Management of patellofemoral instability in the setting of multiligament knee injury

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Abstract: The term multiligament knee injury (MLKI) is applied to various injury patterns involving two or more of the major knee ligaments. While often overlooked, it is also essential to evaluate and recognize injury patterns to the medial and lateral stabilizers of the patellofemoral (PF) joint. To date, there is limited literature discussing the treatment of patellar instability in the setting of multiligament knee injuries. The review seeks to provide a clinically relevant guide to the evaluation and management of patella instability in the setting of the MLKI. We will emphasize key differences in patient demographics, injury mechanism, and presence of concomitant pathology as compared to isolated PF instability that will guide prognosis and treatment decision making.

Keywords: Multiligament knee injury (MLKI); patellofemoral instability (PF instability); medial patellofemoral ligament (MPFL); lateral patellar instability

Introduction

The term multiligament knee injury (MLKI) is used to describe combination injuries to the major knee ligament groups [anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), lateral collateral ligament (LCL) with possible involvement of the posterolateral corner (PLC), and medial collateral ligament (MCL) with possible involvement of the posteromedial corner (PMC)] (1,2). Multiligament knee injuries are relatively rare, accounting for only 0.02% to 0.2% of all orthopaedic injuries (3,4). These injuries most often present in the setting of a traumatic knee dislocation and can be associated with potentially limb threatening sequelae (e.g., neurovascular injury). In addition to the above mentioned ligamentous and neurovascular injuries, there is also possibility for injury to the soft tissue envelope stabilizing the patellofemoral joint (PFJ) (5,6).

In contrast, acute dislocations of the patella are relatively common and account for 2% to 3% of all knee injuries. They are the second most common cause of a traumatic hemarthrosis of the knee behind ACL disruption (7). The overwhelming majority of patellar dislocations are lateral (8). The vast majority of patellar dislocations most often occur in females 10 to 17 years old who participate in sporting activities (9). These injuries typically occur via a low-velocity, indirect mechanism in patients with underlying bony and soft tissue risk factors for patella instability (10,11).

There is a paucity of literature documenting the evaluation and treatment of patella instability in the setting of MLKI. In stark contrast to patella dislocation in the athletic population, the mechanism of injury is typically high velocity trauma, often in patients with normal underlying bony and soft tissue patellofemoral (PF) anatomy. A high index of suspicion is required to efficiently diagnose and effectively treat patella instability in the setting of a significant distracting ligamentous complex and/
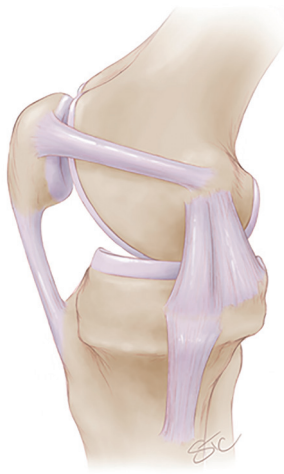
Figure 1 Illustration of the medial knee structures demonstrating the close proximity of the MPFL origin and MCL origin on the femur. MPFL, medial patellofemoral ligament; MCL, medial collateral ligament. Reproduced with permission from The Curators of the University of Missouri (copyright 2018 by The Curators of the University of Missouri).

or neurovascular injury.

The purpose of this review is to provide a clinically relevant guide to the evaluation and management of patella instability in the setting of the MLKI. As will be shown, there are key differences in patient demographics, injury mechanism, presence of concomitant pathology as compared to isolated PF instability that influence prognosis, and treatment strategy. These differences must be appreciated during patient evaluation to appropriately formulate a rational management plan. Our goal is to highlight the aspects of patella instability unique to the knee dislocation population in order to help surgeons develop a framework for treating these complex and rare combination injury patterns.

Relevant PF joint anatomy and biomechanics

### Related structures pertaining to MLKI

The PF joint consists of the patella, femoral trochlear groove, and surrounding soft tissue envelope. The major dynamic stabilizers of this joint include the quadriceps mechanism, core musculature, hip external rotators, and posterior chain (i.e., hamstrings) (12). The patella is a sesamoid bone that has the thickest articular cartilage in the body and increases the lever arm of the extensor mechanism (13). The trochlear groove is largely responsible

for providing the inherent bony stability of the PFJ when the knee is in greater than 20 to 30 degrees of flexion (14). With respect to medial soft tissue PF restraints, the medial patellofemoral ligament (MPFL) is the strongest contributor to patellar stability from approximately 0 to 30 degrees of knee flexion (12,13,15). The MPFL is a thin transverse band of retinacular tissue that provides 50% to 60% of the restraining force against lateral patellar displacement (10,15). The MPFL origin on the femur is located in the saddle region between the adductor tubercle and the medial epicondyle; this is nearby to the origin of the MCL on the femur (*Figure 1*). It inserts onto the medial aspect of the proximal two-thirds of the patella (15,16). The MPFL is torn in nearly all cases of acute patellar dislocations (8,17). The medial patellomeniscal ligament (MPML), medial patellotibial ligament (MPTL), and medial retinaculum also assist in stabilizing the patella against lateral displacement, although to a much lesser degree than the MPFL (12). The lateral retinaculum is a primary stabilizer against medial patella translation and patella eversion, as well as a secondary stabilizer to excessive lateral translation.

Bony alignment parameters are important contributors to PF joint stability. Aberrant bony anatomy predisposes to instability at lower energy and is a risk factor for recurrence. Commonly encountered abnormalities include trochlear dysplasia, patella alta, lateralized force vector [i.e., elevated tibial tubercle-trochlear groove (TT-TG) distance], knee valgus, femoral anteversion, and external tibial torsion.

Clinical evaluation of PF instability in a MLKI setting

Multiligament knee injuries can be classified according to the mechanism of injury. High-velocity injuries occur as a result of direct trauma to the knee and are typically associated with motor vehicle and motorcycle accidents or falls from height (4,18). Low-velocity injuries typically occur during sporting events. These injuries are due to either a direct blow or twisting injury to the knee (19). Ultra-low-velocity injuries occur almost exclusively in obese patients. These injuries tend to occur as the result of seemingly innocuous rotational forces associated with relatively low-energy activities that exceed the knee ligaments' inherent capacity to maintain normal joint integrity (20,21). Recognition of a MLKI is often challenging given that more than two-thirds of all knee dislocations spontaneously reduce prior to presentation (22). As a result, a high index of suspicion must be maintained when evaluating patients
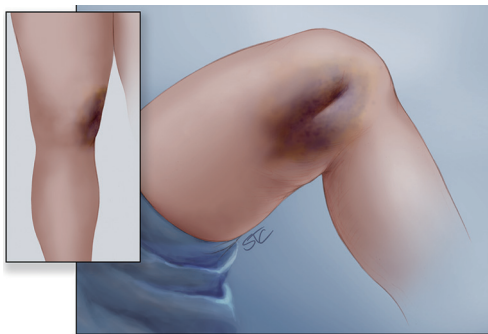
Figure 2 Illustration of a right knee dislocation demonstrating medial skin puckering, which indicates buttonholing of the medial retinaculum. Reproduced with permission from The Curators of the University of Missouri (copyright 2018 by The Curators of the University of Missouri).

with traumatic knee injuries. Similarly, it is rare for the patella to be frankly dislocated on index presentation with combined MLKI. Clinical acumen combined with astute physical examination, examination under anesthesia, stress radiography, and other imaging modalities (i.e., MRI) are critical in recognizing this specific injury pattern.

Multiligament knee injuries can also be classified according to the number and laterality of the ligaments involved using the Schenck Knee Dislocation Classification system (2,23). This classification system has five tiers that progress in severity:

❖ Knee dislocation I (KD I) signifies injury to either the ACL or PCL.
❖ KD II indicates injury to both the ACL and PCL.
❖ KD III is subclassified based on whether the MCL (KD III-M) or LCL (KD III-L) is involved.
❖ KD IV means injury to the ACL, PCL, MCL, and LCL.

KD V is a knee fracture-dislocation (24).

Interestingly, there is no additional classification system for combined injuries to the extensor mechanism. These additional injuries may include rupture of the quadriceps and/or patella tendon or patella dislocation, with or without chondral or osteochondral injury.

All MLKI patients should be initially evaluated according to Advanced Trauma and Life Support (ATLS) principles. Vascular injury is relatively uncommon (1.6% to 12% incidence) but remains a significant concern in these patients; therefore, pedal pulses and ankle brachial indices (ABI) should be assessed, documented, and compared to the contralateral limb (25-28). Several studies suggest that

physical exam alone may not be adequate to detect vascular injuries and thus recommend having a low threshold for further workup with arteriography (22,29). Nerve injury is a less severe but more common associated injury seen in 10% to 40% of patients presenting with a MLKI; the vast majority of these injuries involve the peroneal nerve (18,30).

Clinical examination includes careful attention to asymmetric laxity compared to the opposite uninvolved extremity. In addition to specific laxity testing of the major ligament groups (i.e., ACL, PCL, PLC, PMC), specific laxity testing of the medial and lateral stabilizers of the PF joint should be performed. In the awake patient, competency of the extensor mechanism can be determined by the ability of the patient to perform a straight leg raise. Extensor lag or palpable defects in the extensor mechanism suggest fracture of the patella, rupture of the quadriceps tendon, patella tendon, or medial/lateral retinaculum. In the obtunded or multiply injured patient, clinical examination is best supplemented by careful review of advanced imaging studies to ensure intact extensor mechanism. PF laxity should be evaluated in full extension and throughout the range of motion (ROM) arc if at all possible. Patellar laxity and stability should be correlated with the degree of knee flexion at which both occur. Side-to-side differences in medial or lateral PF laxity should be noted, along with palpable defects or open injuries. Obstruction to normal PF mobility or skin puckering should also be noted as it may indicate a buttonholed medial retinaculum blocking reduction of a knee dislocation (31) (*Figure 2*). Excessive medial-to-lateral translation may indicate soft tissue injury to the medial PF restraints. Lateral sided patella eversion 20 degrees past horizontal or excessive medial-to-lateral patella translation is also pathologic and may indicate injury to the lateral retinaculum. Crepitus throughout a ROM arc or firm block to extension may indicate osteochondral injury or a loose body locked within the joint (*Figure 3*). Similar to the work-up of any MLKI, a standard trauma knee X-ray series should be obtained. MRI is helpful to evaluate for damage to the soft tissue structures, to rule out chondral or osteochondral injury and/or loose body, and to identify and quantify the presence of anatomic risk factors for recurrent PF instability (i.e., trochlear dysplasia, patella alta) (*Figure 4*).
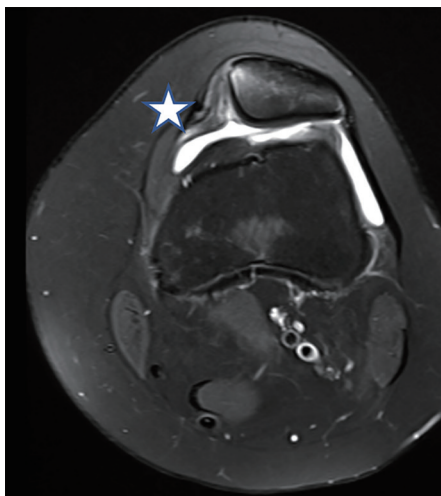
Key differences

Between isolated PF instability and combined instability in the MLKI setting

It is critical to distinguish key features of patella dislocation
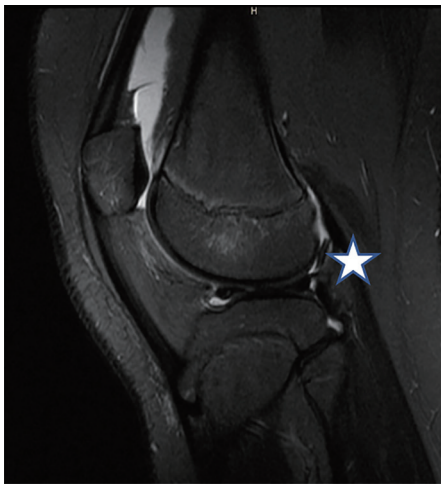
Figure 3 Sagittal MRI demonstrating loose body (star) in the posterior compartment of the knee. MRI, magnetic resonance imaging.

Figure 4 Axial MRI demonstrating disruption (star) of the MPFL at its patellar attachment. MRI, magnetic resonance imaging; MPFL, medial patellofemoral ligament.

combined with knee dislocation versus isolated PF instability. These differences are reviewed here and summarized in *Table 1*.

The patient demographics and injury mechanism of each group differs significantly. Acute, isolated patellar dislocations most commonly occur in young females aged 10 to 17 years who participate in sports (9,17). They tend to occur as the result of a low-velocity twisting injury in which the knee as a whole sustains relatively minor trauma (10,11).

This is in sharp contrast to those who sustain MLKIs: males with an average age of 35 years who are involved in motor vehicle or motorcycle accidents. Multiligament knee injuries are most commonly the result of a high-energy mechanism in which the knee sustains a significant amount of trauma (32,33). Similarly, the vast majority of isolated PF instability cases are closed injuries in neurovascular intact patients; whereas open injuries to the PF soft tissue stabilizers are more commonly encountered in the MLKI population, with inherent increased risk to adjacent neurovascular structures.

As previously discussed, many patients with recurrent isolated patellar instability have underlying bony or soft abnormalities that predispose them to this condition (34). Common abnormalities include trochlear dysplasia, patella alta, a lateralized force vector, knee valgus, hyperlaxity, and/or vastus medialis obliquus (VMO) hypoplasia (12,15,34). In patients sustaining MLKIs, however, the majority of patients lack these predisposing factors for patellar instability (6). Most MLKI patients have normal underlying bony alignment in the PFJ, specifically regarding trochlear morphology and patella height. The energy required to dislocate with normal underlying anatomy is much greater than in patients with aberrant bony anatomy. Additionally, in patients with normal underlying anatomy, the risk of concurrent chondral shear injury or osteochondral fracture with loose body is higher as the energy of the injury increases. This is due to the fact that it takes more force to dislocate a normal joint than an abnormal joint with anatomic risk factors for PF instability. Consequently, MLKI patients have a higher risk of chondral or osteochondral injury with acute patella dislocation than their counterparts with isolated dislocation events.

As discussed, the MPFL is torn in greater than 94% of instability events regardless of underlying etiology. In isolated PF instability patients, the location of MPFL tear varies between the patella, mid-substance, and femoral origin. In contrast, the vast majority of MPFL tears in MLKI occur on the femoral side. In addition, the superficial MCL is torn in all cases of documented MPFL injury in MLKI patients, a finding that is rarely encountered in patients with isolated patella instability (6). This suggests more of a valgus moment causing the medial-sided injury in MLKI versus a predominant rotational-type injury in isolated patella dislocation. Interestingly, the most common bone bruise pattern following isolated dislocation seen on MRI involving the medial patella and lateral trochlea has not been appreciated with patella instability in patients with concomitant MLKI. Lastly, combined PF instability

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Table 1 Key differences between isolated patellofemoral instability and patellofemoral instability in the setting of MLKI

Isolated patellofemoral instability	Combined patellofemoral instability and MLKI
Females aged 10–17 years	Males with average age 35 years
Often have history of PF instability	Rarely have history of prior patella instability
Abnormal underlying anatomy (e.g., trochlear dysplasia, patella alta, generalized laxity, knee valgus, VMO hypoplasia)	Normal underlying anatomy
Low-energy mechanism (e.g., sporting activities)	High-energy mechanism (e.g., motor vehicle and motorcycle accidents)
Typically closed injuries without neurovascular insult	Commonly open injuries with associated neurovascular insult
Varied location of MPFL disruption (femoral side, patellar side, or midsubstance)	MPFL disruption most commonly occurs on/near the femoral attachment
Rarely have an associated MCL tear	Frequently have an associated MCL tear
Decreased risk of OCD/chondral lesions and loose bodies	Increased risk of OCD/chondral lesions and loose bodies
Commonly see classic bone bruise pattern of patella dislocation on MRI (i.e., increased signal in medial patellar facet and lateral trochlea)	Usually lack the classic bone bruise pattern of patella dislocation on MRI

MLKI, multi-ligament knee injury; PF, patellofemoral; VMO, vastus medialis obliquus; MPFL, medial patellofemoral ligament; MCL, medial collateral ligament; OCD, osteochondritis dissecans; MRI, magnetic resonance imaging.

and MLKI patients typically have no antecedent history of patella instability whereas patients with isolated PF instability often suffer recurrent instability on the index or contralateral limb.

Treatment of patellar instability in the MLKI

To date, there is a paucity of literature to guide the treatment of patellar instability in the setting of a MLKI. Allen *et al.* retrospectively reviewed the records of all patients who underwent surgery for a MLKI over a 3-year period (6). There were a total of 51 patients treated with surgery for a MLKI, with pre-operative MRI showing an MPFL tear in 30 (59%) of these patients. Nine patients were lost to follow-up, leaving 21 patients available for comparison to a control group. The control group all had a surgically treated MLKI but with an intact MPFL. The majority of patients were male with an average age of 35.1 years. Based on the Schenck Knee Dislocation Classification, there were 6 KD I, 6 KD III-M, 2 KD III-L, 4 KD IV, and 3 KD V injuries. Thirteen patients had complete MPFL tears, 5 had high-grade partial tears, and 3 had partial tears. The majority of MPFL tears (76%) occurred in the proximal third of the ligament. The superficial MCL was torn in all of the patients with MPFL tears; however, the patellar or lateral femoral condyle bone bruising typically seen on MRI after a patellar dislocation

was not identified in any of the patients. The average Caton-Deschamps ratio was the same in both groups, there were two patients in each group with trochlear dysplasia (grade A), and none of the patients reported patellar instability prior to their injury. Ten patients in the MPFL tear group underwent MCL repair (n=2) or reconstruction (n=8) at the time of MLKI reconstruction. None of the patients underwent MPFL repair or reconstruction. At final follow-up (mean 3.6 years), the average IKDC score was 79.4±16.1 in the isolated MLKI group *vs.* 65.5±22.9 in the MLKI group with MPFL tear (P=0.07). Only 1 (5%) patient complained of PF instability post-operatively. This patient had a KD III-L injury and a high-grade partial MPFL tear but did not undergo repair or reconstruction of the MCL. The authors concluded that MPFL injuries are commonly associated with MLKIs; however, their presence rarely leads to recurrent or symptomatic patellar instability. The authors acknowledge the limitations of their study due to the retrospective nature and small sample size; nonetheless, they should be applauded for investigating this under-researched topic and their study serves as a great starting point for further discussion and future research.

This study by Allen *et al.* (6) is, to our knowledge, the only one in the literature reporting on MPFL tears in the setting of a MLKI. As such, attempting to generalize a treatment strategy for patella instability in the setting of MLKI remains a difficult task due to the lack of substantial
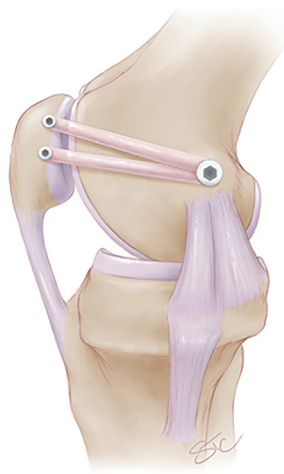
Figure 5 Illustration demonstrating anatomic MPFL reconstruction with a two-tailed technique using interference screw fixation. MPFL, medial patellofemoral ligament. Reproduced with permission from The Curators of the University of Missouri (copyright 2018 by The Curators of the University of Missouri).

supporting evidence. It is useful to briefly summarize the evolving treatment algorithm for acute first-time dislocation in isolated PF instability in order to compare and contrast with the proposed algorithm for managing combined injury in the MLKI.

In the isolated PF dislocation cohort, most authors recommend non-operative treatment for first-time dislocators without osteochondral fracture or loose body. Several studies have demonstrated positive results following conservative management, with recurrent dislocation rates ranging from 13% to 52% (8,35), and 47% to 85% of patients reporting good or excellent subjective outcomes (36-38). However, there is a recognized subset of high-risk patients that may benefit from consideration for early surgical stabilization following a first dislocation without osteochondral injury. These patients are typically younger, participate in sports, and have high risk anatomy including trochlear dysplasia, patella alta, patella tilt, a lateralized force vector, and/or history of contralateral patella instability. Less controversial indications for early surgery include patients with a large loose body and/or osteochondral fracture for loose body removal and/or operative fixation of the osteochondral fragment. In this scenario, soft tissue stabilization is recommended to protect the fixation of the chondral surface. MPFL repair may be performed if the zone of injury is clearly demarcated with good tissue quality and normal underlying anatomy. If the injury to the medial

restraints are diffuse with poor tissue quality, or if there is underlying high risk anatomy, MPFL reconstruction with autograft or allograft is preferred (*Figure 5*).

As discussed previously, the vast majority of MLKI patients with PF instability will have normal underlying anatomy and a clear zone of injury to the medial soft tissue restraints. In the case of open medial sided injury, buttonholing of the retinaculum blocking anatomic reduction, or osteochondral fracture/loose body, surgery is clearly indicated to address these abnormalities (*Table 2*). Open injury should undergo irrigation and debridement with provisional joint stabilization (i.e., external fixation) as indicated by other injury patterns. Operative repair of the torn medial soft tissue structures with absorbable monofilament suture is reasonable to consider at the time of surgery. Similarly, arthrotomy to remove buttonholed medial retinaculum in order to reduce a knee dislocation should include soft tissue repair of the medial PF stabilizers and remainder of medial soft tissue envelope. If an osteochondral injury requires arthrotomy and fixation, medial sided repair is also preferred to protect the fixation from further instability and recurrent injury.

In the acute or subacute setting, if there is no bony block to motion, no open injury, and no osteochondral fracture, specific surgery for the MPFL may be avoided. This is particularly true in the setting of normal underlying anatomy (i.e., trochlear morphology and patella height), as the ligaments will likely heal at an acceptable resting length. In these cases, decision to operate should be dictated by other ligament groups (i.e., ACL/PCL/PMC/PLC) and not the PF joint. Concomitant injury to the MCL may also explain the very low rate of patellar instability following MLKI reconstruction (5%) *vs.* the relatively high rate of recurrent patellar instability following conservative treatment of isolated patellar dislocations (36%) (6,39). In the aforementioned study by Allen *et al.* (6), 10 of the 21 patients underwent concurrent MCL repair or reconstruction at the time of MLKI reconstruction and none of these patients experienced post-operative patellar instability. This certainly could have impacted the ultimate healing and stability of the MPFL; however, of the remaining 11 patients who did not undergo MCL repair or reconstruction, only one patient had patellar instability post-operatively. Therefore, it seems unlikely that surgically treating the torn MCL at the time of MLKI reconstruction has a significant impact on post-operative MPFL stability. Rather, concomitant injury to another structure (i.e., the MCL) in the area of the MPFL may further enhance the

Table 2 Treatment recommendations for patellofemoral instability in the setting of MLKI

| Type of injury	Treatment recommendation
Open injuries, irreducible dislocations, and/or neurovascular insult	Urgent/emergent open reduction with irrigation and debridement
	Vascular repair as needed
	External fixation as indicated
	Early repair of medial PF soft tissues in the setting of a buttonholed medial retinaculum (31)
KD 1–2 (acute/chronic, rarely associated with injury to the PF complex)	Initial treatment driven by injury to the cruciates and/or collaterals
	Typically treat the PF instability similar to an acute isolated patella dislocation (i.e., with conservative treatment)
	Early surgery for PF instability in the setting of a loose body or osteochondral fragment (may require MPFL repair/reconstruction to protect the OCD fixation)
	Consider staged management of the PFJ if instability persists after primary ligament injuries are treated
KD 3–4 (acute, particularly with associated PMC or PFJ injury)	Initial treatment driven by injury to the cruciates and/or collaterals
	Early surgery for PF instability if loose body or osteochondral fragment present
	Consider MPFL repair acutely if going to surgery for other injuries and normal underlying anatomy with clear site of injury
	Defer MPFL reconstruction in the acute setting due to increased risk of morbidity with additional surgery (e.g., arthrofibrosis)
KD 3–4 (chronic, in the setting of failed conservative management)	MPFL repair if good soft tissue quality with normal underlying anatomy and alignment
	MPFL recon if poor soft tissue quality and/or risk factors for recurrent PF instability
	Consider osteotomy to correct coronal malalignment (i.e., valgus deformity) in patients with chronic MCL/PMC injury as this will decrease Q angle and improve PF stability
	Tibial tubercle osteotomy likely not indicated in this setting as most MLKI patients have normal patella height

MLKI, multi-ligament knee injury; PF, patellofemoral; PFJ, patellofemoral joint; KD, knee dislocation; MCL, medial collateral ligament; PMC, posteromedial corner; MPFL, medial patellofemoral ligament; OCD, osteochondritis dissecans.

healing response and thus increase the chance of a stable patella post-operatively.

It is important to point out that more surgery in the face of high energy injury is not always desirable. It is well documented in the orthopedic literature that the more extensive the surgery around a joint, the greater the risk of post-operative arthrofibrosis. The incidence of knee stiffness is less than 5% of patients following an MPFL repair (40). In patients undergoing MLKI reconstruction without PF instability, the rate of knee stiffness already approaches 22% (41). The addition of an MPFL repair or reconstruction to an already substantially traumatized knee undergoing a multiligament reconstruction may dramatically increase the risk of post-operative arthrofibrosis (42). As noted by Allen *et al.* (6), the multiligament-injured knee undergoing reconstruction will experience a rather robust healing response (i.e., scar formation) due to both the nature of the injury itself as well as the surgery, which likely accounts for the lack of PF instability seen in these patients. Overall, caution must be exercised before offering an additional and potentially unnecessary procedure to an acute MLKI patient in order to avoid the increased risk of arthrofibrosis associated with extra surgery.

In the chronic setting, treatment of combined MLKI and PF instability should be based on the subjective sense of PF instability combined with objective evidence of symptomatic laxity on physical examination, and confirmed by imaging studies. If the MLKI has been previously stabilized, treatment of the PF joint may follow classic paradigms for management of isolated instability. If the MLKI needs to be addressed concomitantly, consideration for stabilizing the soft tissue envelope about the patella is important. With normal underlying anatomy and good tissue quality, MPFL imbrication may be performed to remove slack and restore the resting length of the medial PF complex (i.e., MPFL repair). In the setting of aberrant
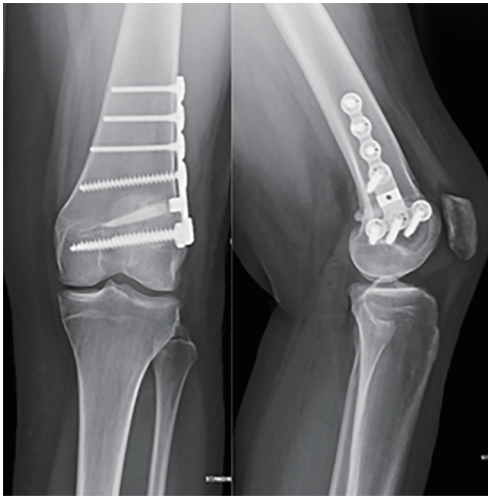
Figure 6 AP and lateral X-rays demonstrating distal femoral varus osteotomy.

anatomy and/or poor tissue quality, MPFL reconstruction with allograft can be considered. Technical consideration must be taken regarding tunnel crowding about the medial epicondyle, particularly alongside concomitant MCL or PMC reconstruction. In the setting of chronic injury to PF restraints and PMC, coronal plane osteotomy may be considered prior to reconstruction to correct valgus and improve the Q-angle. Otherwise, there are few indications for other bony procedures in the management of chronic patella instability in MLKI (*Figure 6*).

Regarding patient reported outcomes, Allen *et al.* (6) shows that patients with MPFL tears did not have statistically worse IKDC scores than patients without MPFL tears. The magnitude of difference, however, was clinically significant, favoring those without MPFL tears. Given that all but one patient did not suffer patellar instability after surgery, injury to the MPFL is not the only contributing factor to the difference in IKDC scores. As previously noted, knees with MPFL injury likely sustained a higher level of trauma which could negatively impact outcomes.

Regarding rehabilitation of patella instability in the MLKI patient, specific precautions and restrictions are driven by the nature of the other ligament and/or chondral/meniscal injuries and not the status of the PF joint. Initial non-operative management of PF dislocation should focus on edema control and gentle ROM, followed by progressive strengthening of the quadriceps, core, hip rotators, and posterior chain musculature. For isolated MPFL repair or reconstruction, patients may begin weight bearing

and ROM as tolerated immediately following surgery. Limitations in weight bearing or ROM may be given for fixation of osteochondral lesions at the surgeon's discretion. In the MLKI patient, specific post-operative weight bearing and ROM restrictions are dictated by the multiligamentous nature of the injury as opposed to the PF joint. In the chronic setting, valgus correcting osteotomy typically requires early limitations in weightbearing prior to bony healing. There are no studies investigating the long-term return to activity in PF instability patients with concomitant MLKI. It is likely that return to normal activities of daily living, light physical activity, and full return to sport are delayed in MLKI patients compared to those with isolated PF instability (43).

Conclusions

PF instability in the setting of MLKI is relatively rare. There is a paucity of literature on the evaluation and management of this complex condition. It is critical to recognize that the patient population, mechanism of injury, and injury patterns in these MLKI patients differ from those with isolated PF instability. These patients are predominantly males in their mid-30s who sustain a high-velocity trauma to an otherwise normal PF joint. The majority of MPFL injuries occur on the femoral side along with concomitant MCL injury. Non-operative treatment of the PF injury in MLKI has led to good overall outcomes with minimal risk of recurrent PF instability. In the MLKI patient, medial PF soft tissue stabilization should be reserved for an open injury, a buttonholed medial retinaculum blocking reduction, an osteochondral fracture from patella dislocation, or chronic refractory PF instability symptoms. This strategy aims to minimize complications (e.g., arthrofibrosis) caused by early additional surgery, with the goal of improving outcomes for this challenging problem.

Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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