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Rehabilitation Guidelines for Knee Multi-ligament Repair/Reconstruction

The knee joint is comprised of an articulation of three bones: the femur (thigh bone), tibia (shin bone), and patella (knee cap). The femur has a medial (inside) and a lateral (outside) condyle that forms a radial or rounded bottom that comes together, forming a trochlear groove for the patella to move. The medial and lateral condyle sit on top of the tibia, which has a flat surface called the tibial plateau.

The knee also is comprised of two menisci, which are fibro-cartilaginous structures and each meniscus is thinner towards the center of the knee and thicker toward the periphery of the knee, giving it a wedge shaped appearance.

The medial meniscus forms a “c” shape and is located between the medial femoral condyle and the medial aspect of the tibia. The lateral meniscus forms an oval shape and is located between the lateral femoral condyle and the lateral aspect of the tibia. The menisci act to improve stability between the tibia and the femur secondary to its wedge shape that acts to limit translation.

The knee also has four major ligaments, which connect bone to bone and provide stability to the joint. These ligaments are termed the medial collateral ligament (MCL) (Figure 1a), lateral collateral ligament (LCL) (Figure 1b), anterior cruciate ligament (ACL) (Figure 2a), and posterior cruciate ligament (PCL) (Figure 2b). The MCL connects the femur and tibia medially (on the inside) and resists valgus (knee buckling in) knee motion.

A common mechanism of injury to the MCL occurs when a force is applied to the outer knee while the foot is planted, causing the knee to move inward. The LCL connects the femur and the fibula laterally (on the outside) and resists varus (knee buckling out) knee motion.

Figure 1 a

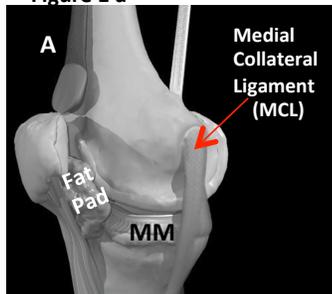


Figure 1 b

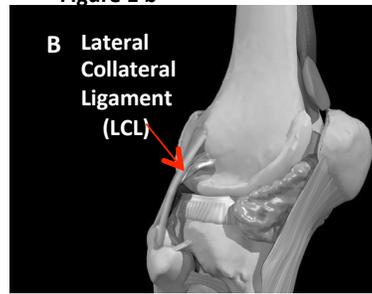


Figure 2 a

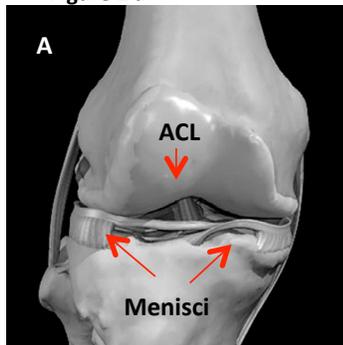


Figure 2 b

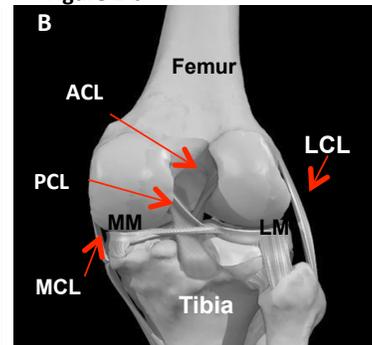


Figure 1 a: Medial or inner view of the knee showing the medial collateral ligament, **b:** Lateral or outer view of the knee showing the lateral collateral ligament. **Figure 2 a:** Anterior or front view of the knee showing the anterior cruciate ligament (ACL), **b:** Posterior or back view of the knee showing the posterior cruciate (PCL)

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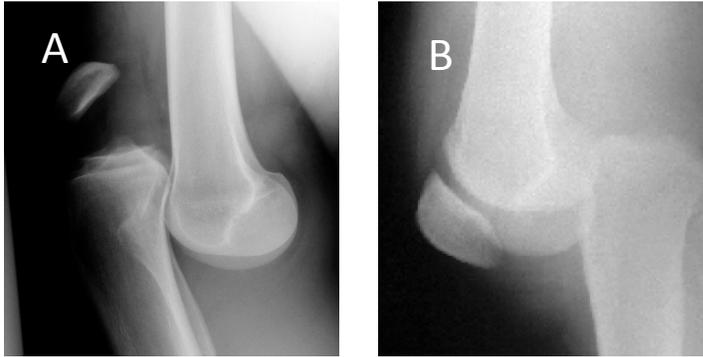


Figure 3 – a: Radiograph showing an example of anterior knee dislocation, **b:** Radiograph showing an example of posterior knee dislocation

A common mechanism of injury to the LCL occurs when a force is applied to the inner knee while the foot is planted, causing the knee to move outward. The ACL and PCL attach the tibia and femur deep inside the knee joint and cross one another like guide wires. The ACL restrains the tibia from moving forward and rotating excessively on the femur. Most ACL injuries occur without contact, most commonly when an individual plants their foot and changes direction while participating in sports. The PCL resists the tibia from moving back excessively on the femur. PCL injuries most commonly occur when an anterior force is applied on the tibia such as when the lower leg hits the dashboard of a car during a car accident or landing on the knee with the knee flexed approximately 90 degrees.

Ligamentous injuries are termed sprains and are graded based on the severity of the injury. A grade 1 ligament sprain is a minimal injury with little to no increase in laxity to the ligament whereas a grade 3 sprain is a complete rupture to the ligament. Knee injuries that involve one of the four ligaments are somewhat common. Injuring two or more of the four major knee ligaments is uncommon and usually occurs as a result of a high energy trauma such as an automobile accident, fall or a significant sports injury. When two or more of the ligaments are ruptured the tibia and

the femur may lose contact from one another and spontaneously come apart or dislocate. A knee dislocation between the femur and the tibia is named by the direction the tibia is orientated from the femur in a dislocated position. Secondary injuries such as nerve damage and or vascular injury are common following a knee dislocation. (1) Often the vascular or nerve injuries require emergency attention to save the limb or possibly the individual's life. Once the knee is evaluated and secondary injuries, if any, are repaired, the initial treatment of the multi-ligament injuries includes immobilization, which is followed by continued evaluation and diagnostic testing to determine the extent of the ligament damage. Treatment options include surgical and non-surgical approaches to care. Treatment decisions often are made based on each individual's pre-injury function and the extent of the ligament damage. Recent studies have suggested patients receiving operative treatment have improved functional outcomes when compared with non-operative treatment. (2) The timing of surgery is critical with evidence that shows if surgery is done immediately following the injury.

following the injury, an individual may experience increased post-operative stiffness and scarring. (3) Research has shown that outcomes of multi-ligament reconstruction are best when the surgery is done within 3 weeks from injury after the patient can reduce the swelling from the initial injury. Surgery will vary depending on the extent of the ligament damage and the specific ligament(s) involved. If the ligament is avulsed from the bone (pulled off the bone) then the surgeon may be able to perform a primary repair of attaching the ligament back to the bone. When a ligament is ruptured it often has to be reconstructed, which means replacing the ligament with other tissue. This can be done by using an autograft (donor tissue from an injured person) or an allograft (donor tissue from a cadaver).

Rehabilitation following multi-ligament reconstruction is vital to regaining motion, strength and function. Initially after surgery the knee is braced and individuals use crutches with minimal to no weight bearing for the first 6 weeks. Gradually more weight bearing and mobility is allowed to prevent stiffness post-operatively. The rehabilitation will slowly progress into strengthening, gait and balancing activities. The UW Health sports rehabilitation guidelines are presented in a criterion based progression. General time frames refer to the usual pace of rehabilitation. However, individual patients will progress at different rates depending on their age, associated injuries, pre-injury health status, rehab compliance, tissue quality and injury severity. Specific time frames, restrictions and precautions may also be given to enhance wound healing and to protect the surgical repair/reconstruction.

Rehabilitation Guidelines for Knee Multi-ligament Repair/Reconstruction

Phase I (Post-op Day 1 to 1 week after surgery)

Precautions	Brace ROM: locked in full extension Weight bearing/ROM: touch down, weight bearing
Range of Motion Exercises	Weight bearing/ROM: Touch down, weight bearing then proceed to as tolerated by patient
Therapeutic Exercises	Quad Sets Ankle pumps Cryotherapy device Elevation Heel slides Seated flexion Prone flexion Wear knee brace for at least six weeks after post op

Phase II (2 week to 5 week after surgery)

Precautions	Brace ROM: locked in full extension Weight bearing/ROM: touch down, weight bearing
Range of Motion Exercises	Weight bearing/ROM: Touch down, weight bearing then proceed to as tolerated by patient
Therapeutic Exercises	Week 2-3 : straight leg raises with no weight Week 4-5: straight leg raises with 1 lbs. of weight Should have 90 degrees of flexion

Phase III (6 week to 12 week after surgery)

Precautions	Brace ROM: discontinue brace when quadriceps strengthening allows, neoprene sleeve with alteral buttress optional
Range of Motion Exercises	Weight bearing/ROM: full;; should have normal ROM
Therapeutic Exercises	Week 6-7: start stationary bike Weeks 8-12: continue stationary bike Start shuttle jumps at week 12 Treadmill Isotonic leg press Toe press Leg curl Stool scooter

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Phase IV (3 months to 6 months following surgery)

Range of Motion Exercises	Brace ROM: Full; no brace Weight bearing: full
Therapeutic Exercises	Initiate progressive jogging program Advance to cutting and sport-specific drills Return to regular sports if cleared by MD

References

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3. Jari, Shelbourne. Nonoperative or delayed surgical treatment of combined cruciate ligaments and medial side knee injuries Sports Med Arthrosc Rev 2001:185-192.