OVERUSE INJURIES OF THE KNEE

D. Richard DiNapoli, D.P.M.
W. Donovan Screst, D.O.

Introduction

As Americans strive to become physically fit they often resort to simple, inexpensive, enjoyable activities such as running and walking. The physician treating sports related problems of the lower extremity will encounter many overuse syndromes. One of the most common presenting complaints is knee pain.

Our discussion will focus on various overuse syndromes of the knee, review of the pertinent anatomy, and methods of treatment as well as a logical stepwise approach to evaluation.

The majority of overuse syndromes of the lower extremity are associated with running and the novice athlete. A number of factors are implicated in the development of such conditions including: errors in training technique, improper equipment, underlying biomechanical flaws, and muscle imbalance. The patient most often reveals the diagnosis during the history portion of the exam. The examining physician should take a thorough history of patient activities, training schedule, participation level, equipment used, and any history of previous injury or treatment.

The vast majority of chronic injuries that occur in the knee have their pathology associated with the soft tissues. The supporting soft tissues of the knee may be damaged during daily occupational, recreational, or competitive activities.

Injuries from direct trauma are easily identifiable. The same soft tissues may be damaged to a similar extent or worse by the repetitive stress of running, jumping, and twisting. Overuse injuries are insidious in onset and are often difficult to diagnose. Treatment may be prolonged and frustrating both for the practitioner and the patient. Each may lack the patience needed for proper treatment so as to avoid a troublesome recurrence.

The knee is the central link connecting the spine with the foot and ankle complex. Many of the surrounding soft tissue structures at the knee also have attachment at the pelvis. Careful analysis of all superior and inferior structures needs to be performed. The knee should never be considered as an isolated unit that functions independently from its neighboring parts.

Patellofemoral Stress Syndrome

Patellofemoral complaints are probably the most common and frustrating of knee problems occurring in the running athlete. This may occur in patients of any age.

Older children with the condition will generally complain of pain and swelling. On exam they have palpable tenderness of the tibial tubercle and may have a mobile patella. Commonly the problem is diagnosed as Osgood-Schlatter's disease. The adolescent will experience pain around the patella and its retinacula. There is a tendency for recurrent dislocation and subluxations, ligamentous laxity, and rapid growth.

Young adults may be affected by patellar tendinitis and the overuse syndrome of the superior pole of the patella from repeated stress. The history is generally unremarkable. Patients occasionally relate one specific incident, but the patellofemoral mechanism has been present long before the symptoms appeared. The patient relates a "jumping out" type of phenomenon in which a click is heard and subsequent locking of the knee is experienced. The patient may relate leg weakness, especially in activities requiring cutting from side to side or stair climbing.

This condition is commonly associated with an increased "Q" angle, excessive femoral anteversion, genu valgum, external tibial torsion, chondromalacia, vastus medialis obliquus dysplasia, pathologic rearfoot pronation, unstable first ray, and gastrocnemius-soleus equinus (Fig. 1). The patient's gait should be observed. Femoral anteversion, tibial torsion, muscle mass, and foot posture is evaluated. Direct palpation of the patella and retinacula and the patellar apprehension test are good tests for patellofemoral pathology.

Treatment

Initially treatment is conservative using ice, non-steroidal anti-inflammatory agents, muscle strengthening, and stretching exercises. Surgical therapy will not be discussed here but it is generally reserved for unresolved cases.

Bursitis

A bursa is a sac of synovial tissue separated by a thin film of fluid which functions as a spacer and lubricant to allow for smooth movement between anatomic structures. A

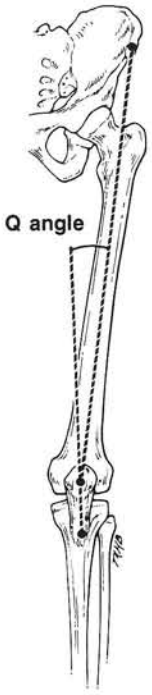


Fig. 1. "Q" angle or quadriceps angle is formed by intersection of two lines. First is measured between center of patella and anterior superior iliac spine. Second is measured between center of patella and tibial tuberosity. An angle greater than 15 degrees indicates tendency towards patellar instability.

detailed review of the pathophysiology of bursal inflammation can be found elsewhere. Bursae may be injured by direct injury or by repeated trauma. Acute bursitis is usually characterized by a distended fluid filled thin sac. In chronic bursitis, the bursa undergoes changes as the walls thicken and form capitations or rice bodies within.

Bursae About the Knee (Fig. 2, Table 1)

Several bursae occur about the knee with great consistency. They may be between the skin and bone (prepatellar), between bone and tendon (deep infrapatellar), tendon and tendon (semitendinosus), tendon and ligament (between the fibular collateral ligament and the popliteus tendon), tendon and capsule (semimembranosus) and in between fascial planes.

Prepatellar Bursitis

Generally, this is an acute problem occurring from a direct blow, but may occur as a chronic problem in the runner. Examination usually reveals swelling over the inferior one half of the patella and may even appear to involve the lower portion of the vastus medialis. Care must be taken to insure that the swelling is localized to the bursa and that there is no intraarticular injury. Range of motion should not be affected as would be the case in hemarthrosis with intraarticular injury.

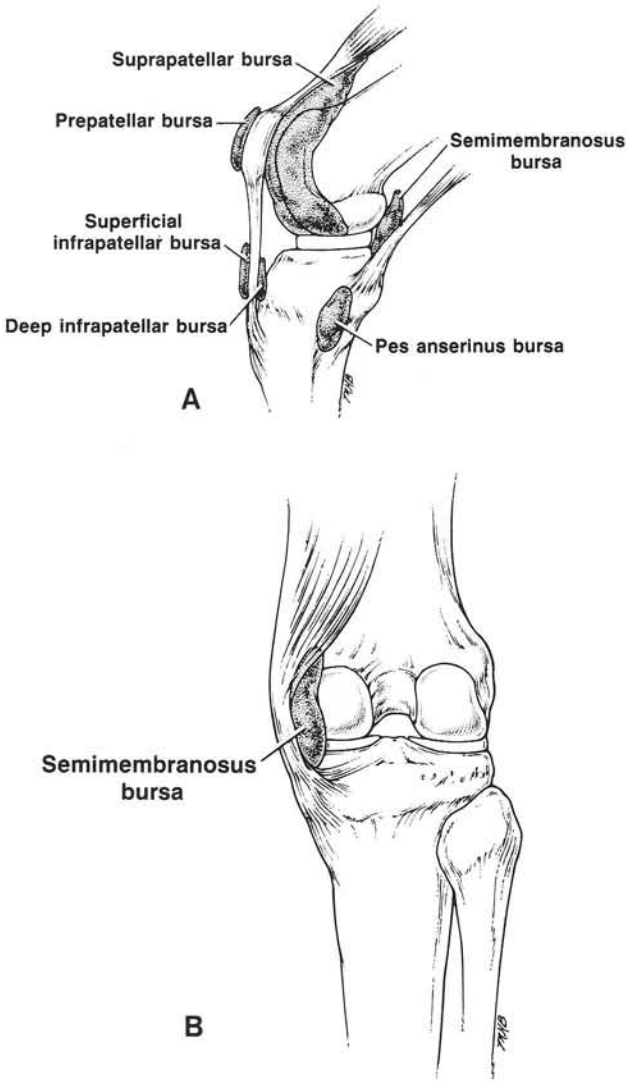


Fig. 2. Bursae about knee. **A.** Medial view. **B.** Posterior view.

Table 1
Bursae Around the Knee

Structure	Example
Skin and bone	Prepatellar bursa
Tendon and tendon	Semitendinosus bursa
Tendon and capsule	Semimembranosus bursa
Subfascial planes	Iliotibial band
Tendon and ligament	Fibular collateral ligament popliteus tendon
Tendon and bone	Deep infrapatellar bursa

Treatment is conservative and depends upon the degree of swelling. Ice, compression, and immobilization are adequate means of treatment for the mild and moderate cases. In situations with extensive swelling, aspiration of the bursae under strict aseptic conditions may be necessary. The use of steroids is not recommended. Isometric exercises and range of motion exercise of the knee should be performed once symptoms have subsided.

Pes Anserinus Bursitis

The pes anserinus bursa is located between the medial collateral ligament and the sartorius, gracilis, and semitendinosus tendons (Fig. 3). This condition is manifested by pain and tenderness along the proximal medial tibial metaphysis. As with many overuse injuries the onset is insidious, and intensifies with activity. Pain may occur along the joint line and may extend proximally to the hamstring muscles.

Causative factors are long distance running, new running programs, tight or contracted hamstring muscles, genu valgum, increased tibial torsion and errors in training such as excessive hill work or neglected stretching programs.

Physical examination

Biomechanical considerations will include excessive femoral anteversion, genu valgum, and tibial torsion. Tenderness can be eilicited along the proximal tibial metaphysis, and often extends along the posteromedial margin of the semimembranosus attachment.

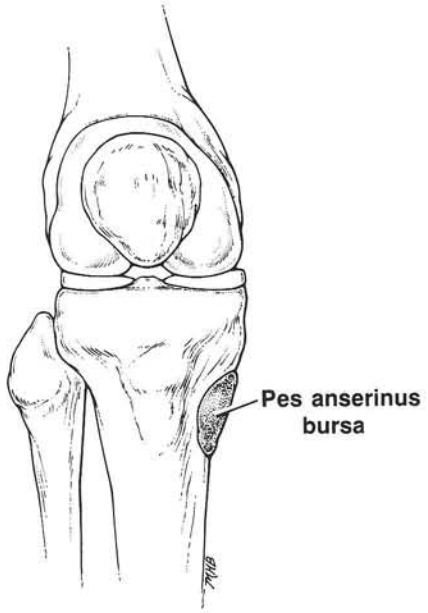


Fig. 3. Clinical location of pes anserinus bursitis.

Differential diagnosis

The differential diagnosis includes Hamstring (semimembranosus or semitendinosus) tendinitis, meniscal injury, stress fractures, bone cysts, bone tumors, and degenerative joint disease.

Treatment

Initial treatment consists of rest, ice, and non-steroidal anti-inflammatory drugs (NSAIDS). Heat may be helpful as the acute state diminishes. Strengthening and flexibility exercise programs should also be employed. Localized steroid injections may also be useful to reduce inflammation.

Addressing the biomechanical problems with orthoses may be helpful. Upon resumption of activity, special attention should be given to reducing mileage and shortening the stride. A stretching and flexibility program is essential as is a sufficient time between workouts.

Other Forms of Bursitis

Medial head of the gastrocnemius and semimembranosus bursitis: The patient presenting with this syndrome is commonly involved in activities requiring repeated contractures of the gastrocnemius and hamstring muscles. Subjective complaints include pain and swelling behind the knee, possible limitation of knee flexion, and pain on extremes of flexion and extension. This bursa may be attached to the joint and the examiner must be aware of the possibility of intraarticular injuries such as medial meniscus damage or other causes of synovitis.

Physical examination

Usually a tender mass is palpated in the area of the medial head of the gastrocnemius muscle and semimembranosus tendon. There may also be tightness and contracture of the hamstrings and even the posterior leg muscles.

Treatment

Usual conservative methods of rest, ice, followed by heat, and NSAIDS is recommended. An exercise program should be undertaken in conjunction with strengthening and stretching performed. Patients who do not respond to conservative therapy should be reevaluated for intraarticular problems.

Tendinitis

Generally defined, tendinitis is an inflammatory reaction involving the tendon sheath and its contained tendon. A crepitus type sensation may be palpated along the course of the tendon. This is a manifestation of the inflammatory process. The inflammatory reaction leads to adhesions. Generally, tendinitis occurs in those tendons that course

around bony structures, under retinaculae, and are contained within a true synovial sheath.

Treatment is conservative using ice, rest, and NSAIDS. Other modalities such as ultrasound, diathermy, and local heat may be of some benefit after the acute phase has resolved. The injection of soluble steroids into tendons is not indicated, although infiltration into adjacent bursal tissue may be quite beneficial.

Patellar Tendinitis: "Jumpers Knee"

This condition, more commonly associated with activities involving some type of jumping as in basketball, modern dance, volley ball, or high jumping is characterized by pain felt anteriorly near the inferior pole of the patella. Most often the pain is insidious in onset, initially described as an ache or isolated discomfort, that usually diminishes with rest but returns with activities that stress the extensor mechanism of the knee. This disease entity has been classified into phases of pain and disability (Table 2).

Table 2
Classification of Jumpers Knee

Phase I	Pain only after practice or participation
Phase II	Some discomfort during practice or participation but not sufficient to interfere with activity
Phase III	Pain during and after participation, enough to interfere with performance
Phase IV	Complete tendon rupture

Physical examination: Patients generally exhibit swelling along the inferior and distal pole of the patella, usually no joint line tenderness or joint effusion is present. Range of motion is usually full except when flexion is stressed and the hip is extended. Palpation of the inferior pole of the patella when it is displaced distalward will reveal marked tenderness. Examination for patellar alignment, patellar alta, patellar baja, and genu recurvatum, abnormal Q angle or Osgood-Schlatter's disease is necessary. Quadriceps atrophy or weakening may be present.

Treatment (Table 3): Generally treatment is determined by the phase of the condition. During the first two phases an adequate period of warmup followed by ice after participation, with the use of aspirin or NSAIDS is quite helpful. Practice sessions should be modified to eliminate jumping or sudden deceleration activities. Strengthening and flexibility exercises should be employed as needed for weakness and contractures. Patellar restraining braces and isometric exercises may also be useful. The treatment period for these two phases may be several months.

Phase III patients should be treated much the same as Phase I and II patients. However, they should eliminate all athletic activity for an extended period of time. In cases of chronic unresolving jumpers knee, surgical intervention may be necessary. Those procedures are beyond the scope of this paper. In cases of complete disruption (Phase IV) surgical intervention is indicated.

Influencing factors in patella tendon disruption are previous steroid injections and aging, much the same as in disruption of the tendo Achillis in older athletes.

Table 3
Treatment of Jumper's Knee

Phase I and II

Adequate preactivity warmup
Post activity ice
NSAID
Stretching of quadriceps and hamstrings
Ultrasound
Modification of activity
Reduced duration of workouts
Isometric exercises
Patellar-restraining brace

Phase III

Rest
Rehabilitation as above
Surgery if not responding to conservative treatment

Phase IV

Acute operative repair of tendon rupture

Osgood-Schlatter's Disease

Generally a condition of the adolescent athlete, it is characterized by pain and tenderness at the distal attachment of the patella tendon. There is much discussion in the literature as to whether this condition is a tendinitis, epiphysitis, osteochondritis, or an avulsion fracture of the developing ossification center. Activities which require repeated jumping and running can produce this condition.

Physical examination reveals pain and tenderness at the tibial tubercle that generally worsens with kneeling and stair climbing.

Treatment: Standard conservative methods as outlined for jumper's knee are used. Immobilization is generally not required unless the patient is symptomatic with level walking. Ice and NSAIDS followed by heat are useful. Steroid injections are not necessary. Stretching and flexibility exercises are recommended for contracted muscle groups.

Semimembranosus Tendinitis

This condition is more common than is usually appreciated. Generally the pain is gradual in onset, isolated to the medial side of the knee near the joint line. It has been postulated that the syndrome may represent microtears in the tendon itself. It can often mimic a torn medial miniscus.

Treatment is conservative consisting of ice, rest, and use of heat after the inflammatory phase resolves. Occasionally infiltration of a steroid into the tendon sheath and the surrounding area may be helpful.

Popliteal Tendinitis

The musculotendinous complex in the lateral part of the knee includes the attachment of the biceps tendon, lateral collateral ligament, aponeurotic attachments of the rectus femoris, and iliotibial band (Fig. 4). There is a bursa located in the same area. Pain in the posterolateral aspect of the knee is generally believed to be due to popliteal tendinitis. The popliteus muscle assists the posterior cruciate ligament in preventing forward displacement of the femur on the flexed knee during the stance phase of gait. It also functions to maintain internal rotation of the tibia and prevent the posterior horn of the lateral meniscus from moving excessively forward as can occur with down hill running.

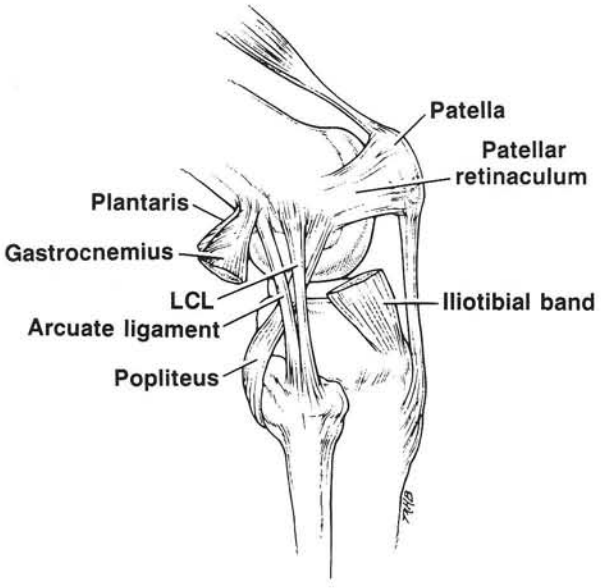


Fig. 4. Lateral knee soft tissue support structures.

Objective symptoms: Pain is generally located along the posterolateral aspect of the knee, worsening with down hill running or sitting cross legged. There may also be pain at the fibular collateral ligament.

Differential diagnosis: (Lateral knee pain)

Lateral meniscus tear
Iliotibial band syndrome
Biceps tendinitis

Physical examination: Tenderness is usually localized over the tendon just posterior to the lateral collateral ligament. Placing the patient in the "4" position, the hip is flexed, abducted and externally rotated and the knee flexed and crossed over the opposite extremity allowing for direct palpation of the posterolateral corner of the knee (Fig. 5).

Treatment: Conservative treatment consists of rest, NSAIDs, local ice massage followed by heat. Steroid injections into the tendon are discouraged but if a simultaneous bursitis is present, local injection may be helpful. Upon resuming activity, excessively long workouts and hill running should be avoided.

Biceps Tendinitis

As a differential for lateral knee pain, this is usually present in individuals who have tight hamstrings. Patients will complain of pain and tenderness palpable at the fibular head region and along the distal one/fourth of the biceps tendons.

Treatment is conservative consisting primarily of ice, NSAIDs, and flexibility exercises. The return to activity is generally controlled by the degree of pain.

Iliotibial Band Syndrome

This condition was initially reported in the late 1970's in Marine officer recruits. It is not an uncommon injury in the long distance runner.

Fig. 5. Patient is placed in the "4" position for palpation of popliteas tendon and lateral collateral knee ligament.

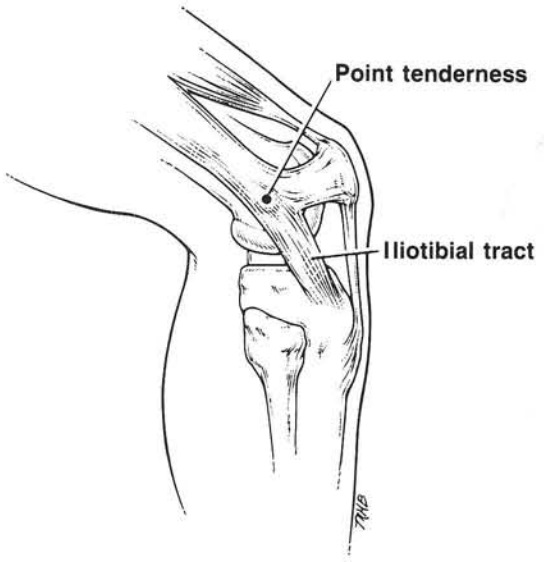


Fig. 6. Location of point tenderness in iliotibial band tendinitis.

Fig. 7. Ober test for evaluation of contracture of tensor fascia lata and gluteus maximus.

The pain is localized over the lateral femoral condyles (Fig. 6). Discomfort is reported above the lateral knee line and downward toward the proximal tibia and the area of Gerdy's tubercle. Pain is initially relieved by rest. The symptoms can become more severe and almost disabling if the athlete continues to run and ignore symptoms. It may become necessary to completely stop all activities.

There are a number of factors that may contribute to the iliotibial band syndrome, including: long distance running, over striding, down hill running, the down side leg of road runners, varus alignment, increased tension on the iliotibial tract, genu varum, excessive or prolonged rearfoot pronation with first ray instability, and internal tibial torsion.

Physical examination: A careful and thorough evaluation of the lower extremity must include limb length measurements and evaluation for possible hip abduction contracture. A test described by Ober in 1936 to evaluate contractures of the abductor group involves placing the patient on an examination table with the affected extremity side up (Fig. 7). The contralateral limb is bent in a 90 degree angle at the hip and knee. The affected side is abducted and extended at the hip maximally with the knee at 90 degrees. The examiner then places the limb in its maximum abducted extended position and then releases the limb. Should the limb remain in that position or not drop to the level or below the level of the examination table then the test is considered positive and the patient has a contracture of the iliotibial band-gluteus maximus-rectus femoris segment. The final positioning is also a good means of providing stretching to this group should the test prove positive.

Direct palpation may reveal swelling with pain and occasional crepitation at the lateral epicondyle area of the femur as well as at Gerdy's tubercle on the proximal lateral aspect of the tibial plateau area. Motion of the knee may reveal snapping or popping along the lateral aspect of the knee joint (Fig. 6).

Treatment is directed at reducing the local inflammatory reaction and correcting the underlying biomechanical factors as indicated.

Various treatment protocols and stretching methods have been devised (Fig. 8). Initially, the patient should use protective measures by avoiding training errors, decreasing the running distance, and avoiding hill running. Should an acute situation arise, the usual conservative means of rest, icing the part, NSAIDS, and stretching of the hip abductors and iliotibial band are indicated. Occasional steroid infiltration may be of some assistance. In the chronic situation the athlete should avoid running for four to six weeks and a regimen of steroid injections every two weeks is helpful until the condition resolves.

Orthotic devices to correct biomechanical malfunctions are usually helpful. It is interesting to note that individuals who develop iliotibial band syndrome will also give a history of greater trochanter bursitis and iliac crest type pain.

Plica Syndrome

The synovial lining of the knee contains certain folds that are remnants from embryologic development. These folds may undergo fibrotic changes either primarily associated with running or secondarily associated with some other intraarticular knee pathology.

The three predominant plica in the knee are infrapatellar plica (ligamentum mucosem), suprapatellar plica, and medial patellar plica (Fig 9).

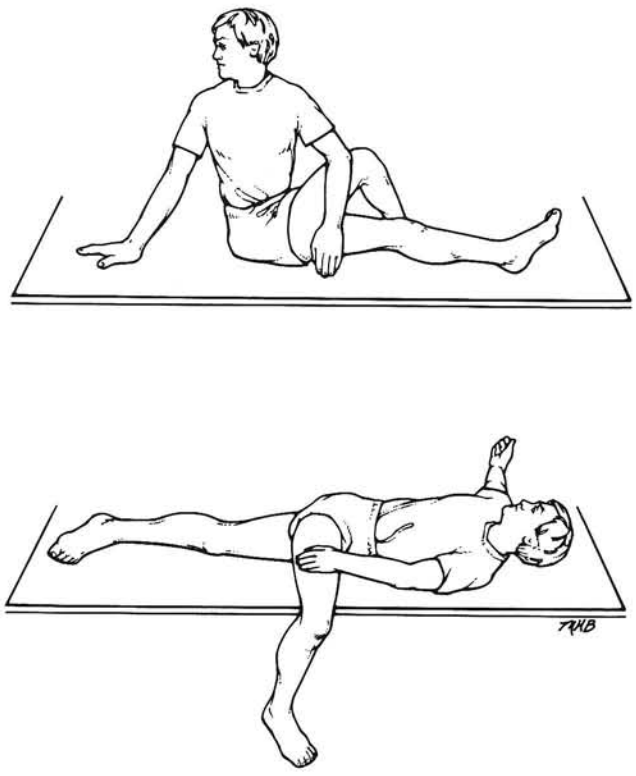


Fig. 8. Iliotibial band stretching techniques.

The medial patellar plica or shelf is most commonly implicated in the pathological conditions of the knee. The shelf attaches to the medial synovial lining of the suprapatellar pouch, extending distally to the synovium covering the infrapatellar fat pad (Fig. 9C). During activity it can bowstring across medial femoral condyle and impinge on the articular cartilage. As flexion increases, impingement between the plica and the medial facet of the patella may occur.

Clinical findings: Pain is found on the medial femoral condyle with an occasional "giving away" sensation and pseudolocking. A thickened and tender band may be palpated beneath the medial retinaculum, if the condition has existed for some time joint effusion may be present. Further diagnostic studies are helpful in defining this clinical syndrome. These include arthrography, flexion cross table laterals, and axial patellar femoral views. The best method for diagnosis is arthroscopy. If an abnormal plica exists, definitive therapy can be performed.

Treatment: Initial treatment of the syndrome should begin with oral anti-inflammatory medications, and cessation of the initiating activity. Once all acute symptoms have resolved, an exercise program should be initiated. Straight leg raises, hip adductor strengthening and quadriceps flexibility exercises are most helpful. Should conservative methods fail operative treatment is appropriate.

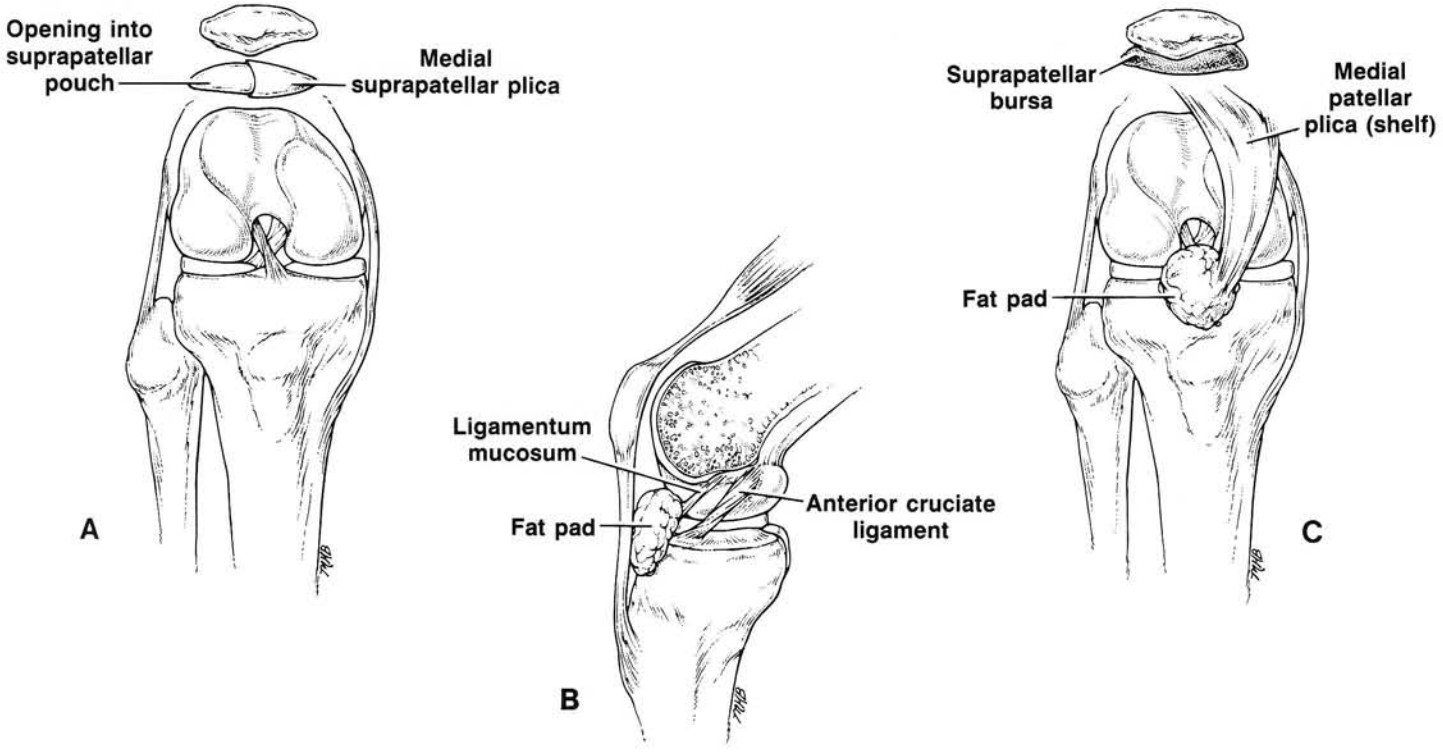


Fig. 9. Synovial plicae. **A.** Supratellar plica. **B.** Ligamentum mucosum. **C.** Mediopatellar plica or shelf. Note location of shelf over medial femoral condyle.

Approach To Examination of the Knee

The knee acts as an essential link in the lower extremity connecting the spine and pelvis to the foot and ankle. Pain at the knee may then originate in any of these areas; spine, hip, knee, ankle/foot complex.

The patient should be appropriately attired to allow for examination of the lower extremity and spine. Inspect both limbs for evaluation and any obvious deformity. A certain amount of symmetry should exist. The patient should be viewed from the front, lateral, and posterior positions.

The patient should be placed in a position to allow easy access to the knee and leg for palpation. Palpation begins with the bony structures. The asymptomatic extremity should be examined first to establish a base line for normalcy for that individual.

MEDIAL STRUCTURES

Tibial plateau
Tibial tubercle
Medial femoral condyle
Adductor tubercle

LATERAL STRUCTURES

Tibial plateau
Lateral tubercle
Femoral condyle
Femoral epicondyle
Head of the fibula
Gerdy's tubercle

PATELLAR FEMORAL JOINT

Soft Tissue Palpation:
- Zone I: Anterior
- Zone II: Medial
- Zone III: Lateral
- Zone IV: Posterior

Zone I (Anterior)
- Quadriceps
- Infrapatellar tendon
- Superficial infrapatellar bursa
- Prepatellar bursae
- Pes anserinus bursa

Zone II (Medial Aspect)
- Medial meniscus
- Medial collateral ligament
- Pes anserinus

Zone III (Lateral Aspect)
- Lateral collateral ligament
- Anterior superior tibulofibular ligament
- Biceps femoris tendon
- Iliotibial tract
- Common peroneal nerve

Zone IV (Posterior Aspect)
- Popliteal fossa
- Posterior tibial nerve
- Popliteal vein and artery
- Gastrocnemius

Tests for Joint Stability

The knee joint is restrained by a strong network of soft tissue structures. We have reviewed many chronic soft tissue problems and examined their pertinent anatomy. Joint instability is usually the result of an acute traumatic process. Treatment is rendered after determination of the disrupted ligaments. Four main tests are employed to evaluate the four major stabilizing ligaments of the knee.

Collateral ligaments: The patient should be lying on the examination table in a supine position (Fig. 10). The knee should be flexed enough to unlock it from full extension.

The medial collateral ligament is tested by securing the ankle with one hand and placing the other hand around one knee so that the thenar eminence is against the fibula head. A valgus stress is applied to the knee in an attempt to open the medial aspect of the knee joint. The medial joint line should be palpated for gapping. If there is disruption of the medial collateral ligament a "clunk" sensation will be noted when the valgus stress is removed and the femur and tibia close on one another.

The lateral collateral is tested in a similar manner. The hand positions are reversed and a varus stress is applied to the knee. The lateral joint line is palpated for any gapping. The "clunk" sensation will be noted as the femur and tibia come together after the varus stress is removed.

Cruciate ligaments: The anterior and posterior cruciate ligaments restrict excessive anterior and posterior shift of the femur on the tibia (Fig. 11). These are intracapsular ligaments originating on the inner surface of the femoral condyles and attaching to the tuberosities of the knee.

To test the anterior cruciate ligament, the patient should lie supine on the table with the knees flexed at 90 degrees and the feet flat on the table. The examiner should position himself at the end of the table to facilitate stabilizing the feet. The hands are cupped about the knee with the fingers on the posterior aspect of one knee joint and along the medial and lateral joint margins. The thumbs are placed on the anterior tubercle of the tibia. An anterior drawer or slide is performed by pulling the tibia from beneath the femur. If it slides forward more than a few degrees, it may be indicative of torn anterior cruciate ligament. If the anterior drawer test is positive the maneuver needs to be repeated with the leg in internal and external rotation. External rotation will tighten the posteromedial portion of the joint capsule while internal rotation will tighten the posterolateral portion of the joint capsule. If the forward movement of the tibia on the femur remains unchanged while the leg is in a rotated position, it is indicative of capsule and possibly meniscal damage.

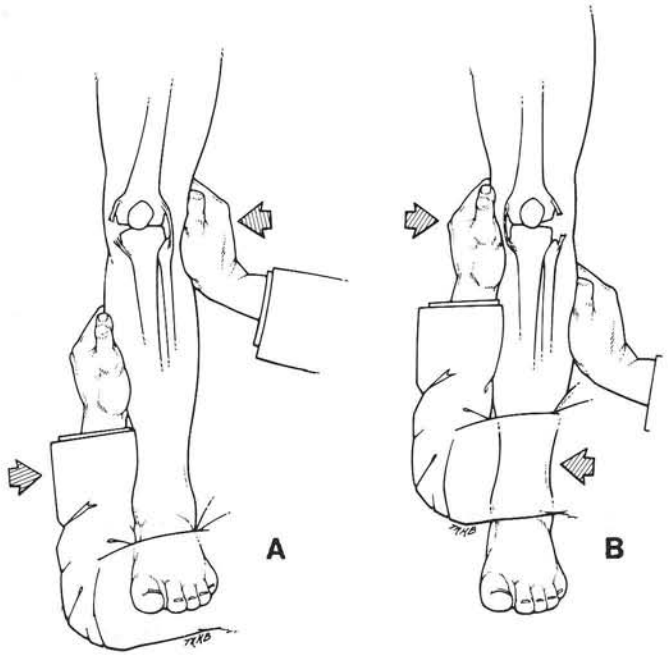


Fig. 10. Testing of collateral knee ligaments. **A.** To test medial collateral ligament a valgus stress is applied to lateral aspect of knee. **B.** To test lateral collateral ligament a varus stress is applied to medial aspect of knee.

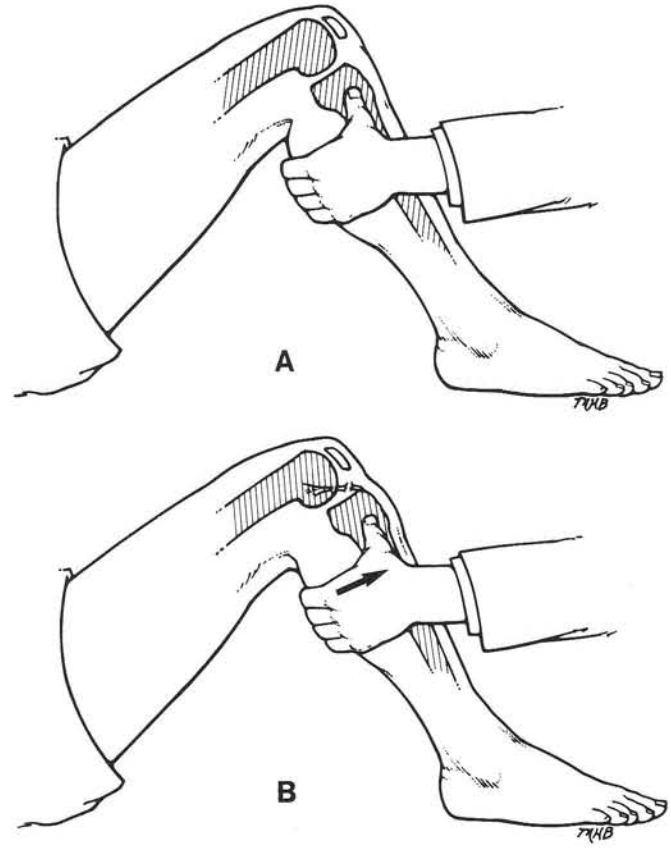
The posterior cruciate ligament is examined in a similar manner. The patient remains in the same position and the tibia is pushed posteriorly. Excessive movement of the tibia on the femur may indicate significant damage to the ligament.

The anterior and posterior drawer tests may be performed as a continuous movement. The examination should be performed bilaterally.

Special Tests

A number of special tests have been described in the literature. We will utilize two of these for evaluation of meniscal damage.

McMurry Test: During flexion and extension of the knee a torn meniscus may produce a palpable or audible "click" along the joint line. The patient is placed in a supine position with the legs flat. Hold the heel of the patient in one hand and fully flex one knee while rotating it internally and externally to loosen the knee joint. Then extend the leg fully by externally rotating the leg, applying a valgus stress and palpate the medial joint line. A palpable or audible "click" may indicate medial meniscal damage (Fig. 12).



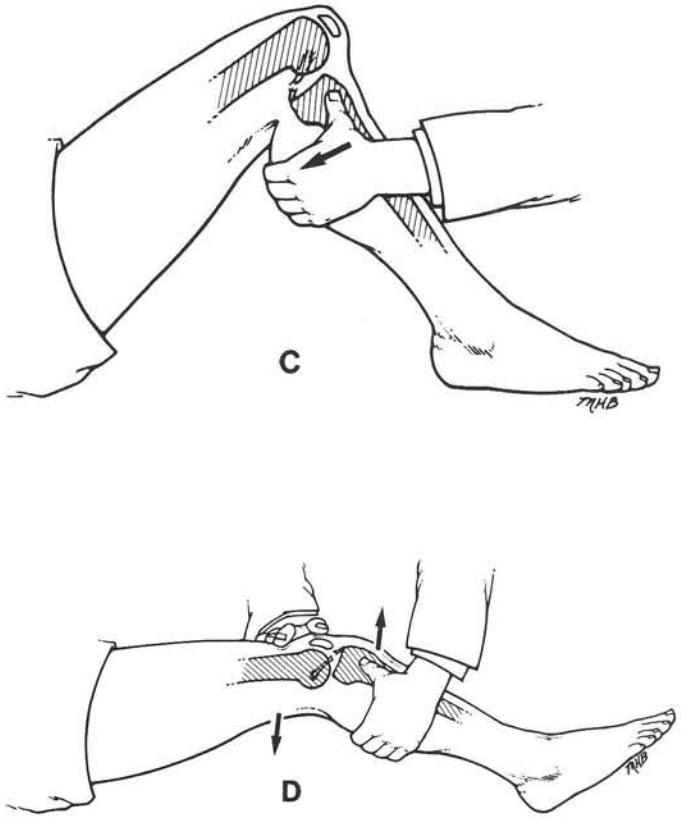


Fig. 11. Evaluation of cruciate ligaments. **A.** Anterior drawer test. **B.** Positive anterior drawer sign indicative of torn anterior cruciate ligament. **C.** Positive posterior drawer sign. **D.** Lachman test. Evaluation of anterior cruciate by performing anterior drawer test with knee in 25 degrees of flexion.

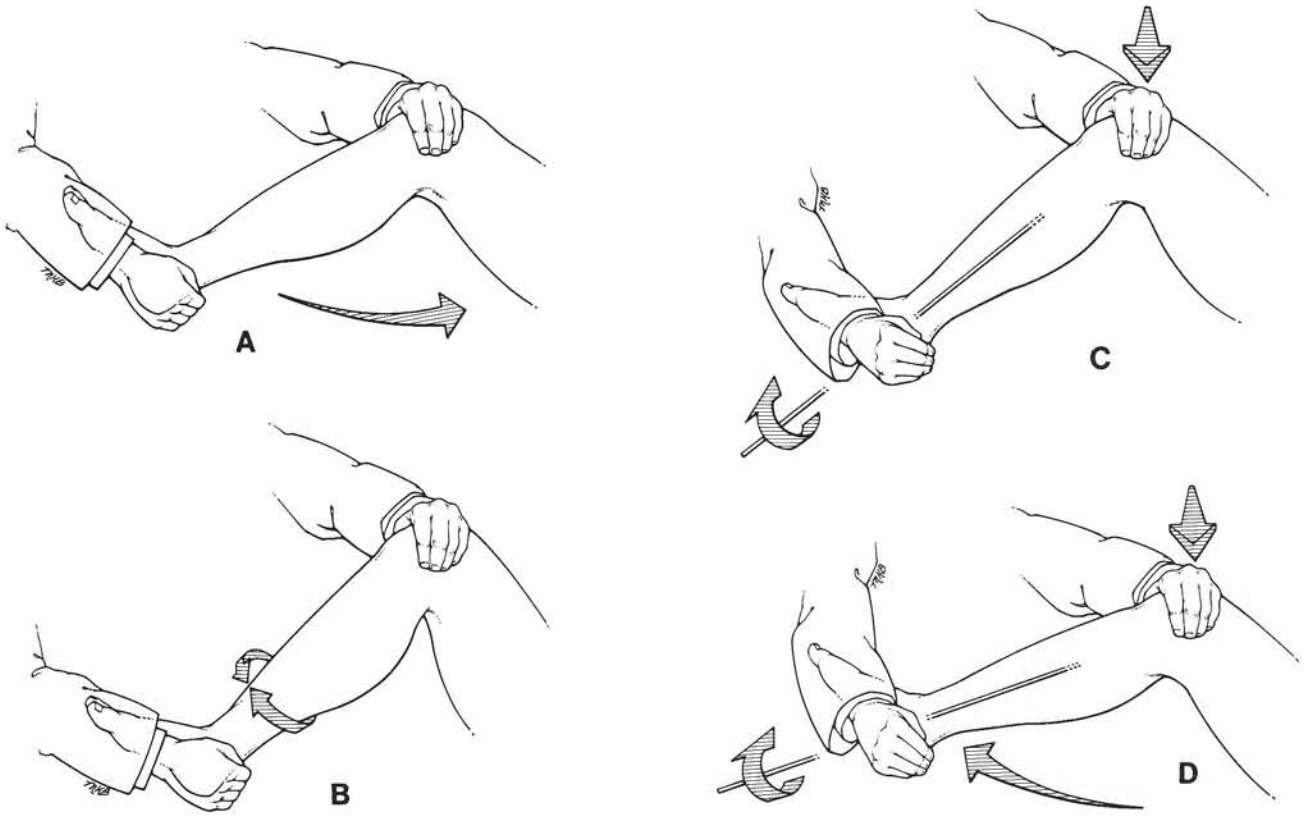


Fig. 12. McMurry test. **A.** Knee is flexed. **B.** Internally or externally rotate tibia on femur. **C. & D.** Place valgus stress on knee while it is externally rotated and slowly extended.

Apley's test: The compression-grinding test is designed to aid in the diagnosis of a torn meniscus (Fig. 13). The patient is prone on the examination table and the leg is flexed to 90 degrees. The patient's leg is stabilized by the examiner placing his own knee on the patient's posterior thigh. The knee joint is compressed by pushing down on the heel. This maneuver compresses the menisci between the condyle of the tibia and femur. The tibia is then rotated upon the femur while being compressed. Identification of pain by the patient may indicate medial or lateral meniscal tear.

The distraction test: is performed to distinguish between meniscal and ligament damage. This test should be performed after the compression test. The patient remains in the same position as described. Traction is then applied to the leg while internally and externally rotating it. This reduces the pressure on the meniscus and tests the collateral ligaments. Pain with rotation and traction usually indicates ligament damage.

Patella grinding test: This test is used in evaluating the patellofemoral articulation. It is positive in a variety of situations including: chondromalacia patella, osteochondral defects, and degenerative arthritis. The patient is placed in a supine position on the examining table. The patella is pushed distally in the trochlear groove of the femur.

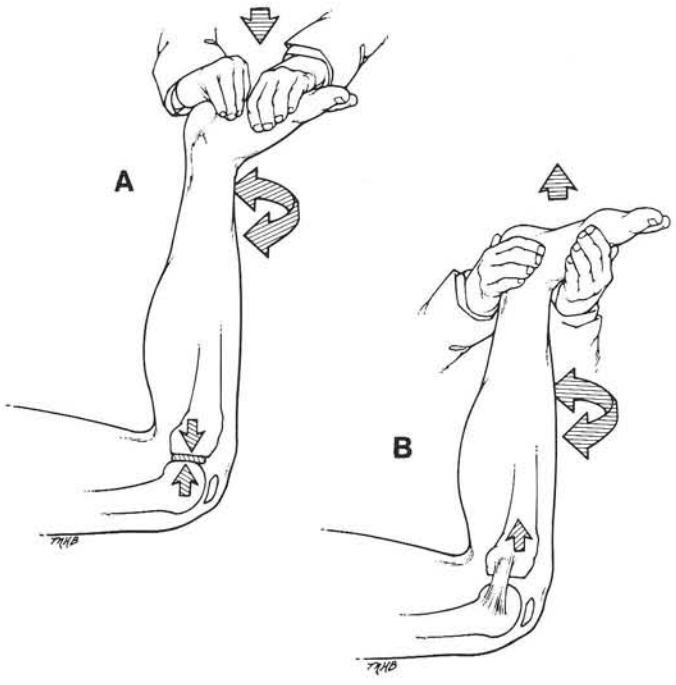


Fig. 13. Apley's compression and distraction test. **A.** Leg is compressed at knee to detect meniscal damage. **B.** Tibia is then distracted and internally and externally rotated.

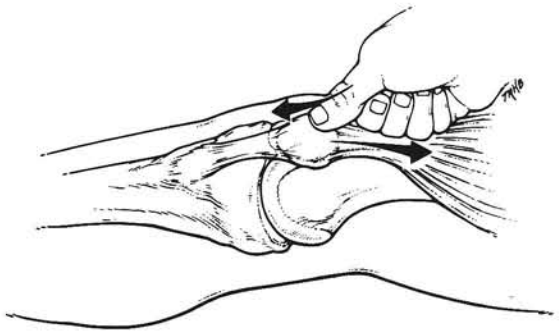


Fig. 14. Patella grinding test to evaluate patellofemoral articular surface.

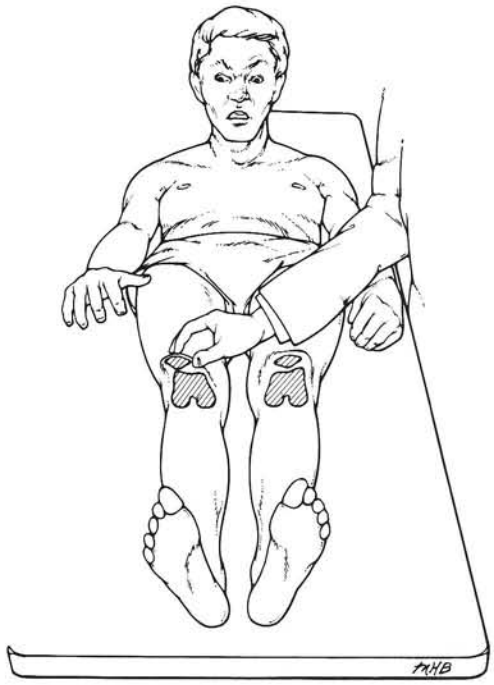


Fig. 15. Patella apprehension test for subluxating or dislocating patella.

The patient is then asked to tighten the quadriceps. Resistance and palpation are applied to the patella. The movement should be smooth and painless. The test is positive if crepitation and pain are the result (Fig. 14).

Patella apprehension test: This test is used to distinguish a subluxating or dislocating patella. The patient is placed in a supine position with legs flat and relaxed. If it is suspected the patient has a laterally subluxating patella pressure is applied to the medial border of the patella. If there is no laxity or pathology there will be very little reaction from the patient. However, if the patella begins to subluxate the patient's face will reveal marked apprehension and distress (Fig. 15).

References

Andrews JR: Overuse syndromes of the lower extremity. *Clinics in Sports Medicine* 2:137-148, 1983.

Brody DM: Running injuries. Prevention and management. *Clinical Symposia* 39:3, 1987.

Brody DM: Running injuries. *Clinical Symposia* 32:4, 1980.

Hoppenfeld S: *Physical Examination of the Spine and Extremities.* New York, Appleton-Century-Crofts, Chapter 7, 1976.

Nicholas JA, Hershman EB (eds): *The Lower Extremity and Spine in Sports Medicine,* vol 1. St Louis, CV Mosby Co, Chapters 21, 25, 28-33, 1986.

Scott WN, Nisonson B, Nicholas JA (eds): *Principles of Sports Medicine,* Baltimore, Williams & Wilkins, Chapter 15, 1984.