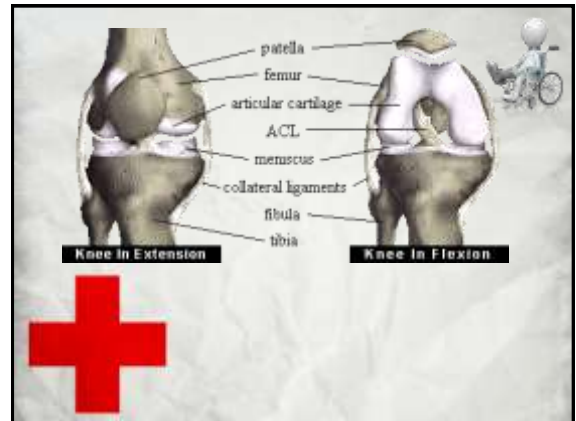




Anatomy

- The ACL attaches to the tibia anterior to the intercondylar eminence and extends to the medial aspect of the lateral femoral condyle.
- Described as 2 bands:
 - smaller anteromedial section
 - larger posterolateral section (Girgis et al, 1975)
- Third band described by Arnoczky and Warren, 1988)



Function

- The ACL has a primary role of stabilising the knee joint.
- During the final 30° of extension the ACL tightens and provides a pivot around which the medial femoral condyle rotates.
- The anteromedial band appears to be tight throughout most movements.
- The posterolateral band is taut in extension but slackens during flexion.
- The ACL resists anterior slide of the tibia on the femur.

Injuring Force/Action

- The ACL may be damaged in high velocity twisting, pivoting injuries.
- Pre-disposing factors:
 - small intercondylar notch,
 - increased accessory glide.
- High force valgus strain.
- Very high force varus strain.



Repair and Rehabilitation

- **Conservative management:**
 - Patients undergo a strengthening protocol for hamstrings and quadriceps. The ACL stumps are left free.
 - The knee remains loose (no restraint) although patients continue to exercise to a moderate level.
 - Risk of 'giving way' and further episodes of pain.
 - Activities curtailed.

Surgical Repair

- Surgery for ACL reconstruction should always be delayed for approx. 4 weeks to allow sufficient decrease in the inflammatory response.
- Patients who have undergone surgery prior to this have shown poor results in terms of their rehabilitation.
- Full active RoM must be achieved prior to surgery.

Common Repair Techniques

- **Allograft (very uncommon):**
 - use of Dacron graft, artificial implants.
- **Autograft:**
 - Cadavre ACL transplant.
 - Hamstring tendon.
 - Middle third of patellar tendon with screws.
 - Bone-tendon-bone inserts (patellar tendon).

Surgical Management

- **Middle Third Patellar Tendon:**
 - A slip of the patellar tendon is removed and inserted into the origin and insertion of the original ACL.
 - The ends are attached to the bony segments by screws inserted deep into the femoral condyle and the tibial plateau.
 - Full RoM is achieved in surgery before the patient is sent to recovery.

• Bone-tendon-bone autograft:

- A section of bone is taken from the patella attached to a slip of the tendon and attached to a piece of bone from the tibial insertion of the quadriceps tendon.
- Two small holes are drilled at the insertion points from the original ACL and the bone sections are inserted into these holes. The bones heal and holds the new ACL in place.

Video

- <http://www.youtube.com/watch?v=CJA0Xrs8NBU&feature=related>
- <http://www.youtube.com/watch?v=i8EpT3uCVWU>
- <http://www.youtube.com/watch?v=nIAjzngBMUw&feature=related>
- <http://www.youtube.com/watch?v=OfKsWPqgyp0&feature=related>

Physical Therapy Management

- Regardless of the surgical intervention, PT is always dictated by the orthopedic surgeon.
- The aims of treatment are always to regain full RoM, mobilisation of scar tissue and maintenance of movement at the patello-femoral joint.
- Tightened muscles or soft tissues may also need stretched.

Normal Protocol (Shelbourne et al, 1996)

- **Pre-Surgery:**
 - full RoM.
 - decreased swelling around the knee joint.
 - may be in PoP or Donjoy brace to eliminate rotation.
 - quads. and hams. strengthening programmes.

Week 0-4 (post-op)

- Continuous passive motion used to maintain full knee RoM.
- Isometric quads. or electrical stimulation.
- Patello-femoral joint mobilisation.
- Soft tissue mobilisation around knee.
- Weight bearing commences early on with patients FWB by week 4
- May be started in the hydro pool.

Week 4-6 (post-op)

- Active hamstrings (0-90°) in prone lying.
- Passive extension activities (90-0°).
- Use of exercise bike (as pain allows).
- No active open chain quads. exercises.

Recent evidence suggests that open chain quads in the early stages of rehab may stretch the graft and be responsible for a small % of unsuccessful procedures.

Week 6 (post-op)

- Closed kinetic chain activities can begin (with or without a brace).
- Step-ups, vastus medialis obliquus (VMO) exercises.

Open Kinetic Chain

- All torsion/force transmits directly through the knee joint and through the ACL which acts as a turning point for the weight - producing a pull on the graft which could stretch it and potentially undo the purpose of repair. The graft may not 'pop' or rupture but would become ineffective.

Examples of OKCE's

- **THESE ARE DANGEROUS TO ACL's**
 - seated leg extensions - with cable or free weights.
 - quads bar with weight.
 - seated weight boot.
 - isokinetic machine - open chain set-up.
 - prone leg weights (Westminster Pulley)
 - manually resistance/dynaband (can be CKC).
 - kicking.

Closed Kinetic Chain

- All torsion/force is transmitted through the limbs - from foot to lower leg to femur to hip - using the various muscle groups with a minimal even force - no direct torsion on the knee or any other joint - safe but effective way of strengthening quads in the first 6 to 9 months.

Examples of CKCE's

- **THESE ARE SAFE EXERCISES**
 - leg press
 - squats - body weight or free weight.
 - step machine.
 - step-ups.
 - cycling/rowing machine.
 - isokinetic machines - closed chain set-up..
 - plyometrics.

Week 6-12 (post-op)

- Hamstrings exercises (0-125° flexion).
- Active exercises with resisted quads (90-60° only).
- No restricted quads in the final 30° of extension.
- Wobble board for proprioception training.
- Mini trampoline.

Week 12-20 (post-op)

- Straight line running (no changes of direction at this point).
- Prone knee flexion (full RoM).
- Rowing machines, stepping machines.
- CKCE's.

Week 20-26 (post-op)

- Resisted straight leg raises.
- Begin solo sports (badminton, tennis etc.)
- Increase functional activities - skipping, weaving when running, figure of eights.
- Acceleration - deceleration activities.



Week 26-40 (post-op)

- Full isokinetic spectrum training.
- Jumping, twisting, free weights for quads.
- OKCE's and CKCE's.
- Gradual return to normal sporting activities and eventually full resumption of activities.



Accelerated Protocol (Shelbourne et al, 1996)

- **Phase 1 (pre-op):**
 - may last 4 weeks or more.
 - ensure full RoM.
 - decrease swelling.
 - mental preparation of patient.
 - strengthening protocol for quads and hams.



Phase II (0-2 weeks)

- Regain full RoM with hyperextension.
- Ensure wound healing.
- Maintain active isometric quads. control.
- Decrease swelling.
- Active knee flexion (0-90°).



Phase III (3-5 weeks)

- Resume normal gait (full weight bearing).
- Increase flexion to equal opposite side.
- Begin CKCE's:
 - knee bends
 - step-ups
 - calf raises
 - leg presses
 - static bicycle/stair machine



Phase IV (week 5 ->)

- Full isokinetic workout/assessment (CKC).
- Regain 65% strength and full RoM - begin lateral shuffles, skipping and gentle running.
- Return to activity as knee allows.
- Return to sport some 2-3 months post-op.
- Further 3-4 months required for patient to become comfortable with the knee in the sporting arena.



Web Sites



- <http://www.aclmd.com/>
- <http://www.staehelin.ch/st/litref.html>
- <http://www.staehelin.ch/st/diskuse.html>
- <http://www.staehelin.ch/pt/litera.html>
- <http://akujunkan.stetson.edu/~smedina/ACL/acl.html>



More Web Sites



- <http://www.aclmd.com/ACLRehab/ACL%20Rehabilitation%20printable.htm>
- <http://www.hyperski.com/articles/apr96mainland.aclinjuries.htm>
- <http://www.scoi.com/aclrecon.htm>



**Any
Questions?**

