam Physician* 75:194-202, 2007
14. Insall J, Salvati E: Patella position in the normal knee joint. *Radiology* 101:101-104, 1971
15. Gracitelli GC, Pierami R, Tonelli TA, et al: Assessment of patellar height measurement methods from digital radiography. *Revista Brasileira De Ortopedia Engl Ed* 47:210-213, 2012
16. Maldague B, Malghem J: Significance of the radiograph of the knee profile in the detection of patellar instability. Preliminary report. *Revue De Chir Orthopédique Et Réparatrice De L'appareil Moteur* 71 Suppl 2:5-13, 1985
17. Merican A, Amis A: Anatomy of the lateral retinaculum of the knee. *J Bone Jt Surg Br Volume* 90-B:527-534, 2008
18. Fulkerson JP, Gossling HR: Anatomy of the knee joint lateral retinaculum. *Clin Orthop Relat R* 153:183-188, 1980
19. Capkin S, Zeybek G, Ergur I, et al: An anatomic study of the lateral patellofemoral ligament. *Acta Orthop Traumatol* 51:73-76, 2017
20. Kolowich PA, Paulos LE, Rosenberg TD, et al: Lateral release of the patella: Indications and contraindications. *Am J Sports Med* 18:359-365, 1990
21. Unal B, Hinckel BB, Sherman SL, et al: Comparison of lateral retinaculum release and lengthening in the treatment of patellofemoral disorders. *Am J Orthop Belle Mead N J* 46:224-228, 2017
22. Iranpour F, Merican AM, Amis AA, et al: The Width:thickness ratio of the Patella. *Clin Orthop Relat R* 466:1198-1203, 2008
23. Schneider T, Fink B, Abel R, et al: Hemarthrosis as a major complication after arthroscopic subcutaneous lateral retinacular release: A prospective study. *Am J Knee Surg* 11:95-100, 1998
24. Song G-Y, Hong L, Zhang H, et al: Iatrogenic medial patellar instability following lateral retinacular release of the knee joint. *Knee Surg Sports Traumatol Arthrosc* 24:2825-2830, 2016
25. McCarthy MA, Bollier MJ: Medial patella subluxation: Diagnosis and treatment. *Iowa Orthop J* 35:26-33, 2015
26. Beckert M, Crebs D, Nieto M, et al: Lateral patellofemoral ligament reconstruction to restore functional capacity in patients previously undergoing lateral retinacular release. *World J Clin Cases* 4:202, 2016
27. Sanchis-Alfonso V, Montesinos-Berry E, Monllau J, et al: Results of isolated lateral retinacular reconstruction for iatrogenic medial patellar instability. *Arthrosc J Arthrosc Relat Surg* 31:422-427, 2015
28. Panni A, Tartarone M, Patricola A, et al: Long-term results of lateral retinacular release. *Arthrosc J Arthrosc Relat Surg* 21:526-531, 2005
29. O'Neill D: Open lateral retinacular lengthening compared with arthroscopic release. A prospective, randomized outcome study. *J Bone Jt Surg Am Vol* 79:1759-1769, 1997
30. Pagenstert G, Wolf N, Bachmann M, et al: Open lateral patellar retinacular lengthening versus open retinacular release in lateral patellar hypercompression syndrome: A prospective double-blinded comparative study on complications and outcome. *Arthrosc J Arthrosc Relat Surg* 28:788-797, 2012
31. Kramer DE, Kalish LA, Abola MV, et al: The effects of medial synovial plica excision with and without lateral retinacular release on adolescents with anterior knee pain. *J Child Orthop* 10:155-162, 2016
32. Gerbino PG, Zurakowski D, Soto R, et al: Long-term functional outcome after lateral patellar retinacular release in adolescents. *J Pediatr Orthoped* 28:118-123, 2008
33. Arshi A, Cohen JR, Wang JC, et al: Operative management of patellar instability in the United States. *Orthop J Sports Med* 4:2325967116662873, 2016
34. Malatray M, Magnussen R, Lustig S, et al: Lateral retinacular release is not recommended in association to MPFL reconstruction in recurrent patellar dislocation. *Knee Surg Sports Traumatol Arthrosc* 1-6, 2018. <https://doi.org/10.1007/s00167-018-5294-7>
35. Ricchetti ET, Mehta S, Sennett BJ, et al: Comparison of lateral release versus lateral release with medial soft-tissue realignment for the treatment of recurrent patellar instability: A systematic review. *Arthrosc J Arthrosc Relat Surg* 23:463-468, 2007