Extensor mechanism injuries can occur in patients of all ages. An understanding of the biomechanics of the patellofemoral joint is essential in diagnosing and treating these conditions. Identification of a mechanical derangement is necessary to correct the underlying cause of the patients complaints. A distinction must be made between bone and soft-tissue injury, and that between acute and chronic injury. There are many causes of extensor mechanism injuries that may be discussed. This chapter will focus on four principal extensor mechanism injuries: (1) patellar and quadriceps tendinitis, (2) quadriceps rupture, (3) patellar tendon rupture, and (4) patellar fractures.

**Patellar and Quadriceps Tendinitis**

*Patellar and quadriceps tendinitis* are overuse syndromes defined as repetitive overloading of the patellar tendon and quadriceps tendon. This results in an irritation to the patellar and the quadriceps tendons, as well as the inferior and superior aspect of the patellae, and is related to activity duration and intensity. Typically, patients complain of knee aching; point tenderness may be found along the inferior or superior pole of the patella. Occasionally, patients may experience pain along the tibial tuberosity, peripatellar soft tissues, or along the entire length of the patellar or the quadriceps tendon.

Jumper's knee is a typical functional overload injury because it affects those athletes who submit their knee extensor mechanisms to intense and repeated stress. Defined as an insertional tendinopathy, jumper's knee affects, in order of frequency, the insertion of the patellar tendon into the patella (65% of cases), attachment of the quadriceps tendon to the patella (25%), and the attachment of the patellar tendon to the tibial tuberosity (10%). Tendinitis results from repetitive overloading and therefore presents insidiously, most commonly in athletes participating in running or jumping sports such as basketball, volleyball, high jumping, and aerobic exercise. The type of practice surface and type of footwear, as well as the intensity and the frequency of training are factors that may contribute to the incidence of patellar and quadriceps tendinitis. A high level of performance in these athletes can be maintained, provided they avoid jumping activities. Patellar and quadriceps tendinitis in nonathletes may interfere with activities of daily living, such as stair climbing, kneeling, and getting up from a chair. Ascending and descending stairs frequently are problematic due to the high patellofemoral loads and eccentric loading of the quadriceps that create increased compressive forces across the patellofemoral joint. A thorough history will determine the degree of involvement and aid in organizing a treatment plan.

The bone tendon junction has been implicated as the site of inflammatory injury, presumably from microscopic or macroscopic...
ruptures of the ligament. This may manifest itself radiographically as elongation or fragmentation of the inferior pole, a periosteal reaction of the anterior patella, or calcification of the patellar tendon.

Biomechanical derangements may also contribute to patellar and quadriceps tendinitis. Poor flexibility of the lower extremity, especially tight quadriceps, creates increased loading of the patellofemoral joint. Any patellofemoral asymmetry is capable of concentrating stresses focally, resulting in local irritation and inflammation. Patella alta, baja, subluxation, and hypermobility all are capable of altering patellofemoral physiology, as are angular and rotational deformities or limb length discrepancies. Malalignment of the patella will predispose the patient to anterior knee pain and the possibility of articular cartilage breakdown.

Blazina et al. have developed a classification system for patellar tendinitis. Phase I is defined as pain after activity only. Phase II describes pain that occurs before and after, but not during the activity. Phase III describes pain occurring during and after activity that results in functional impairment sufficient to interfere with performance. Both phase I and II respond well to conservative treatment; symptoms usually resolve after a period of rest. Activities should be modified to protect the extensor mechanism from eccentric or high loads. Activities that aggravate the patient's symptoms are avoided; other training modalities must be used. All other activities may be continued. A period of warm-up and stretching should occur prior to sports participation. Restoring flexibility and strength are critical if muscle atrophy is to be avoided. All muscle strengthening should be done in the pain-free range, so as not to further injure the inflamed tissues. Isometric exercises are used to minimize compressive forces across the patellofemoral joint. Short arc quadriceps exercises are especially effective in strengthening the vastus medialis obliquus (VMO). It should be emphasized that muscle strengthening and stretching are the mainstay of treatment. Therapeutic modalities such as ultrasound, phonophoresis, or iontophoresis have been used to decrease patellofemoral pain. Ice packs may be applied immediately following activity, and have been advocated by many authors. A general conditioning program should be started to improve muscle tone and flexibility. In order for the inflamed tissues to heal, a period of activity modification is necessary. Jumping and eccentric loading of the extensor mechanism is discouraged. A short course of nonsteroidal anti-inflammatory medication may help control swelling and inflammation, and provide pain relief. An external support to provide proprioceptive feedback may be of benefit.

Peripatellar bursitis is a common occupationally related condition that should not be confused with either patellar or quadriceps tendinitis. Soft-tissue irritation in the anterior aspect of the knee has been associated with occupations that require kneeling postures, such as carpet laying and floor laying. "Housemaid's knee" refers to inflammation of the prepatellar bursa, which usually covers the lower half of the patella and the upper half of the patellar tendon. Inflammation of the deep infrapatellar bursa is recognized as pain, tenderness, and swelling localized between the lower part of the patellar tendon and the upper part of the tibia. Treatment of peripatellar bursitis is usually symptomatic, generally responding to conservative measures and avoidance of kneeling postures. Rarely, infection of the deep infrapatellar and prepatellar bursae can develop; these cases require antibiotics and adequate irrigation and drainage.

Soft-Tissue Disruptions

Anatomy

The quadriceps musculature, the quadriceps tendon, the patella, and the patella tendon all contribute to the extensor mechanism of the knee. The structure of the quadriceps musculature is composed of the rectus femoris, the vastus medialis, the vastus lateralis, and the vastus intermedius, which coalesce in a trilaminar fashion to form the quadriceps tendon. The rectus femoris, which is the most