THE SAN DIEGO KNEE CLINIC

MANAGEMENT OF ACUTE KNEE INJURIES

We will be offering counseling on diet and exercise. If interested, please contact my office and schedule a medically supervised *Health and Orthopedic Fitness* assessment appointment which will include a spine and joint health assessment evaluation. This assessment will not be covered by health insurance.

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Abstract

The treatment of knee injuries is based upon the structure that is damaged, as well as the severity of the injury. Rest, ice, compression, and elevation (RICE) therapy is a standard component of treatment during the acute, initial phase of injury. Exercise, which should be tailored to the individual needs of the patient, protects the supporting structures around the injury and maintains mobility. Bracing is useful as prophylactic, functional, or rehabilitative therapy. Patients with injury requiring further diagnostic procedures or more technical treatment should be referred to an orthopedic specialist. The current articles on knee injuries delineates management options and provides techniques for optimum patient care.

Many knee injuries can be adequately treated in the family practice setting. The primary care physician assesses the injury and delivers first-line treatment, or regarding major injuries to the knee, recognizes limitations and knows what treatment options are available from orthopedic specialists. Several basic principles can be applied in the management of the acute knee (Figure 1). Recognition of a ligamentous injury is based on clinical findings. If left untreated, ligamentous injury can lead to reinjury of the initially damaged structure (Phisitkul, 2006).

Frontal View of Right Knee (with patella reflected)

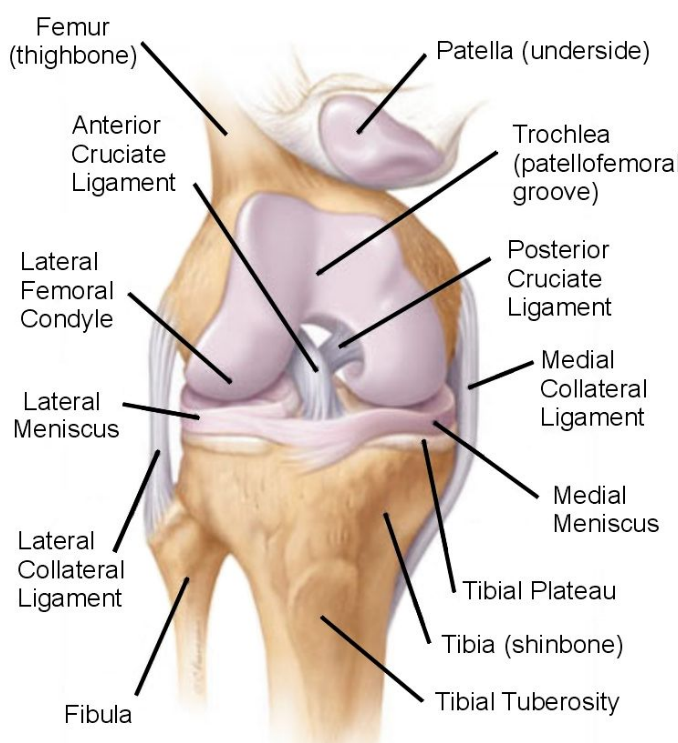

Figure 1.

In addition, the diagnosis of any instability must be accompanied by an assessment of associated structures. The aggressiveness with which an injury is treated is dependent upon several variables (Table 1). The patient and physician should make any treatment decisions in concert. Successful treatment—conservative or surgical—affording a satisfactory functional outcome requires a basic understanding of the healing processes within the knee, enabling a scientific approach to the management of the injury. Before treating conditions of the knee, it is also necessary to ascertain the extent of the damage by clinically grading the lesion and testing for instability (Mangine, 2008). Rest, application of ice, compression, and elevation—the RICE regimen—is commonly first-line therapy in the acute phase of injury.

Table 1: Factors Influencing Aggressiveness of Knee Injury Therapy

Aggressive	**Non-aggressive**
Younger (aged 20 to 35 y)	Older (aged>35 y)
Athletic	Sedentary
Motivated	Non-motivated
Slim	Obese

Administration of an anti-inflammatory agent provides pain relief and enhances healing. Judicious use of exercise therapy is often the most important component of a treatment regimen permitting the athlete to return to sporting activities, in many cases without the need for surgery. Supportive and protective bracing can be used both following an injury and postoperatively to facilitate the proper healing of damaged tissues and to prevent further damage to susceptible structures.

Several factors influence the healing of a ligamentous knee injury. The blood supply to the injured area, the approximation of damaged tissue, and the application and timing of stress are all elements in the healing process.

A working knowledge of the mechanism involved in an injury is essential in order to understand the principles of treatment (Arnoczky, 1979). Experiments with dogs have shown that after a collateral ligament has torn, the remaining defect fills with blood to form a hematoma. The vessels from the surrounding areolar tissue then penetrate the hematoma, forming a fibrovascular scar. By the fifth day, the fibroblasts multiply and begin to lay down collagen. Initially, the fibroblasts are disordered, and only by week 3 are they oriented in an orderly parallel fashion. Tensile strength develops in the ligament from weeks 3 to 8, at which time the ligament appears thickened but grossly normal. Ligamentous healing following injury is dependent upon the blood supply, the tissue approximation, stress on the ligament, and the timing of the stress (Warren, 1984).

Vascular networks from the loose areolar periligamentous tissues supply the lateral and superficial medial collateral ligaments (MCL), whereas the deep MCL receives its blood supply from capsular and synovial vessels. Terminal branches of the middle and inferior genicular arteries that contribute to the richly vascular synovial membrane surrounding the ligaments provide blood for both cruciate ligaments (the anterior cruciate ligaments [ACL] and the posterior cruciate ligaments [PCL]). In addition, medial and lateral branches of the inferior genicular arteries course through the infrapatellar fat pad to the ACL. The bony attachments do not contribute to the blood supply of the ligaments.

New studies done by van der List, MD at Cornell University describe a technique of anterior cruciate ligament primary repair without using allograft or autograft. Van der List reports a high degree of success in primary repairs of the ACL with proximal evolutions and distal repairs with bone evolutions (List, 2016).

Concerning the approximation of tissue and healing, experimental studies show that ligaments are unable to heal by secondary intention (O'Donoghue, 1966). Consequently, in order for healing to occur via a method other than scarification, the opposing torn ends of a grade III ligament tear must be approximated. Satisfactory healing can occur in the collateral ligaments by this process due to the proximity of the damaged ends of ligaments. Cruciate ligaments move as the knee flexes and extends, which theoretically prevents apposition and generally prohibits healing of the torn ends of the ligaments. Recent literature suggests that in some cases ligament surgical reapproximation can also be effective (List, 2016).

When placing stress on an injured ligament, the timing influences the healing process. Placement of excessive abnormal stress can impede the healing process by physically disrupting the weakened tissue, causing reinjury or exacerbating the current injury.

Grading the severity of damage and assessing the instability of the ligament are essential components of the pretreatment workup. The extent of injury dictates therapeutic intervention (Simon, 2015).

Depending upon the forces generated about the knee at the time of injury, the damaged ligaments can either stretch past the point of elasticity, partially tear, or totally rupture. A method of illustrating the different degrees of strain to patients is to hold a tissue in one hand and then slowly pull it apart with the other. As one pulls, a weakening of the middle fibers appears with minimal separation (which can be compared with a grade I ligamentous injury). Further traction causes the tissue to separate in other areas (which is similar to a grade II ligamentous injury), whereas pulling the tissue completely apart is comparable to a grade III injury.

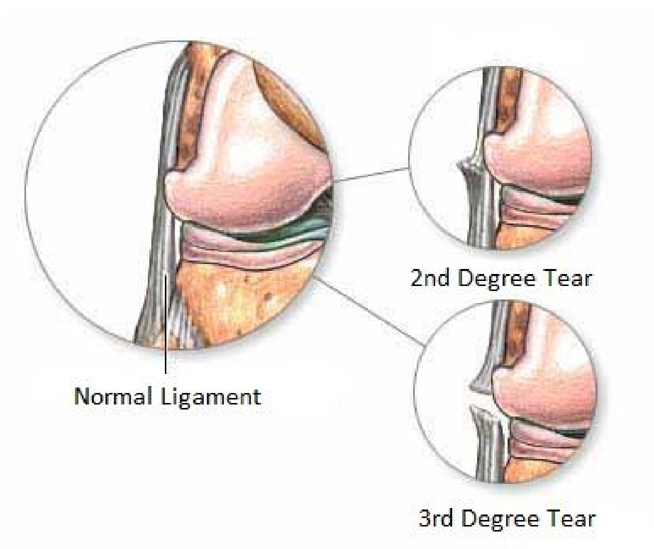

Figure 2: Grading of ligamentous injuries Grade I (Pain, Swelling, and tenderness may be present; no hemarthrosis nor instability on stress test); Grade II (Pain, swelling, tenderness, and hemarthrosis may be present; no-to-minimal instability on

stress test); Grade III (Pain, swelling, tenderness, hemarthrosis, and instability all may be present).

Clinically, patients with grade I ligament injuries present with pain and tenderness to palpation (Jung, 2009). The injury is stable to stress testing.

Patients with grade II injuries present similarly; however, the injured knee demonstrates up to 10 mm of instability, with a firm endpoint to clinical stressing. Complete, or grade III, tears have an indefinite end point with greater than 10 mm stress testing instability.

Instability in an athlete's knee, according to Hughston's classification (Hughston, 1976), is based on global stability, rather than the anatomic integrity of one ligament. Manual clinical examination for instability is highly subjective and the different terminology used, including mild, moderate, and severe or 1^+, 2^+, 3^+, can cause considerable confusion. Insall suggests that to avoid confusing and possibly non-reproducible clinical records, that laxity should be described according to the amount of displacement measured in millimeters (Insall, 1984). Both medial and lateral instability are quantified according to the amount of joint line opening measured in millimeters that occurs with stress testing. Anteroposterior instability, measured by the Lachman or drawer tests, can be graded according to the amount of abnormal anterior or posterior tibial translation on the femur. Rotatory instabilities might best be graded according to the amount of tibial translation relative to the femur: anteromedially, anterolaterally, or posterolaterally. The pivot shift and external rotation recurvatum tests can be recorded as negative or positive.

When treating knee injuries, it is important to follow two guiding principles: Do not overload the injured tissue; however, minimize joint immobility. Rest, ice, compression, and elevation are standard therapies in the acute phase of injury. An individualized exercise program builds strength and provides protection of the ligamentous injury.

The initial treatment of a knee injury is symptomatic and protective (Ratzlaff, 2010). Institution of RICE therapy, which may continue for a number of days depending on the severity of the injury, decreases the swelling and provides relief.

Following the acute phase of management or postoperatively, two basic principles guide the treatment and rehabilitation of structural injury to the knee: minimize immobility, and avoid overloading the healing tissue. It is well established that immobility leads to a decrease in muscle mass, weakening of the ligaments, and even weakening of the ligamentous bony attachment (Booth, 1983). In order to achieve maximal functioning following an injury or surgery, the patient, clinician, and physical therapist must work together to institute individually tailored therapy programs. Exercise combinations are designed to strengthen the supporting joint structures, and at the same time, to protect the injured tissue until sufficient tensile strength has developed in the healing ligament.

Individualize exercise programs to allow for patient-to-patient variations and the desired muscle development necessary to treat specific conditions (Hunter, 2009). Designing a program for a patient also depends upon his or her level of symptoms, tolerance to exercise, and overall pre-injury physical condition. Furthermore, alterations in the program are often in order, either to increase the level or exercise as strength and endurance permit, or to decrease such, if existing symptoms worsen or new symptoms appear (Shaarani, 2012). This is particularly applicable to the patellofemoral joint, in which the injury may be symptomatic following resisted knee flexion-to-extension exercises. Exercise programs commonly involve combinations of three types of exercise: isometric, isotonic, or isokinetic.[12,13]

Isometric exercise implies that the muscle is kept at a constant length while it contracts. An example of this type of exercise is straight leg holds, during which the patient assumes a seated position and holds the leg out straight in front of him or her. The key feature to this exercise is that there is no movement of the joint, and consequently, no dynamic stresses are placed on the ligaments. Isometric exercises can be used early in a treatment regimen for ligament injury. However, strength is only gained at the specific angle at which the joint is held during contraction, and little endurance is developed with isometric exercising.

Isotonic exercise constitutes movement of a load through an arc of motion. The load can be either in the form of free weights or involve the use of the body's weight. Typical isotonic exercises include squats with or without weights, knee extension exercises, or leg presses, and are commonly used by bodybuilders in the gymnasium setting. Isotonic exercises do not provide equal resistance throughout the complete range of motion; strength gained is greatest in those muscle fibers used in the initial part of the movement to overcome the inertia.

Isokinetic exercise involves controlling the speed of the muscular contraction. The resistance varies in proportion to the changing muscular capability at every point in the range of motion. In effect, the resistance varies with the angle of pull and the degree of fatigue. Training programs utilizing the LIDO (Loredan Biomedical, Davis, California) or Cyber Extremity Testing and Rehabilitation System (Ronkonkoma, New York) machines can be used for isokinetic exercise and should be part of any well-equipped physical therapy clinic (Figure 2). Isokinetic exercise strengthens muscle fibers throughout the entire arc of motion used in the exercise.

Figure 3.
Isokinetic flexion-to-extension exercise of the knee on the LIDO machine, showing the strength of the quadriceps and hamstring muscle groups on the monitor beside the patient.

Progressive resistance exercise (PRE) combine the exercise types using progressively increasing resistance to rehabilitate and develop muscular strength and endurance (Vincent, 2012). A typical rehabilitation program for the knee includes isometric quadriceps and hamstring exercises, isotonic knee flexion, short arc quadriceps, hip abduction, adduction, and flexion exercises. The positions should be held for a count of 10 seconds and repeated 10 times to comprise a set. Each set should be performed 3 times, and the entire program completed at least twice a day. As muscular strength develops, ankle weights can be added to increase the resistance to the motion. The resistance can be increased with each series of repetitions, using one half of the maximum weight tolerated by the patient in the first set, three quarters of the maximum in the second, and the maximum weight in the third set (Delorme, 1948). Flexibility is an important facet of any fitness program, and stretching of the appropriate muscle groups should be performed as warm-up and cool-down exercises, before and after each program.

The primary goal during recovery from surgery or an injury is to achieve the most functionally normal knee. Total success can be viewed as a return to the sport and performance at the same levels as before the injury. After being released from the doctor and assuming the patient is pain free and rehabilitated, any return to sport following major injury should be gradual and pain free. Appropriate recovery involves progressively more exercises ranging from walking to jogging to running initially on a flat surface. Sprinting with sudden stops is not allowed initially. The patient should be educated about the importance of returning to their sport gradually. High velocity sports, including soccer, football, basketball, and skiing, are regarded as high risk. Participation in intermediate velocity sports, may be appropriate for valuable intermediary phase on the athlete's return to his sporting activity. Low-risk sports such as swimming, rowing, or cycling that place the least impact in the knees, and yet permit the patient to experience a cardiovascular workout.

In addition to conditioning to rehabilitate the knee, exercise to maintain cardiovascular and pulmonary health is important, particularly for the competitive athlete. We encourage the patient to participate in exercise that will not endanger the knee injury, but will promote cardiopulmonary conditioning, such as riding a stationary bicycle using only the uninjured leg, or swimming on the patient's back with a gentle flutter kick and culling with the arms.

Bracing is utilized as prophylactic, rehabilitative, or functional therapy to enhance healing or to prevent further injury. Use of a comfortable, cost-effective brace increases patient compliance with the treatment regimen.

The numerous types of bracing available can be subdivided into three categories: 1) prophylactic braces to prevent an injury 2) rehabilitative braces to optimize the healing and minimize damage to healing structures; and 3) functional braces to provide knee stability during activity. The soft-tissue interface between the bony levers and the brace is mechanically disadvantaged to resist the tangential forces experienced with rotation at the knee. Although bracing is effective at reducing loads on the supporting structures of the knee—virus or valgus, or both, limited protection is afforded from rotational forces.

Much controversy surrounds the issue of prophylactic bracing,[16] with in vivo studies on athletes failing to reveal any significant reduction in ligamentous injuries with such preventive measures (Hewson, 1986). Indeed, two such studies suggest an increased likelihood of injury (Rovere, 1987). Post-operative braces protect the healing ligament from overloading situations and allow a predetermined range of motion to minimize the effects of immobility. In the immediate postoperative phase, atrophy of the soft tissue results in loss of significant girth. Consequently, braces utilized during this period must be able to accommodate these changes.[15] As patient confidence and strength return, the purely rehabilitative brace can be replaced by a functional brace for protection during sport.

Functional bracing is commonly used by athletes who have suffered an injury to their knee and require protection from further injury. Such bracing is not restricted to surgically managed patients. Wearing a functional brace can subjectively improve athletic performance and reduce the frequency of the knee "giving way." Despite the use of braces, high-risk sports involving cutting, pivoting, or jumping are still associated with a higher incidence of instability in the ACL-deficient patient (Branch, 1990).

Other factors to consider regarding bracing include the psychologic response of the athlete. Some patients become dependent on their braces, while others engage in activities other than those prescribed by the treating physician. Both practices can lead to reinjury and can be avoided by adequate patient education (Cawley, 1990). Compliance is also increased with a comfortable, affordable, aesthetic orthosis.

Conclusion

The primary care physician plays a significant role in the management of knee injuries. Diagnosis of injury may be determined from information gleaned from patient history-taking and physical examination. Radiography and needle aspiration of the joint may further define the damage. Treatment of the injury is dependent upon the severity of the injury, determined by grading and instability of the injury, among other factors (Table 2).

RICE therapy is the mainstay of management of the acute phase of the injury. When the injury does not require referral to an orthopedic specialist for arthroscopy or surgery, institution of an individualized exercise program (Ageberg, 2010) is essential to enhance healing, reestablish mobility, and protect the ligamentous injury.

Bracing can be utilized to protect the knee following injury. In addition, orthosis provides support during rehabilitative phases and stability following therapy to protect the injury and surrounding structures from further damage.

Referral to a specialist is mandatory when the injury requires additional diagnostic evaluation to assess supporting structures and when more technical intervention is necessary. Injuries that are left untreated or treated improperly can progress, implicating other structures and resulting in permanent loss of function.

Table 2: Management of Various Knee Injury				
Injury	**Cause**	**Initial management**	**Referral**	**Comment**
Medial instability	Valgus stress to knee.	**Grade I**: in the acute phase, prescribe RICE therapy and crutches to avoid weight-bearing. Apply an elastic bandage (ACE) or brace to prevent further damage from valgus loads. Begin isometric exercises immediately. **Grade II-III** tears of the MCL: Examine for concomitant pathology. Palpate the anatomy, test for instability to valgus stress at 0° and 30° of flexion. Perform the drawer, Lachman, and meniscal tests. Check neurovascular status.	Refer with persistent pain, especially at the joint margins; meniscus might be torn. Refer for possible arthroscopy to assess attachment of the medial meniscus and involvement of the cruciate ligaments.	These are the most common injuries among younger athletes. Generally, isolated tears to the collateral ligaments are not surgically repaired. Immobilization for 4–6 weeks permits scarring of the ligament.
Lateral instability	Damage to these structures usually results from high-velocity injury.	**Grade I LCL:** In the acute phase, prescribe RICE therapy and crutches to avoid weight-bearing. Apply an elastic bandage or brace. Begin isometric exercises immediately. **Grade II–III injuries:** Palpate anatomy. Test for instability to varus stress at 0° to 30° of flexion. Place knee in figure 4 position and palpate for LCL integrity. Perform Lachman, drawer, and meniscal tests. Check neurovascular status.	Refer for possible arthroscopy to assess whether the lateral meniscus is attached and the cruciate ligaments are involved.	Lateral stabilizing structure injury occurs less often than medial structure damage. Due to the proximity of the peroneal nerve, palsies may occur with severe injury; assessment of nerve function is mandatory.
Posterior instability	A blow to the anterior proximal tibia with the knee in 90° of flexion; for	**Grade I:** in the acute phase, prescribe RICE and apply a brace. Rehabilitative exercise	Refer patients with Grade II–III injury for arthroscopy and	Can terminate a career, or interfere with activities of daily

	example, falling off a bicycle and landing on the anterior proximal tibia.	focuses on strengthening the quadriceps mechanism.	treatment of any injuries to the ligament, menisci, or articular cartilage.	living, particularly descending stairs. Treatment of a young, active patient is often repair of the PCL with associated bony tibial avulsion. Postsurgical exercise should protect the ligament for at least 6 weeks. Bracing should prohibit full knee flexion.
Anterior instability	Caused by internal rotation and extension or deceleration rotational injury. Patient may report hearing a snap at the time of injury and/or the development of rapid effusion.	**Grade I lesion w/out effusion:** Prescribe RICE and follow the patient closely. **Grade II–III:** Test with Lachman and anterior drawer tests in all positions. Perform meniscal test, if swelling does not preclude such. Check neurovascular status.	Immediately refer patients with **Grade II–III** ACL rupture to verify diagnosis and possible arthroscopy to confirm diagnosis and assess associated structures. Treatment of rupture ranges from conservative management to intra-articular reconstructive surgery. In a young, highly motivated athlete with a **Grade III** rupture, reconstruction may be considered.	Menisci are often injured with the ACL. If left untreated, the ACL-deficient knee is at increased risk for meniscal tearing with associated premature degenerative disease. Each patient must be managed on an individual basis.
Rotational instability	Cruciate injury, w/w-out collateral ligament involvement.	Associate acute pain and swelling may impede initial diagnosis.	Damage to the ACL or other structures—the MCL, PCL, or components of	When strongly suspected, refer patient for MRI or arthroscopy. Aggressive

			the cruciate ligament, particularly those resulting in instability other than straight lateral instability at 30°, warrant referral.	acute surgical repair of torn structures, involving apposition of damaged structures and tendon transplant for replacement and/or augmentation often is appropriate for athletes.
Meniscal injury	Menisci are damaged in contact/noncontact flexion-rotational injuries: *longitudinal tear*—perpendicular to superior and inferior surfaces of meniscus and parallel to circumference; *radial tear*—begins at inner margin of meniscus and extends radially outward toward the capsular insertion; and *horizontal tear*—often referred to as a cleavage tear, because breach is parallel to the tibial articular surface and extends along the natural cleavage lines of the meniscus up to circumferential fibers.	Palpate the joint margins. Perform the McMurray test, if possible. Immobilize the joint and place patient on crutches with protected weight-bearing.	Early referral is important. Without early intervention, degeneration and re-injury can lead to more complicated and complex bucket-handle tears—a full-thickness, longitudinal tear with the inner medial margin free to move within the joint. Parrot beak tears, for example, are an extension of a combination radial and longitudinal tear.	Treatment has changed due to arthroscopy. The generally accepted approach is to preserve as much normally functioning meniscus as possible, to alleviate symptoms, and to limit joint disease at the same time, minimizing risk for further injury. Arthroscopy, performed on an outpatient basis, is a common diagnostic and treatment procedure. The damaged portion of a tear to the meniscus is frequently excised, with remodeling of the remaining menisci. Some longitudinal tears can be repaired by suture. MRI is

				helpful in some cases.
Chondromalacia patella	Chondromalacia is a blanket term to describe anterior knee pain. A relationship may exist between symptoms and arthroscopic findings of softening of the patellar articular cartilage. Causes may be mechanical, inflammatory, degenerative, posttraumatic, dystrophic, or vascular.	Assess the Q angle, palpate the patella and adjacent structures for crepitus or tenderness with movement of the joint. Test for apprehension suggestive of recurrent lateral subluxation. Anterior knee pain on resisted knee extension indicates patellofemoral dysfunction. Exercise to strengthen the quadriceps muscles, particularly the VMO, is the cornerstone of treatment. Patient must avoid knee extension exercises that unduly pressure the patellofemoral joint, worsening symptoms. Electrical stimulation can increase patient awareness and assist in neuromuscular education. Appropriate footwear with adequate arch support is important.	Following 3–6 months of exercise therapy, refer the patient to an orthopedic surgeon for consideration for surgery, if appropriate.	Arthroscopy reveals softening and disruption of the articular cartilage—chondromalacia patella—from patellofemoral dysfunction or anterior knee pain syndrome.
Patellofemoral dysfunction	Abnormal tracking of the patella in the femoral groove can lead to pressure syndromes, presenting as anterior knee pain. Several factors contribute to abnormal tracking, including strength of the Vastus Medialis Obliquus (VMO), increased Q angle, tight hamstrings,	Assess the Q angle, palpate the patella and adjacent structures for crepitus or tenderness with movement of the joint. Test for apprehension suggestive of recurrent lateral subluxation. Anterior knee pain on resisted knee extension indicates patellofemoral dysfunction. Exercise to strengthen the quadriceps muscles,	Refer a patient with early patellar instability or catching or locking with lateral patellar subluxation to a specialist for arthroscopy to determine the need for patellar chondroplasty or a realignment procedure.	

	high-riding patella, and a tight lateral retinaculum. Patient presents with patellofemoral dysfunction with months' to years' history of a unilateral or bilateral anterior knee pain. Pain after prolonged flexion and 90° while sitting, relieved by extension of the knee produces the so-called theater sign.	particularly the VMO, is the cornerstone of treatment. Patient must avoid knee extension exercises that unduly pressure the patellofemoral joint, worsening symptoms. Electrical stimulation can increase patient awareness and assist in neuromuscular education. Appropriate footwear with adequate arch support is important.		
Plicae	Remnants of three embryonic pouches from which the knee capsule develops are plicae. Plicae result when the septae fail to resorb and remain as variably sized pleats or shelves in the knee. Signs of trauma or overuse—snapping, swelling, or pain—can reveal their presence.	Palpate the anterior knee and anterior retinaculum for pain. Flex and extend the knee check for catching or popping. Initially, treatment is conservative (for 6–12 weeks), focusing on decreasing exercise levels, muscle strengthening exercises, and administration of anti-inflammatory medications.	Arthroscopic excision provides relief of symptoms in most patients. Refer if symptoms persist or worsen after conservative therapy.	
Osteochondritis dissecans	Separation of part of the cartilage with underlying subchondral bone from the articular surface. May be traumatic or ischemic in origin. Lesion ranges from minimal surface irregularity to partial detachment and complete separation of the fragment from the surface. Often	Radiographic studies are required for diagnosis. A bone scan may be necessary to rule out epiphyseal defects. Initially, treatment is conservative, with crutches and protective weight-bearing.	Referral for consideration of arthroscopy is necessary in most cases, particularly in those with bone separation.	Some cases can be repaired by curettage of the defect or reinsertion of the fragment into the crater from where it originated. Other cases require removal of the fragment and bone grafting. The crater may not be evident in later stages,

	occurs at the femoral surfaces. Symptoms correlated to severity of the injury—minimal pain following exercise with mild lesions; stiffness and giving way with more severe lesions. Complete separation of the fragment results in “loose body” symptoms, causing occasional locking.			because the bed fills in with a regenerative cartilage, similar to (but weaker than) normal articular cartilage.
Soft tissue injury	Trauma or change in training program (overuse injury); change in terrain (runner), an increase in distance, gradient, or speed places chronic stress on the soft tissues. Improperly fitted or inappropriate footwear can cause overstress of tendons, muscles, muscle insertions, and bursae.	Generally, treatment of soft tissue injury is symptomatic and protective, permitting the damaged tissue to heal. In the acute phase, soft tissue injuries to the knee should be managed with anti-inflammatory medication, avoidance of exercise that might aggravate the condition, and physical therapy. Prescribe a gradual return to the activity, with proper footwear and orthosis, if necessary. The patient should be encouraged to perform warm-up and cool-down exercises.		
Bursitis	Frictional overuse or blunt trauma. The patient presents with pain, swelling, and point tenderness over the bursae.	Perform diagnostic aspiration for culture sensitivity to distinguish between pyogenic and nonpyogenic bursitis, followed by RICE therapy. Nonpyogenic bursitis responds well to corticosteroid medication; pyogenic	Refer patients with recurrent, chronic bursitis (which can lead to pyogenic infection) for assessment and possible excision. (Post-traumatic bursae may	The most commonly affected bursae are the prepatellar (carpet layer’s knee), pes anserine, superficial and deep infrapatellar, and

		injury should be treated with a penicillinase-resistant agent until the sensitivity of the infecting strain has been determined.	result from blunt injury. A pseudo sheath, histologically resembling a bursa, forms around the clot, causing swelling and pain. The bursa is either excised or aspiration is performed).	tibial collateral ligament bursae.
Tendonitis	Overuse is often the cause of tendonitis of the knee, which commonly affects the iliotibial band or the patellar tendon. Repetitive trauma to the tendon results in microtears at the insertion of the tendon to the bone.		Refer chronic cases, as some patients with patellar tendonitis require surgery to remove damaged tissue and repair the tendon.	
Iliotibial band (ITB) syndrome	Causes snapping, diffuse pain, and traumas over the ITB, proximal to lateral joint.	Palpate the anterior knee. The patient should rest and receive physical therapy.		
Patellar tendonitis (jumper's knee)	Results from repetitive extensor strain at the patellar tendon—patella interface associated with various jumping or running activities.	The patient should avoid stress of the extensor mechanism, receive physical therapy, and gradually return to the activity.		Jumper's knee can be very resistant to treatment, even with surgery.
Osgood-Schlatter's disease	Results from inflammation of the tibial tuberosity at the patellar tendon insertion, common in adolescent athletes.	Conservative treatment is appropriate. Radiography is mandatory.	Refer patients who demonstrate very severe acute symptoms, suggesting apophyseal separation; and	Patients in whom radiography reveals presence of bony ossicles may require surgery when growth plate closes.

			when symptoms become chronic.	
ACL=anterior cruciate ligament; LCL=lateral collateral ligament; MCL=medial collateral ligament; Q angle=quadriceps angle; VMO= vastus medialis obliquus.				

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