Introduction
Anterior knee pain is a poorly understood entity that has not been well studied in the literature. One reason for this is because “anterior knee pain” is not specific, and the cause for this symptom may encompass many different etiologies. Studies vary with their own particular definitions, and thus comparisons and conclusions are difficult to interpret. It is, therefore, important when one discusses anterior knee pain that a specific definition be initially offered. This chapter will describe anterior knee pain after anterior cruciate ligament reconstructive surgery. After a definition is made, discussions will include incidence and possible etiologies. Prevention of anterior knee pain will be addressed, including preoperative, intraoperative, and postoperative concerns. Finally, treatment options will be offered. It has been the practice in our clinic to evaluate patients carefully with regular follow-up, scrutinizing their results so that we may learn from them and continually improve our techniques and outcomes. Through the course of the chapter, we will interject our findings where appropriate in an effort to shed light on this complicated subject.

Definition
Anterior knee pain after reconstruction of the ACL has been documented as a frequent complaint of patients in many studies in the literature.2-5,7,14,20 It is important, however, to differentiate pain in the knee into two broad categories. A knee that functions well until a specific injury causes a change can be understood by the patient as being broken, as opposed to when the knee gradually becomes painful or sore from overuse. Patients can easily distinguish between these two entities, and this distinction becomes helpful during history taking for narrowing a differential diagnosis. Both these entities can occur after ACL reconstruction surgery. The former encompasses all the different injuries that can occur in any knee regardless of previous surgery. These injuries must be identified and treated, but are not within the scope of this chapter. Knee soreness after surgery is more commonly the complaint of the patient. This pain is often vague and cannot be specifically localized with one finger. The patient, when asked to point to where it hurts, will often sweep his fingers along both sides of the patellar tendon, from the sides of the patella to the tibia tubercle. Often, the patient will think of this as “kneecap” symptoms.

Etiology
A review of the literature offers many possible factors leading to anterior knee pain in patients who have not had surgery. These include malalignment, muscular imbalance, improper training mechanics and overuse, biochemical substance changes, and psychological issues.10 The speculation that these factors are involved in the cause of postoperative pain has altered operative and rehabilitative protocols at some institutions.

Alignment of the lower extremity has been implicated in the literature as a possible cause of anterior knee pain.10 The quadriceps angle (Q-angle) in particular has been thought to be a
significant issue. It is defined as the angle created by drawing lines from the anterior superior iliac spine to the middle of the patella to the tibia tubercle. The average Q-angle is 10 to 15 degrees with knee extended. An increased Q-angle theoretically places more stress on the lateral portion of the patella as the knee is flexed as the contact area decreases. This may result in tilting, subluxation, or even frank dislocation. Of these, tilting is most common especially in women and may cause poor patella tracking and excess wear. Some surgeons will perform a lateral retinacular release in conjunction with anterior cruciate ligament reconstruction if tilting of the patella is present. Because patella tilt is usually asymptomatic in these patients before injury, it has been our experience that a lateral release is usually not necessary and we no longer perform it unless properly indicated.

Muscle imbalance has also been proposed as a cause of tilt and subluxation. A relative weakness of the vastus medialis muscle has often been taught to be a key component of muscle imbalance, and physical therapy protocols have been designed to selectively strengthen this muscle. However, it has recently been shown by EMG analysis that it is difficult if not impossible to isolate the vastus medialis using the proposed exercises, and in reality the entire quadriceps is being rehabilitated together. After injury to the anterior cruciate ligament, swelling in the knee causes a temporary shutdown of the quadriceps muscles, causing it to be weak. While many preoperative protocols stress regaining quadriceps strength before surgery, we mainly emphasize the return of full range of motion and leg control in the injured knee. Since 1998, we have been routinely harvesting the graft from the contralateral extremity, which has allowed us to focus the preoperative and postoperative rehabilitation on regaining range of motion and leg control without an immediate concern for gaining strength. Strengthening exercises for the graft-donor site can begin immediately after surgery without a concern for loss of range of motion or an effusion. Separating the postoperative rehabilitation between knees allows for an earlier return of range of motion in the ACL reconstructed knee and a quicker return of strength in graft-donor knee. Ultimately, patients are able to return to normal activities and sports sooner.

Overuse of any muscle or tendon may cause soreness, and this is no exception after anterior cruciate ligament reconstruction. Although we believe that this is a completely different entity from the anterior knee pain that we are discussing in this chapter, it should be included in the differential diagnosis when an ipsilateral bone-patellar tendon-bone autograft technique is utilized. Some of our patients who have undergone the contralateral graft procedure have complained of soreness in the graft-donor knee after completing a few successive “two-a-day” practices. The soreness in this setting is simply overuse-related patella tendon pain. We reached this conclusion by realizing that the graft-donor knee does not share many of the same concerns as the injured knee, which therefore excludes many possible sources of pain. Assuming the graft-donor leg is normal (no previous injuries or congenital abnormalities), there are no other associated pathologies such as cartilage damage or meniscus tears that could cause anterior knee pain. Harvesting the graft is an extra-articular procedure; therefore, iatrogenic intra-articular damage that may cause pain is excluded. Given that knee range of motion and strength are normal preoperatively, and are easily regained postoperatively, the contributions by these factors to pain are minimized. Furthermore, the athletes do not complain of pain during the first few days of the new practice week, but only after many successive practices, and rest usually alleviates their symptoms. We realized that we were overworking the tendon and not allowing it to recuperate between workouts. For the same reason that weightlifters alternate which body region they concentrate on each day, the patella tendon and quadriceps muscle need a day to rest between heavy strengthening workouts. We have therefore recently changed our contralateral donor-graft leg strengthening workouts to be performed every other day, and this is still under review. What this clearly shows is that the harvesting of the tendon itself is probably not the cause of the anterior knee pain syndrome.

Of much lesser prevalence is a psychosomatic basis for this pain. This should be low on the differential diagnosis list, but should not be dismissed altogether should an organic cause for the pain not be found. Sustaining an anterior cruciate ligament injury, while certainly not as career threatening and ominous as it may have been only a few short years ago, can have a very strong effect on an athlete’s mental state. We must remember that we are treating the patient and not just the knee injury.

Although much of the above may have some role in causing anterior knee pain post anterior