

Immediate Surgical Repair of the Medial Patellar Stabilizers for Acute Patellar Dislocation

A Review of Eight Cases

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ABSTRACT

An open surgical repair of the injured medial patellar stabilizers, including the vastus medialis obliquus muscle and the medial patellofemoral ligament, after acute patellar dislocation was studied in eight patients. At initial examination, all patients had tenderness over the adductor tubercle and a positive patellar apprehension sign. Four of eight patients had obvious ecchymosis over the adductor tubercle. Magnetic resonance imaging, diagnostic arthroscopy, and open surgical exploration documented injury to both the medial patellofemoral ligament and the origin of the vastus medialis obliquus muscle. In all patients, the torn muscle was retracted in an anterior and superior direction and an arthroscopic lateral release was performed followed by open primary repair of the medial patellofemoral ligament to the adductor tubercle and repair of the vastus medialis obliquus muscle to the adductor magnus tendon. Patients were evaluated postoperatively with the Kujala scoring questionnaire. The average follow-up was 3.0 years, with a minimum of 1.5 years. No patients experienced a recurrent dislocation. The average Kujala score was 91.9. Patients rated their return to athletic activity at an average 86% of their pre-injury level. The average subjective satisfaction was 96%. In appropriate cases of acute patellar dislocation, we recommend primary repair of the medial patellofemoral ligament and the vastus medialis obliquus muscle to avoid recurrent dislocation, chronic subluxation, pain, and disability.

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Acute dislocation of the patella is a common knee injury in which the pathophysiology is poorly understood and management is controversial. Nonoperative treatment often results in recurrent dislocation or persistent symptoms of instability.^{9,16,29,30} In 1977, Cofield and Bryan⁹ reported a 44% redislocation rate with nonoperative management in 48 patients with acute patellar dislocation. Hawkins et al.¹⁶ stated that chronic retropatellar pain and associated instability can be anticipated in 40% to 70% of patients after acute patellar dislocation. In 1997, Mäenpää and Lehto²⁹ reported another series of patients with similar results. They studied 100 patients who had acute patellar dislocation and who were treated nonoperatively. With a 13-year average follow-up, they found a 44% redislocation rate. Of the patients who did not experience a redislocation, a 19% incidence of either patellofemoral pain or subluxation added to the overall unsatisfactory rate of 63%. Because of the largely unsatisfactory results with nonoperative treatment, various surgical procedures have been designed to correct the pathologic lesions that are primarily associated with acute patellar dislocations.^{4,8,23,34,38}

The medial patellofemoral ligament provides passive restraint to lateral subluxation of the patella and is the primary structure injured in patients with acute patellar dislocations.^{10,12} The need for anatomic repair of the medial patellofemoral ligament for the operative treatment of acute patellar dislocations has been previously emphasized.^{34,38} The vastus medialis obliquus muscle is the primary dynamic medial stabilizer of the patella and is also commonly injured during acute patellar dislocation.³ In 1996, Sallay et al.³⁴ studied the pathoanatomy of knees with acute patellar dislocations and noted increased signal and a variable amount of retraction in the distal muscle belly of the vastus medialis obliquus muscle in 78% of cases (18 of 23). The potential for patellar maltracking with disruption of the vastus medialis

obliquus muscle has been recognized by Hunter et al.,²⁰ although they studied vastus medialis obliquus muscle disruption in association with medial collateral ligament injuries. Cadaveric studies have demonstrated detrimental alterations in both patellofemoral pressures and tracking with simulation of vastus medialis obliquus muscle injury or dysplasia.^{1,14} Although the function of the vastus medialis obliquus muscle as a medial stabilizer of the patella has been established, repair of the distal origin of the muscle after acute patellar dislocation has not been previously described.

The objective of this study was to evaluate the pathologic lesions in the knees of patients who sustained acute patellar dislocations and to evaluate these patients' outcomes after treatment with primary repair of both the medial patellofemoral ligament and the vastus medialis obliquus muscle.

MATERIALS AND METHODS

Between 1994 and 1998, a total of eight patients with a substantiated diagnosis of acute patellar dislocation were seen and treated by the senior author (JHH). All of these patients are included in this study. Patients who had experienced a prior dislocation were considered to have recurrent dislocation of the patella and were eliminated from the study. There were four women and four men, with an average age of 32 years (range, 16 to 56). In seven patients the injury was caused by a noncontact twisting mechanism accompanied by a valgus force on the flexed knee. One patient reported a direct blow to the knee. One patient reported episodes of patellar subluxation before the dislocation. Two patients reported prior episodes of anterior knee pain but denied episodes of subluxation before the dislocation. All other patients denied prior anterior knee pain or patellar subluxation. In all patients, physical examination revealed a large amount of effusion with swelling on the medial aspect of the knee and tenderness over the adductor tubercle.

A standard set of radiographs was obtained to assess osseous relationships and look for osteochondral fractures. These radiographs included a standing AP view in full extension, a standing posteroanterior view in 45° of flexion, a nonweightbearing lateral view at 30° of flexion, and a Merchant view. In addition to looking for osseous injury, we calculated the Insall-Salvati ratio,²¹ lateral patellar displacement, lateral patellofemoral angle, and the femoral sulcus angle.

An MRI scan was obtained in all patients to assess the extent of injury to the medial patellofemoral ligament, the vastus medialis obliquus muscle, and any other structures that may have been injured (Table 1). The axial images best identified rupture of the medial patellofemoral ligament and injury to the vastus medialis obliquus muscle. Extravasation of fluid outside the joint assisted in outlining the injured structures and the location of the injury.

All patients were evaluated under general or regional anesthesia for lateral patellar instability. In all patients the patella could be dislocated laterally with minimal manual force with the knee flexed approximately 20° to 40°. Arthroscopy was performed on all patients with particular attention to osteochondral lesions of the patella and the distal femur.

TABLE 1
Associated Injuries Observed on MRI Scans^a

Injury	N	%
Tear of vastus medialis obliquus muscle	6	75
Bone bruises lateral femoral condyles	5	62.5
Patella bone bruise	2	25
Loose bodies	1	12.5
Meniscal tears	1	12.5
MCL sprains	4	50

^a All eight patients had a tear of the medial patellofemoral ligament as a criterion for entering the study.

These lesions were treated according to their stability and size. The medial capsule was examined for hemorrhage and tears. Tracking of the patella was observed using the 30° scope via the anteromedial portal. This was followed by an arthroscopic lateral release performed by dividing the lateral retinaculum by electrocautery under direct visualization. Care was taken not to extend the release superiorly into the insertion of the vastus lateralis muscle.

Open repair was then performed through a 7- to 10-cm incision starting at the adductor tubercle and directed proximally along the adductor magnus tendon. Care was taken to avoid injuring the infrapatellar branch of the saphenous nerve. The investing muscular fascia was incised and the muscle belly of the vastus medialis obliquus muscle was identified. The posterior extent of the vastus medialis obliquus muscle was exposed and in all cases its origin at the adductor magnus tendon was found to be torn and retracted to a superior and anterior position. The dissection was continued to the distal margin of the vastus medialis obliquus muscle, where the medial patellofemoral ligament was identified as a condensation of fibers which in all patients had been torn from the adductor tubercle.

The vastus medialis obliquus muscle origin was repaired to the adductor magnus tendon using interrupted nonabsorbable sutures. The repair began proximally and was continued distally with an effort made to advance the vastus medialis obliquus muscle from its proximal and anterior retracted position to a more distal and posterior position. The medial patellofemoral ligament was then repaired to its stump in the adductor tubercle and adjacent fascia with nonabsorbable sutures. Suturing both the medial patellofemoral ligament to the adductor tubercle and the vastus medialis obliquus muscle to the large adductor magnus tendon provided a strong repair. The wound was then closed in layers. Patellar tracking was then assessed arthroscopically.

Postoperatively, all patients initially used a knee immobilizer. Quadriceps muscle setting exercises were begun immediately after surgery; formal physical therapy was started after the splint was removed. The knee immobilizer was discontinued when the patients had satisfactory leg control, which was usually about 2 weeks after surgery. Patients then began active and passive range of motion exercises. The patients progressively rehabilitated and were usually able to resume their preinjury level of activity at approximately 4 months after surgery.

At follow-up the patients were asked to rate themselves subjectively based on episodes of recurrent dislocations, subluxations, pain, and disability using the Kujala question-

naire (Table 2).²⁵ This subjective rating determined their percentage level of satisfaction and the percent to which they were able to return to their preinjury level of activity. At the last follow-up, the patients were examined for quadriceps muscle atrophy, patellar apprehension, quadriceps angle, crepitation, and range of motion. The range of motion was measured with a goniometer. Flexion was measured during active supine flexion and extension was measured with the patient standing and actively hyperextending the knee. Motion data were recorded and results were arrived at by comparing the injured knee with the noninjured normal knee.

RESULTS

At initial examination, all patients had tenderness over the adductor tubercle and a positive patellar apprehension sign. Four patients had significant ecchymosis over the adductor tubercle. None of the patients demonstrated obvious fractures on plain radiographs.

The MRI scans demonstrated a tear of the medial patellofemoral ligament from the adductor tubercle in all patients. The vastus medialis obliquus muscle was found to be torn from the adductor magnus tendon just proximal to the medial patellofemoral ligament in six of the eight patients. The tears in the vastus medialis obliquus muscle were all

located at the distal origin of the muscle, where it attaches to the adductor magnus tendon. The distal muscle belly appeared to be retracted in an anterior and superior direction in all cases. Axial MRI scans of a typical vastus medialis obliquus muscle and medial patellofemoral ligament injury are shown in Figure 1.

The average time from injury to surgery was 7.6 days. Arthroscopic examination demonstrated intracapsular tears with hemorrhage along the medial retinacular structures in five of eight patients. One had a meniscal tear that was unreparable and required debridement. Four patients had chondral lesions. In two patients the lesion was located on the medial aspect of the patella and in the other two patients the lesion was located on the lateral aspect of the femoral condyle. The chondral lesions were treated with a smoothing chondroplasty. One patient had a loose body, which was removed.

At open exploration, all patients were found to have tears of the vastus medialis obliquus muscle from the adductor magnus tendon. The vastus medialis obliquus muscle was retracted anteriorly and superiorly in all cases. The tear typically extended approximately 5 cm proximal to the adductor tubercle. The adductor magnus tendon was intact in all cases. At the distal margin of the vastus medialis obliquus muscle, the medial patellofemoral ligament was identified as a capsular thickening and was torn near its

TABLE 2
Kujala Scoring Questionnaire^a

- | | |
|--|--|
| <p>1. Limp: __
a) None (5)
b) Slight or periodic (3)
c) Constant (0)</p> <p>2. Support: __
a) Full support without pain (5)
b) Painful (3)
c) Weightbearing impossible (0)</p> <p>3. Walking: __
a) Unlimited (5)
b) More than 2 km (3)
c) 1-2 km (2)
d) Unable (0)</p> <p>4. Stairs: __
a) No difficulty (10)
b) Slight pain when descending (8)
c) Pain both when ascending and descending (5)
d) Unable (0)</p> <p>5. Squatting: __
a) No difficulty (10)
b) Repeated squatting painful (4)
c) Painful each time (3)
d) Possible with partial weightbearing (2)
e) Unable (0)</p> <p>6. Running: __
a) No difficulty (10)
b) Pain after more than 2 km (8)
c) Slight pain from the start (6)
d) Severe pain (3)
e) Unable (0)</p> <p>7. Jumping: __
a) No difficulty (10)
b) Slight difficulty (7)
c) Constant pain (2)
d) Unable (0)</p> | <p>8. Prolonged sitting with knee flexed: __
a) No difficulty (10)
b) Pain after exercise (8)
c) Constant pain (6)
d) Pain forces to extend knees (4)
e) Unable (0)</p> <p>9. Pain: __
a) None (10)
b) Slight and occasional (8)
c) Interferes with sleep (6)
d) Occasionally severe (3)
e) Constant and severe (0)</p> <p>10. Swelling: __
a) None (10)
b) After severe exertion (8)
c) After daily activities (6)
d) Every morning (4)
e) Constant (0)</p> <p>11. Abnormal painful kneecap movements: __
(patellar subluxations)
a) None (10)
b) Occasionally in sports activities (6)
c) Occasionally in daily activities (4)
d) At least one dislocation after surgery (2)
e) More than two dislocations (0)</p> <p>12. Atrophy of thigh: __
a) None (5)
b) Slight (3)
c) Severe (0)</p> <p>13. Flexion deficiency: __
a) None (5)
b) Slight (3)
c) Severe (0)</p> |
|--|--|

Total points: _____

^a Reprinted from Kujala et al.²⁶



Figure 1. Axial MRI scan demonstrating tears of the vastus medialis obliquus muscle and medial patellofemoral ligament (arrow).

femoral insertion. The femoral stump with adjacent fascia was always present and was used for primary repair.

The average follow-up was 3 years, with a minimum of 1.5 years. The average Kujala score was 91.9 (Table 3). The most common cause of score reduction was difficulty with stair climbing, squatting, jumping, and prolonged sitting. Most patients had trouble with activities requiring knee flexion and strong quadriceps muscle forces (Fig. 2).

Four patients had a decrease in knee flexion when the involved knee was compared with their noninjured knee. One patient lost 20° of flexion, and three patients lost 10° or less. None of the patients lost extension and none of the patients reported disability related to motion deficit. The average patient satisfaction with the operation was 97%, and the average percent return to preinjury level of physical activity was 86%. None of the patients experienced recurrent patellar dislocation, and six of eight patients denied any episodes of subluxation. Of the two patients who reported patellar subluxation, one patient had only a single episode during the rehabilitation period and is now fully active with-

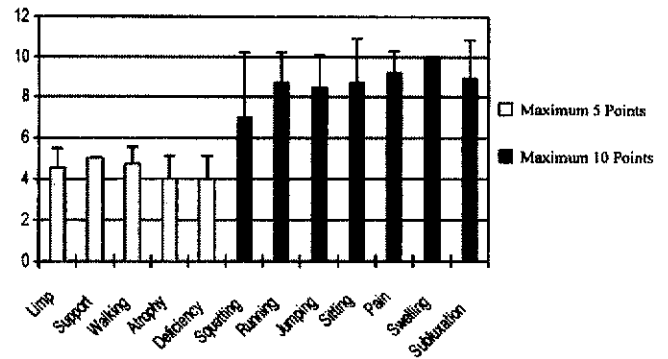


Figure 2. Kujala knee questionnaire results.

out further incident. The second patient had several subluxations during sporting activity. The average Kujala score for subluxation was 8.7 of a possible 10.

DISCUSSION

The operative goal in this study was to perform a primary repair of both the medial patellofemoral ligament as well as the origin of the vastus medialis obliquus muscle. Warren and Marshall³⁷ characterized the medial patellofemoral ligament as varying in size and thickness and originating on the adductor tubercle. The insertion of the medial patellofemoral ligament courses anteriorly and attaches onto the undersurface of the vastus medialis obliquus muscle and patella.^{10,37} Feller and coworkers¹³ also described the medial patellofemoral ligament blending with the deep fascia of the vastus medialis obliquus muscle, suggesting that the passive medial patellofemoral ligament and dynamic vastus medialis obliquus muscle may act in concert. Conlan and coworkers¹⁰ studied the function of the medial patellofemoral ligament in 25 cadaver specimens and found it to be the major medial soft tissue restraint, contributing 53% of the force resisting lateral displacement of the distal extensor mechanism. Desio and coworkers¹² similarly determined the medial patellofemoral ligament to contribute 60% of the total medial restraining force on the patella.

Injury to the medial patellofemoral ligament in association with acute patellar dislocation has been previously recognized.^{2,3,19,31,34} Avikainen et al.² noted that medial patel-

TABLE 3
Patient Data and Scores at Final Outcome

Age/Sex	Injury mechanism	Follow-up (years)	Kujala score	Percentage overall satisfaction	Percentage level of activity regained
44 M	Noncontact	4.9	87	90	70
56 F	Noncontact	3.3	98	100	100
31 M	Contact	2.8	78	100	80
25 F	Noncontact	1.9	92	95	90
25 M	Noncontact	2.0	98	90	90
33 F	Noncontact	3.3	98	100	85
16 M	Noncontact	1.5	100	100	95
27 F	Noncontact	4.0	84	100	80
Average		3.0	91.9	96.9	86.3

lofemoral ligament tears occurred at the femoral origin in all 10 of their patients with acute patellar dislocations. Similarly, Sallay et al.³⁴ reported that more than 90% of the tears in their study (15 of 16) occurred at the femoral origin of the medial patellofemoral ligament. Burks et al.⁶ simulated patellar dislocations in a cadaver model and demonstrated that injury of the medial patellofemoral ligament occurred predominantly at the femoral origin. The findings in our group of eight patients were similar to those of the cited authors, with all tears of the medial patellofemoral ligament occurring at the femoral origin.

The vastus medialis obliquus muscle was first described as a distinct muscle by Lieb and Perry²⁶ in 1968, and was later confirmed by Reider et al.³³ in 1981. Bose and Kanasuntheram⁵ described the vastus medialis obliquus muscle as taking origin partially from the adductor longus tendon, the adductor magnus tendon, and the medial intermuscular septum, with the main origin from the tendon of the adductor magnus. Similar findings were also observed by Conlan and coworkers,¹⁰ who performed anatomic dissections on eight cadaver specimens. By applying force at an angle of 55° to 70° to the midaxillary line, the vastus medialis obliquus muscle functions as a dynamic medial stabilizer of the patella.³³ The ability to pull in such an oblique direction to the patella is due to its unique anatomy, consisting of an origin on the medial soft tissue adductor magnus tendon. In testing six normal cadaver limbs, Goh et al.¹⁴ demonstrated that "The absence of VMO tension caused the patella to displace laterally (4.2 mm) and increased the load on the lateral patellar facet throughout the range of knee motion." In an in vivo model, Koh et al.²⁴ demonstrated that stimulation of the vastus medialis obliquus muscle stabilizes medial tracking of the patella.

Bassett³ described disruption of the vastus medialis obliquus muscle off of the adductor tubercle in cases of acute patellar dislocation allowing proximal retraction of the origin. Dysplasia of the vastus medialis obliquus muscle has also been correlated with patellar subluxation by Henry and Craven,¹⁸ who studied 465 patients with anterior knee pain. Vastus medialis obliquus muscle dysplasia is described by Hughston¹⁹ as "muscle hypoplasia with an insertion onto the patella that is less oblique than normal" which, when present, may be the most significant factor in lateral patellar subluxation. Carson et al.⁷ found an association between vastus medialis obliquus muscle hypoplasia and disorders of the patellofemoral joint. Raimondo and coworkers³² documented the unique features of vastus medialis obliquus muscle dysplasia in a single cadaver specimen. They were able to quantitate the smaller physiologic cross-sectional area and the less oblique orientation of the vastus medialis obliquus muscle fibers. These anatomic characteristics of the dysplastic vastus medialis obliquus muscle weaken its ability to dynamically stabilize the patella on the medial side.

To date, no objective diagnostic criteria have been established to diagnose vastus medialis obliquus muscle dysplasia. By physical examination, the physician can assess the muscle bulk and estimate the muscle orientation and the position of insertion of the vastus medialis obliquus muscle onto the patella. In this study, the criteria for vastus medialis obliquus muscle dysplasia included a concave or flat

appearance of the muscle belly and a proximal location of the muscle mass. All our patients demonstrated vastus medialis obliquus muscle dysplasia of the noninjured knee by these criteria. Although the number of patients in this study was small, our results suggest that vastus medialis obliquus muscle dysplasia is associated with patellar dislocation, and this finding is consistent with the results of others who have found vastus medialis obliquus muscle dysplasia to be associated with patellar instability.^{18,19}

Several investigators have proposed that patellar subluxation and dislocation occur in patients with abnormal extensor mechanisms.^{17,22} Jackson²² has stated that patellar dislocations without evidence of patellar maltracking are rare. We have observed tears of the vastus medialis obliquus muscle and medial patellofemoral ligament that were suggested on physical examination by tenderness over the adductor tubercle and ecchymosis over the adductor tubercle and adductor magnus tendon. We found MRI to be very useful in identifying the pathologic changes associated with patellar dislocation. Kujala et al.²⁵ found that MRI could detect increased lateral patellar tilt in patients with acute and recurrent patella dislocation when compared with controls. In two of our patients, the MRI scans were falsely negative for a tear of the vastus medialis obliquus muscle. At surgery, the vastus medialis obliquus muscle was found to be torn from its insertion in both cases. However, the MRI scans demonstrated the medial patellofemoral ligament to be ruptured in all eight cases. Failure to diagnose the vastus medialis obliquus muscle tear was likely due to difficulty in differentiating the vastus medialis obliquus muscle from the medial patellofemoral ligament on MRI.

Operative treatments previously described have included arthroscopic evaluation with simple lateral release.^{11,35} Dainer et al.¹¹ reported 93% excellent and good results in 14 patients with acute patellar dislocation who underwent arthroscopic treatment of articular cartilage injury followed by immobilization, but their results deteriorated when they added a lateral release. Sherman et al.³⁵ reported 25% poor results with arthroscopic lateral release in 45 knees with recurrent dislocation of the patella.

Harilainen and Myllynen¹⁵ reported on a series of patients who underwent open lateral release in addition to medial capsular reefing. They reported an average Lysholm score of 94 at 12 months' follow-up. They did not have the benefit of MRI, which would have enabled them to locate the true lesion. Small et al.³⁶ performed a lateral release in combination with an arthroscopically assisted medial plication. This attractive procedure has limited morbidity; however, neither the dynamic stabilizer (the vastus medialis obliquus muscle) nor the static stabilizer (the medial patellofemoral ligament) are restored to their normal anatomic positions. Avikainen et al.² reported an average Lysholm score of 84 in their patients after tenodesis of the medial patellofemoral ligament with the distal 8 cm of the adductor magnus tendon. Although these results are encouraging, this type of reconstruction may compromise vastus medialis obliquus muscle function by altering its origin.

Sallay et al.³⁴ have noted that repair of the medial patellofemoral ligament restores the normal orientation of the vastus medialis obliquus muscle by re-establishing

its normal posterior insertion at the adductor tubercle. They reported an average Lysholm score of 81 in their series of patients. Although Sallay et al. recognized that the medial patellofemoral ligament and the vastus medialis obliquus muscle act in concert, and that the vastus medialis obliquus muscle was sometimes injured, direct repair of this muscle to the adductor magnus tendon was not suggested.

By suturing the vastus medialis obliquus muscle back to the adductor magnus tendon, we believe that we restored the ability of this muscle to pull obliquely on the medial border of the patella, which provided proper dynamic backup to the static stability provided by the medial patellofemoral ligament. As shown in Figure 3, healing after nonoperative treatment may result in a less medially directed vector of the vastus medialis obliquus muscle, which potentially reduces its dynamic medial stabilizing force. Loss of the firm attachment to the adductor magnus tendon at the distal origin also potentially weakens the strength of pull of the vastus medialis obliquus muscle, which further reduces its dynamic stabilizing force. The importance of vastus medialis obliquus muscle integrity was demonstrated in the study by Madigan et al.,²⁸ which produced poor results when the vastus medialis obliquus muscle was released as part of the surgical treatment for recurrent dislocation of the patella.

Using our diagnostic criteria, all eight patients in this series were noted to have dysplasia of the vastus medialis obliquus muscle. Repair under these circumstances may be particularly beneficial to prevent further compromise of pre-existing vastus medialis obliquus muscle deficiency. Furthermore, we believe that acute repair with advancement of the vastus medialis obliquus muscle origin is superior to more traditional late advancement at its insertion on the patella. The medial component of force depends on the muscle orientation, which depends on both its insertion onto the patella and, perhaps more importantly, on its origin. The adductor magnus tendon provides a strong structure to which the vastus medialis obliquus muscle may be sutured.

The vastus medialis obliquus muscle repair described in this study further augments the procedure described by Sallay et al.,³⁴ which directly repairs the medial patellofemoral ligament alone. We believe that the essential soft tissue lesion in acute patellar dislocation is both rupture of the medial patellofemoral ligament and tear of the vastus medialis obliquus muscle from its origin. We further believe it is the repair of the origin of these two structures that is critical to restoring medial stability to the patella. At the time of surgery, using the arthroscope, we have noted immediate improvement of patellar tracking after repair of the medial patellofemoral ligament and the vastus medialis obliquus muscle.

Previous reports all used the Lysholm knee questionnaire, which may not be specific or sensitive for patellofemoral symptoms since the Lysholm questionnaire was designed to evaluate pain and instability related to ACL ruptures.²⁷ The Kujala questionnaire²⁵ is a means of subjective testing that is specific for patellofemoral disorders; it contains questions about various aspects of extensor mechanism function (Table 2). Kujala et al. used this questionnaire to evaluate four groups of patients: normal control subjects, patients with anterior knee pain, patients with patellar subluxation, and

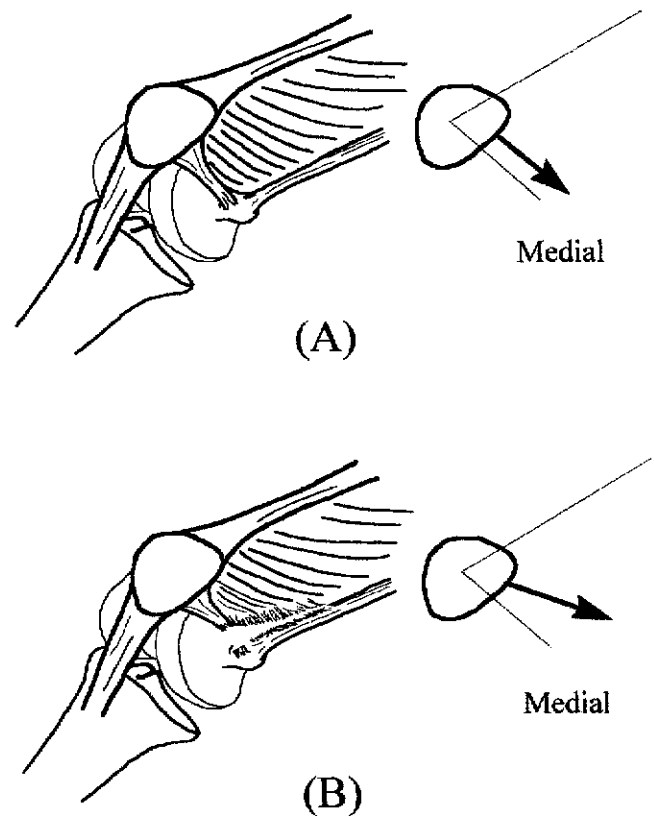


Figure 3. A, the vastus medialis obliquus muscle places a medially directed force on the patella because of its attachment location. B, when the muscle is torn its medial stabilizing force on the patella is disrupted.

patients with recurrent patellar dislocation. These four cohorts scored 99.9, 82.8, 68.2, and 62.2 points, respectively. Mäenpää and Lehto²⁹ validated the usefulness of this questionnaire in their study of 100 patients treated nonoperatively for acute patellar dislocation. In that study, the average Kujala score was 82 points for patients treated with a posterior splint.

Our results are encouraging when compared with those of previous reports of nonoperative treatment.^{9,16,29} The average postoperative Kujala score in our series was 91.9 points. Although our series was small, this score compares favorably to the 62.2 points scored by patients with untreated recurrent patellar dislocation in the Kujala et al.²⁵ study and the 82 points scored by the nonoperatively treated group of patients with acute patellar dislocation described by Mäenpää and Lehto.²⁹ In our study, patients most frequently scored lower on the Kujala scale on questions pertaining to activity requiring knee flexion or large quadriceps muscle forces, such as squatting and stair climbing.

Two of our patients had experienced episodes of subluxation. One patient had only one abnormal movement during the postoperative rehabilitation period. One patient had several episodes that always occurred during sports. The average score for subluxation in our series was 8.7 of a possible 10. This score is better than the score of 6.4 in the patients

receiving nonoperative treatment in the Kujala et al. series. Our series was too small for us to draw final conclusions, but we believe that with a larger sample of patients this form of treatment will show a significant improvement over the natural history of nonoperatively treated acute patellar dislocation. It is also possible that it will be an improvement over most of the operative approaches that do not repair the primary pathologic lesions.

Four of our patients reported a detectable decrease in maximum knee flexion when the involved knee was compared with the noninjured knee. All of the patients demonstrated full extension. Neither manipulations nor extended aggressive physical therapy was required for any of these patients. None of the patients experienced disability related to loss of motion. We believe that this was partly due to the more aggressive rehabilitation that we adopted later in this series. The more active approach to rehabilitation did not adversely affect the final outcome of treatment.

The medial patellofemoral ligament is critical for medial patellar stability and is usually ruptured off the adductor tubercle in patients with acute patellar dislocation. With lateral displacement of the patella there is usually disruption of the distal origin of the vastus medialis obliquus muscle off the adductor magnus tendon as well. Both of these structures should be repaired anatomically to restore normal medial patellofemoral biomechanics. Magnetic resonance imaging is essential in the preoperative evaluation of this traumatic lesion. It allows the surgeon to define the pathologic structures and plan appropriate treatment. In our experience this includes examination under anesthesia, arthroscopy with treatment of articular cartilage injury, arthroscopic lateral release, and repair of the medial patellofemoral ligament and the vastus medialis obliquus muscle origin, with aggressive rehabilitation. Using the Kujala scoring system, in this small series we have shown this to be an effective method of managing acute patellar dislocation.

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