

Comparison of Lateral Retinaculum Release and Lengthening in the Treatment of Patellofemoral Disorders

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Abstract

For lateral retinaculum (LR) tightness, release or lengthening is the indicated surgical correction. LR release (LRR) or lengthening (LRL) may be a primary **treatment for painful lateral compression syndrome** or as an adjunct treatment in the setting of patellofemoral **instability**. Although it is challenging, assessment of the soft-tissue **balance** between the medial restraint (the medial patellofemoral ligament) and the lateral restraint (the lateral retinaculum) is fundamental to a good outcome.

LRR and LRL are **effective** in the treatment of patellofemoral disorders in which lateral tightness is part of the pathology. **Understanding the indications for treatment is essential**. Although both procedures have standard postoperative complications, LRL as an alternative to LRR maintains lateral soft-tissue integrity and avoids **iatrogenic** medial patellar laxity, which is a serious complication with LRR. For these reasons, we recommend using LRL to address LR tightness in patellofemoral disorders.

factors. One difficult aspect of anatomical assessment is judging the soft-tissue **balance** between the medial restraints (medial patellofemoral ligament [MPFL]; medial quadriceps tendon to femoral ligament; medial patellotibial and patellomeniscal ligaments) and the lateral restraints (lateral retinaculum [LR] specifically). Both LR tightness and patellar instability can be interpreted as anterior knee pain. Differentiating these entities is one of the most difficult clinical challenges in orthopedics.

LR **release** (LRR) has been found to improve patellar **mobility and tracking**.¹ In the absence of clearly defined guidelines, the procedure quickly gained in popularity because of its technical simplicity and the enticing “one tool fits all” **treatment** approach suggested in early reviews. Injudicious use of LRR, alone or in combination with other procedures, led to iatrogenic instability and chronic pain. LR lengthening (LRL) was introduced to address LR tightness while maintaining lateral soft-tissue integrity and avoiding some of the severe complications of LRR.²

Today, isolated use of LRR/LRL is recommended only for treatment of **LR tightness** and pain secondary to **lateral patellar hypercompression**.³ It can also be used as an adjunct treatment in the setting of patellofemoral instability. LRR/LRL should never be used as primary treatment for patellofemoral instability.

In this review of treatments for LR tightness and patellofemoral disorders, we compare the use of LRR and LRL.

Discussion

LR procedures are indicated for LR tightness, which is assessed by taking a history, performing a physical examination, and obtaining diagnostic imaging. Decisions should be based on all findings considered together and never on imaging findings alone.

Anterior knee pain is a common clinical problem that can be **challenging** to correct, in large part because of **multiple** causative factors, including structural/anatomical, functional, alignment, and neuroperception/pain pathway

Authors' Disclosure Statement: The authors report no actual or potential conflict of interest in relation to this article.

Physical Examination

The physical examination should include assessment of limb alignment, patellar mobility, muscle balance, and dynamic patellar tracking.

Limb Alignment. Abnormal valgus, rotational deformities, and increased Q-angle are associated with LR tightness. Valgus alignment can be assessed on standing inspection; rotational deformities with increased hip anteversion by hip motion with the patient in the prone position (increased hip internal rotation, decreased hip external rotation); and Q-angle on weight-bearing standing examination and with the patient flexing and extending the knee while seated.

Patellar Mobility. The patellar glide and tilt tests provide the most direct evaluations of LR tightness. Medial displacement of <1 quadrant is consistent with tightness, and displacement of >3 quadrants is consistent with laxity. In full extension, the patellar glide test evaluates only the soft-tissue restraints; at 30° flexion, it also evaluates patellofemoral engagement. The patellar tilt test measures the lifting of the lateral edge of the patella. With normal elevation being 0° to 20°, lack of patellar tilt means the LR is tight, and tilt of >20° means it is loose. MPFL patency can be examined with the Lachman test; the examiner rapidly moves the patella laterally while feeling for the characteristic hard endpoint of lateral translation.

Muscle Balance. The tone, strength, and tightness of the core (abdomen, dorsal, and hip muscles) and lower extremities (quadriceps, hamstrings, gastrocnemius) should be evaluated.

Dynamic Patellar Tracking. The J-sign is the course (shaped like an inverted J) that the patella takes when it is medialized into the trochlea from its laterally displaced resting position as the knee goes from full extension to flexion. The J-sign can be associated with LR tightness, trochlear dysplasia, and patella alta.

Imaging

Although we cannot provide a comprehensive review of the imaging literature, the following radiologic examinations should be used to assess the patellofemoral joint.

30° Lateral Radiograph. Increased tilt is seen when the lateral facet is not anterior to the patellar ridge. Also evaluated are trochlear anatomy, patellar height, and other factors involved in patellofemoral disorders.

30° Flexed Axial (Merchant) Radiograph. Patellar tilt, subluxation, and trochlear dysplasia are

evaluated. Images obtained with progressive flexion can be very useful in verifying patellar tilt reduction. Lack of reduction during early flexion suggests LR tightness.⁴

Alignment Axial Radiographs (Scanogram). Valgus alignment is assessed with this full-length, standing, long-leg examination.

Computed Tomography/Magnetic Resonance Imaging. Many parameters of patellar alignment have been described. Basic assessment should include evaluation of patellar tilt, angle by the line across posterior condyles and a line through the greatest patellar width (>20° indicates abnormality and LR tightness) and tibial tubercle-trochlear groove distance (computed tomography or magnetic resonance imaging scan of the knee is used to measure this distance, and to confirm a significant amount in light of complex patellofemoral malalignment⁵).

Indications

Lateral compression syndrome with LR tightness is often successfully treated with isolated LRR, and results are reproducible and predictable.⁶ Surgical intervention for patellofemoral pain should be undertaken only after failed extensive nonoperative treatment with physical therapy and bracing/taping. Patients with LR tightness on preoperative examination, lateral patellar tilt on imaging, and normal Q-angle can obtain satisfactory results with this procedure. Patellar subluxation or dislocation history, high Q-angle (>20°), grade 3 or 4 chondral injury, and patellofemoral arthritis are associated with poorer outcomes when the procedure is performed in isolation.⁹ International Patellofemoral Study Group members agreed that LRR/LRL is a valid treatment option when indicated, but it is rarely performed in isolation and constitutes only 1% to 2% of surgeries performed by this group of experts.⁷ When lateral compression syndrome progresses to arthritis, LRR/LRL can be performed with lateral patella facetectomy for maximal improvement.⁴ In the setting of patellofemoral instability, LRR/LRL can be combined with proximal and/or distal realignment surgery if the LR is tight. The LR is the last line of defense limiting lateral translation in the setting

Take-Home Points

- Understanding the indications for treatment is essential.
- Identifying the superficial (oblique fibers) and deep layers (transverse fibers) of the LR is very important and can lengthen the LR by as much as 20 mm.
- Open procedures reduce the risk of hematomas and related pain.
- The goal is to obtain 1 or 2 patellar quadrants of medial and lateral patellar glide in extension and a neutral patella.
- If the Z-plasty is combined with MPFL reconstruction or tibial tubercle transfer, the LR is set to length after the tubercle transfer and before the MPFL reconstruction (to avoid overconstraint).

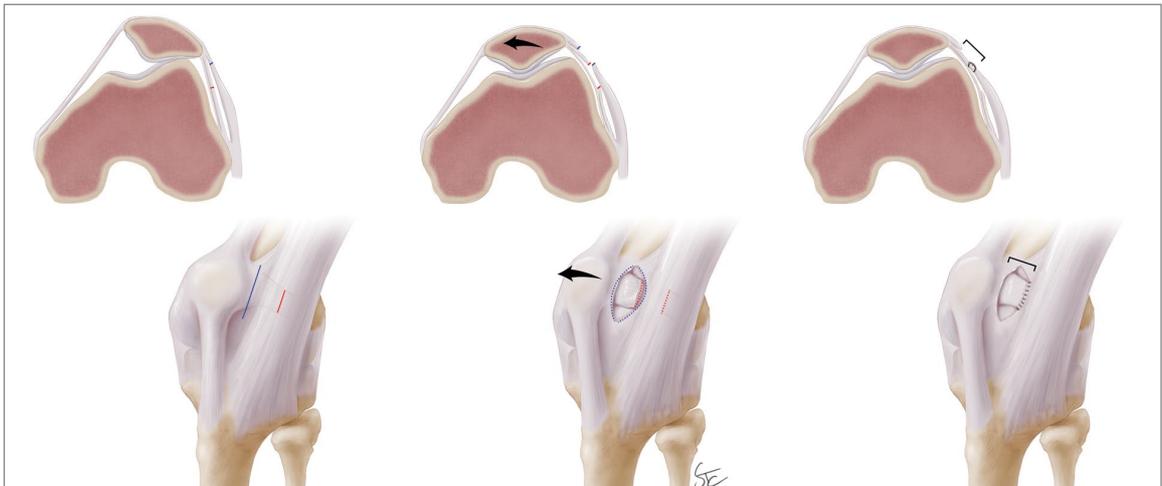


Figure 1. Illustration of lateral retinaculum (LR) lengthening. The 2 leftmost images depict a laterally subluxed patella with tight LR. The LR has 2 distinct layers—superficial oblique fibers (blue) from anterior iliotibial band and deep transverse fibers (red) from the femur—which insert on the superior lateral patella. The 2 center images depict LR layers sharply dissected and longitudinally cut at different levels to allow patella to reduce medially and to center on the trochlea. The 2 rightmost images depict reapproximation of 2 LR layers edge to edge at the appropriate tension.

of an incompetent MPFL. Isolated LRR/LRL in the setting of instability further destabilizes the patella and worsens the instability. Therefore, LRR/LRL is a poor surgical option as an isolated procedure for this condition and should be used only as an adjunct in cases of patellofemoral instability with LR tightness that does not allow the patella to be centralized into the trochlea.⁸ LRR/LRL can also be performed to improve patellar tracking in patellofemoral arthroplasty and total knee arthroplasty.

Lateral Retinaculum Release Versus Lengthening

LRR was first described for the treatment of patellar instability in 1891.⁹ It was also used for the treatment of lateral patellar hypercompression syndrome associated with LR tightness that led to lateral patellar tracking, joint overload, degeneration, and anterior knee pain.¹⁰ Metcalf¹⁰ further popularized the procedure by describing a minimally invasive arthroscopic version. However, the arthroscopic technique is as aggressive as the open technique and may be performed with less control, potentially making its results more variable. As proximal and distal releases are performed from the “inside out,” more capsule and muscle disruption is needed to release the more superficial layers.

Z-plasty lengthening of the LR was described as an alternative for maintaining lateral patellar soft-tissue integrity while reducing the tension of the lateral tissue restraints.³ This is our preferred method.

Performing LRL instead of LRR avoids iatrogenic medial patellar instability, avoids overrelease and muscle injury, and improves soft-tissue balance.³ Open release or lengthening reduces inadver-

tent injury to the lateral superior/inferior geniculate arteries and allows direct hemostasis. Two prospective randomized studies found functional knee outcomes and return to athletic activities were improved more after LRL than LRR.^{11,12} These procedures had similar rates of postoperative knee stiffness, decreased muscle mass, and decreased strength. Each prospective study used an extensive LRR technique for LRR cases (various authors have recommended performing the release until the patella is perpendicular to the trochlea), which may have affected outcomes. In any case, with lengthening, the surgeon is less likely to excessively disrupt the lateral tissues.

Lateral Retinaculum Release. LRR can be openly performed by lateral parapatellar incision,¹ a mini-open percutaneous technique, or arthroscopy. For these open techniques, incisions of various sizes have been used to access the LR and incise it about 1 cm lateral to the patella starting at the distal end of the vastus lateralis and extending distally until patellar tilt reduction is sufficient. If tightness in deep flexion persists, the LRR can be extended distally to the tibial tubercle. Open techniques have the advantage of sparing the joint capsule. All-arthroscopic techniques involve using electrocautery to cut through the capsule and access the LR.

Lateral Retinaculum Lengthening. The LR is sharply divided into a superficial layer of superficial oblique fibers from the anterior iliotibial band and a deep layer of transverse fibers from the femur. For LRR, these 2 layers must be identified separate from the articular capsule.¹³

Figure 1 illustrates the anatomy and the es-

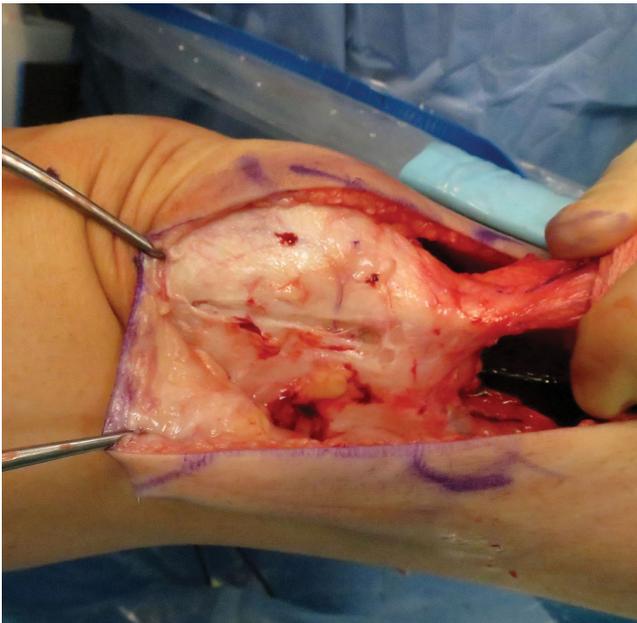


Figure 2. Exposed proximal lateral soft tissues of the patella. The outer layer of the lateral retinaculum is sharply incised at the lateral border of the patella.

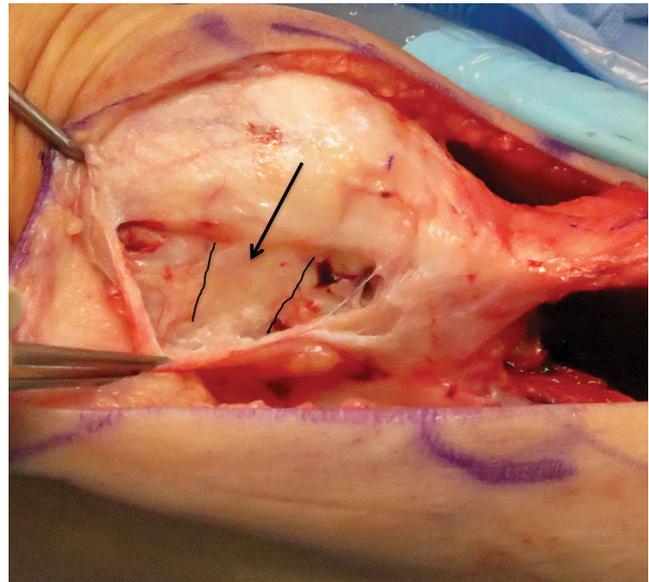


Figure 3. The superficial oblique fibers of the lateral retinaculum (LR) are sharply dissected from the deep transverse fibers and are elevated as dissection is carried posteriorly, exposing the deep LR layer (arrow). The actual deep LR layer is only 1.5 cm to 2 cm wide (2 black lines). Dissection is propagated until appropriate length (≤ 2 cm) is achieved.

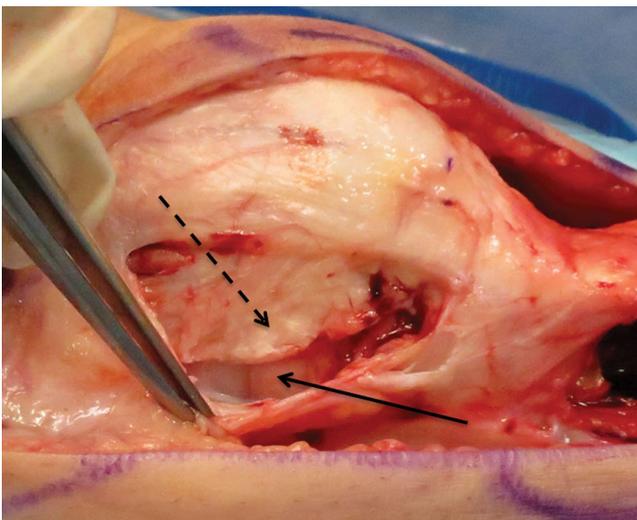


Figure 4. The deep transverse fibers (dashed arrow) are then incised longitudinally. The underlying capsule is visualized (solid arrow).

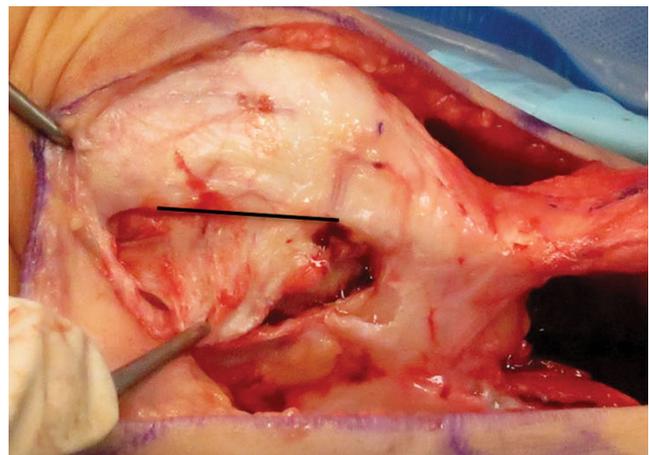


Figure 5. The cut edges of the superior oblique and deep transverse fibers are then sutured together, with appropriate lengthening performed to remove excess tension in lateral structures while maintaining lateral soft-tissue integrity. The black line indicates the original position of the superficial lateral retinaculum layer. Length of as much as 2 cm can be obtained.

sential steps of the procedure. The fascia lata is carefully removed over the lateral patella, releasing some lateral tension and helping in the identification of the superficial and deep layers. The proximal lateral soft tissues of the patella are exposed, and the outer oblique layer of the LR is incised near the lateral border of the patella (**Figure 2**). The incision begins around the level of the proximal patellar pole and extends distally to the inferior patellar pole. The superficial oblique fibers of the LR are sharply dissected from the deep transverse fibers

and are elevated as dissection is carried posteriorly to the posterior-most extent of the retinacular envelope, usually 1 cm to 2 cm (**Figure 3**). The deep transverse fibers are then incised longitudinally (**Figure 4**). In many cases, a capsule that adheres to the deep layer can be separated from it. In cases with combined tibial tubercle transfers, the capsule is incised in order to mobilize the patella medially or distally. Then, the knee is moved through its full range of motion, positioned in 30° flexion, and engaged into the trochlear groove. The length of both

the MPFL and the LR can then be adjusted. The cut edges of the superior oblique and deep transverse fibers are then sutured together with absorbable suture, and the appropriate amount of lengthening is performed to remove excess tension in lateral structures while maintaining lateral soft-tissue integrity (**Figure 5**). Neither the MPFL nor the LR is tensioned; rather, their lengths are adjusted, as they act as checkreins guiding the patella. If this procedure is performed with tibial tubercle transfer (medial and/or distal) or MPFL reconstruction, tubercle fixation is done first; next, MPFL length and then LR length are set.

Complications

Complications of performing LRR/LRL to change the lateral restraint include medial patellar instability, increased lateral pain, repair failure, recurrent lateral instability, quadriceps weakness and atrophy, postoperative hemarthrosis, knee stiffness, wound complications, and thermal skin injury.⁷ These complications often result from poor surgical technique and too aggressive release. Although recommended patellar tilt historically has varied from 45° to 90°, the current goal is to normalize the tight soft-tissue restraints without creating secondary instability.

The most significant complication of LRR is medial patellar instability caused by muscle atrophy and loss of soft-tissue restraint.¹⁴ Medial instability can be difficult to diagnose and should be considered in any patient with patellofemoral pain, popping, or patellar instability after LRR.¹⁵ A positive medial subluxation test or medial patellar apprehension test suggests medial instability.

Medial patellar instability usually requires surgical treatment. Direct LR repair, lateral soft-tissue reconstruction, and other procedures can be used to restore lateral restraint.¹⁵ However, these are salvage techniques, and patients often remain significantly limited by pain or instability. Therefore, the LR must be carefully addressed and preferably should undergo lengthening rather than release.

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