The anterior and posterior cruciate ligaments contribute 85 to 95 percent to the stabilization of the knee in the sagittal plane for anterior or posterior displacement of the tibia upon the femur. The remainder of stability is provided by the so-called “secondary restraints” including the menisci, the collateral ligaments, the capsular structures (posterior, posteromedial, posterolateral), the gastrocnemius muscles and the popliteus tendon. Intact cruciate ligaments render the knee stable to varus or valgus stress at full extension, even in the face of collateral ligament injury or laxity. Conversely, collateral ligament and capsular injury alone may produce a degree of tibial rotatory instability in the presence of intact cruciates.

"Studies in recent years indicate that significant cruciate instability leads to accelerated deterioration of the knee."

Injuries can be of high or medium forceful velocity, frequently but not exclusively occurring during athletics. Mechanisms may include hyperextension, with or without a twisting action, a direct blow to the tibia either anterior or posteriorly or rapid deceleration of the knee. Variable degrees of injury may occur. Isolated cruciate ligament injury, single or combined, is a condition which rarely occurs. Cruciate ligament injury can be interstitial stretching or complete rupture. This is usually in the mid-substance of the ligament and rarely with avulsion of the femoral origin or tibial insertion. More rarely in the adult, there is preservation of the intact ligament but avulsion of a fracture fragment at the point of attachment to the tibia or femur. This may occur with preservation of the secondary restraints, so the initial knee laxity may vary in severity. With time, the secondary restraints may stretch and the instability may increase. Associated acute injuries can include the menisci, the collateral ligaments and the capsular structures. Rupture of both cruciates is a high velocity event invariably accompanied by major damage to the capsule and one or more menisci and collateral ligaments.

The most recognized injury complex is the “O’Donohue’s Unhappy Triad”. This is a ruptured anterior cruciate and medial collateral ligament and a torn medial meniscus. With anterior cruciate tears only, the lateral meniscus is more – continued –
commonly injured than the medial meniscus.

Diagnosis is done with initial manual evaluation which is often unreliable in the face of the evolving hemarthrosis, pain and spasm. Often only a manual evaluation under anesthesia provides accurate assessment of the instability. Arthroscopic exam is useful early or late, but is contraindicated in the grossly unstable knee. This is due to inevitable extravasation of the infused fluid outside of the joint with attendant compression of extra-articular tissues. Routine X-rays rarely show bony damage but are essential to rule out bone pathology.

Appropriate treatment must be customized. Collateral ligament ruptures require early identification and surgical treatment, at which time capsular tears are also repaired. This gives access to the menisci which may be repaired or partially or completely excised. Specific treatment of cruciate injuries has evolved rapidly in recent years.

"The most recognized injury complex is the “O’Donohue’s Unhappy Triad."

Posterior cruciate instability is generally felt to be a greater long term problem and a source of disability to the useful life of the knee joint. A certain degree of anterior cruciate instability may be tolerated a long time, depending on the age, lifestyle and physical requirements of the individual.

With successful treatment of menisci and collateral ligament injuries, many individuals have done quite well over time. Intensive thigh muscle rehabilitation, mild activity alteration such as eliminating twisting or cutting athletic activity, and bracing for certain activities is useful. The initial instability may progress from mild to major in patients where the secondary restraints eventually stretch out.

Studies in recent years indicate that significant cruciate instability leads to accelerated deterioration of the knee. This may include later meniscus tears, tibiofemoral chondromalacia and ultimately, degenerative arthritis. Studies of the biomechanical and physiological nature of these ligaments and the various biologic and synthetic materials used in treatment is one of the most intense, exciting and voluminous areas of study in the field of orthopedic surgery. The information learned is diverse with much controversy and conflicting information. One can find a statistical study to support almost any mode of surgical treatment.

Overall, with the above knowledge, the trend has been to more aggressive and precise early surgical intervention with corresponding improved, if not perfect, long term results. The minimum and maximum age limits for major repair or reconstruction have been expanded. Technology for accurate assessment of the degree and nature of the instability and the precision of surgical treatment has advanced by quantum leaps. Few people in the present era, would tolerate the prestige and disability of the old “trict knee” from football days.

Surgical treatment may be summarized as follows:

1. Isolated repair of a ruptured cruciate ligament uniformly fails. This is due to the difficulty in suturing and poor vascularization of the repair, inasmuch as most tears involve the midportion of the ligament. A rare exception is instability resulting from bony avulsion of a ligament insertion. In this case, reattachment may prove entirely successful. Such injuries are much more common in children than adults.

2. Arthroscopic or open debridement of the cruciate ligament tear and appropriate treatment of associated structures may be successful for a time. Muscle rehabilitation, bracing and activity modification is utilized, leaving the injured cruciate untreated.

– continued –
3. Primary repair of an acute cruciate tear should be accompanied by reinforcement with some portion of the patients anatomy or a tissue allograft. This usually requires a tendon, an iliotibial band or a patellar ligament.

“The basic lifelong commitment to maintaining the condition of the extremity is needed for optimal long term results.”

4. True acute phase reconstruction, ie...actual replacement of the destroyed ligament as may be done in the young, extremely active individual, may involve a more complicated process. Depending on the nature of the instability, ie...straight anterior or straight posterior versus multidirectional instability, which generally includes rotatory laxity in any of four directions, the decision must be made whether a purely intra-articular or extra-articular repair or a combination of both may be needed. The major problem with biological materials is proper placement and revascularization to provide truly viable tissue with long term holding properties.

5. Autogenous tissue, ie...that which derives from the patient, may include a hamstring tendon, an iliotibial band, or a segment of the patellar ligament with a piece of tibial and patellar bone at each end, is usually passed through channels in the patients tibia and femur. Many feel this affords the best chance to revascularize these transferred tissues. Even extra-articular procedures incorporate these principles. There the source of revascularization must come from soft tissue more than from bone.

6. Allografts, ie...from human cadavers, either of soft tissue components or patellar ligaments with bone at each end, offer encouraging results. These are obtainable in various sizes, are usually fresh frozen, and are of low antigenic potential. This eliminates the need for specific tissue typing between donor and recipient. The theoretical advantage is a plentiful supply of the tissue and preservation of the patient’s normal muscle, tendon and ligamentous structures without rerouting them for ligament reconstruction. An isolated human cruciate allograft without its bony attachments has yet to be proven workable.

7. Prosthetic ligaments, such as Gore-Tex or carbon fiber materials which are designed to be inert and to replace the deficient ligaments, have not proven very successful over time. Fatigue and breakage are common. Woven type tissue of collagen or synthetic material designed to allow ingrowth of the patient’s own collagen in reconstruction may offer some success. As yet, prosthetic materials are still in the experimental stage and many have been discarded as not workable.

8. Arthroscopically assisted ligament reconstruction has gained popularity with precision instrumentation for making drill holes and fine tuning proper tension on the ligament substitute. The technique is demanding and the learning curve is slow. Reported advantages are rapid rehabilitation and restoration of motion.

“...the trend has been to more aggressive and precise early surgical intervention with corresponding improved, if not perfect, long term results.”

Richard D. Thorson, M.D.
Orthopedic Surgeon

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