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ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

REHABILITATION GUIDELINES

DISCLAIMER:
There is no consensus regarding the optimal rehabilitation regimen following ACL Deficiency or Reconstruction

APPENDIX

Open versus Closed Chain Exercise

Closed kinetic chain exercises are performed with the foot placed on a surface (e.g. floor, step, pedal) and the entire limb is bearing a load and compressed.

In open chain exercises (e.g. leg extensions) a relatively larger shear stress is applied to the joint.

Closed chain exercises performed near full extension have less patellofemoral joint forces. Co-activation of quadriceps and hamstrings (best at 30' of knee flexion in closed chain, Wilk et al, 1996) help to reduce anterior shear thereby decrease the strain on the ACL.

The closed kinetic chain exercise places functional stresses on the joint and the extremity in ways that are similar to normal weight bearing activities.

The joint compression that occurs when the extremity is loaded by body weight provides inherent joint stability and allows more strenuous strengthening work outs without the degree of shearing forces that occur with conventional open kinetic exercises. (Shelbourne & Nitz, 1990).

Evidence regarding the strain on the ACL during various types of exercises is limited regarding the magnitude of loading that is detrimental to the graft following ACL reconstruction.

Knee Braces

Post operative HKB to be worn ~6 weeks

There is still no research which shows that braces can control knee rotation.

If the patient's knee is stable and they have completed a comprehensive rehabilitation program they do not need to wear any type of brace for return to sport. May be worn for up to one year for confidence building.

ACL prevention program for contralateral knee especially young female athletes, prior to return to sport; focus on landing mechanics and proprioception, High risk for tear up to 2 years post op.

No Nsaids – Ibuprofen, Advil, Motrin, Aleve, Naproxen, Naprosyn

DVT prophylaxis - May take ASA 325mg BID for DVT prevention, unless allergy, for 30 days postoperatively

Tobacco abuse
Time frames may be extended, due to slower incorporation and healing

Anterior Cruciate Ligament Reconstruction Rehabilitation Program

What is involved in the repair of the Anterior Cruciate Ligament?

The aim of reconstruction of the ACL is to replace the damaged ligament with a graft which reproduces the features of the anterior cruciate ligament. The method employed is to take from the patient's body (autograft) a piece of fibrous tissue of similar size and strength to the ACL and fix it within the knee joint in the same position as the old ACL. There are two main sources for fibrous tissue to be used as a graft: semitendinosus and gracilis muscles of the hamstrings which run down the inner aspect of the thigh, or the middle portion of the patella tendon which runs from the kneecap to the tibia. Regeneration occurs at the site from which the graft is taken. A Third option, allograft (cadaver) tissue, sterilized and processed without weakening the tissue, while minimizing graft harvest site pain, surgical time, short or long term complications from graft harvest.

Arthroscopic reconstruction utilizes 2 or 3 small incisions rather than 1 large incision, with less postoperative pain and a more rapid recovery of movement and function. In each case drill holes are made through the tibia into the knee joint and through the outer aspect of the femur into the joint. The graft is then passed through these holes so that it lies in the correct position through the joint. The graft is then secured at each end.

Anterior Cruciate ligament surgery and rehabilitation have undergone considerable changes over the past decade. There is continuing research into the treatment of ACL injuries which has been reviewed for the design of this rehabilitation program.

The major goals of ACL surgery and rehabilitation are:

- Restore normal joint anatomy.
- Provide static and dynamic stability.
- Maintain aerobic conditioning and psychological well being.
- Return to work and sport as quickly as possible.

It is extremely important that the patient has an active involvement in the rehabilitation and is aware of this fact.

Precautions and Considerations:

(Basis for design of this program)

- Kinematics of knee movement: Between 10 degrees and 45 degrees flexion, quadriceps open chain contraction causes greatest strain on the ACL.
- Principles of healing collagen and progressive controlled loading: A balance is needed between stimulus for growth and overloading the new graft.
- Graft Protection: The new graft undergoes physiological changes as fibroblast activity changes the graft's morphology to become more ligamentous. The graft is weakest between 6 and 16 weeks post-operatively. Therefore, **BE CAREFUL DURING THIS PERIOD.**
- Early mobilization: Has advantages such as maintenance of articular cartilage nutrition and bone mineralization
- Closed chain exercises: Rather than open chain exercises are utilized and designed to minimize load on the ACL graft (see appendix).
- Loss of ACL mechanoreceptors: Therefore, there must be a large emphasis on proprioceptive work.

Summary of Staged Program

Stage I	Immediately post-operative
Stage II	Hamstring and Quadriceps control
Stage III	Proprioception
Stage IV	Sport Specific
Stage V	Returning to training and competition

Stage I

Time Period: Day 1 to Day 10-14

Goals: Increase ROM
Decrease pain
Decrease swelling

Possible Complications: Infection
Stiffness
Stretch Graft
Hemorrhage
Deep Venous Thrombosis

Activity:

- Post-operative brace 0-90 degrees
- Hamstring exercises - static contractions at 30, 60 and 90 degrees performed in the brace, progress to concentric and eccentric in standing.
- Co-contraction of hamstrings and quads;
  a) Statically at 60 and 90 degrees
  b) Actively flex and extend to 90 degrees,
  c) Standing, partial weight bearing.
- Biofeedback's can be extremely useful.
- Crutch walking partial weight bearing to Full weight bearing depending on associated procedures.
- Control pain and swelling using ice therapy (vascutherm/game ready).

Stage II

Time Period: 2-6 weeks

Goals: Increase ROM
Increase weight bearing
Increase hamstring and quads control
Progress out of brace at week 6

Possible Complications: Infection
Stiffness
Increasing laxity of graft

Activity:

- Sutures are removed and physiotherapy commences.
- Brace is worn up to week 4 now set at 0 - 90 degrees. Patients with lax ligaments (i.e. hyper-elasticity) will be immobilized for 6 weeks. Patient can come out of the brace for physiotherapy. Patient may remove brace for sleeping at 4 weeks. Continue to control pain and swelling using ice therapy
- 0 - 130 degrees ROM should be aimed for by 4 to 6 weeks.
- Progress to full weight bearing once quad control is good and near to full extension (no extension lag).
- SLR Multi-direction in brace until no extension lag with good quad control, then out of brace
- Patella mobilizations.
- Two-leg quarter squats, emphasizing co-contraction of hamstring and quadriceps. Begin with isometrics then progress to concentric/eccentric repetition. Watch for patella pain.
- Progress light open chain **hamstring** exercises with resistance.
- Static co-contraction of hamstring and quadriceps at 0 degrees, 60 degrees and 90 degrees continues. DO these with the tibia externally rotated.
- Use of biofeedback for retraining.
- Gait re-education.
- Stationary bike.
- Begin static proprioception - i.e. stand on affected leg and balance.
- May start light leg press in external rotation.
- Start pool work once brace is removed and wounds healed. Start with walking and hip

exercises. Straight leg kicks only.

Stage III

Time Period: 6 - 12 weeks

Goals: Improve neuromuscular control and proprioception
Strengthen hamstrings
Protect graft
Improve patient confidence

Possible Complications: Arthrofibrosis
Chronic inflammation
Patellofemoral irritability
Graft laxity and rupture

Activity:

- Patient should have full ROM by end of this stage.
- Progression of quarter squats to half squats. Add resistance using either stretch cord, hand weights or bar bell.
- Progress proprioceptive work from static to dynamic, e.g. shift weight from one leg to other, balance and eventually jogging on mini-tramp, wobble board, etc.
- Progress leg press and hamstring curls keeping tibia externally rotated.
- Continue quads and hamstring control both statically and dynamically in functional weight bearing positions, e.g. standing on one leg, lunges, wall squats, etc.
- Step ups and step downs.
- Cycling on normal bicycle.
- Swimming - straight leg kick only (no breaststroke or flutter kick).
- Introduce gymnasium equipment such as stepper and rowing machine (both closed chain).
- Start jogging on the flat (no down hills) once good muscle control and no swelling. 3-4 months
- Hip and ankle exercises.
- CORE exercises
- Exercise contralateral leg.

Stage IV

Time Period: 12 weeks - 5 months

Goals: Incorporate more sport specific exercises
Incorporate agility and reaction time into proprioceptive work
Increase total leg strength
Develop patient confidence

Possible Complications: Arthrofibrosis continued
Patellofemoral irritability

Activity:

- Progression of strength work, e.g.
  - Half squats with resistance,
  - Leg press,
  - Leg curls,
  - Wall squats,
  - Step work on progressively higher steps.
- * Still no open chain resisted leg extensions.
- Proprioceptive work on mini-tramp or Bosu, such as landing on affected leg and hopping.
- Based on progression - Agility work, e.g. Catching a ball, sideways running, two leg jumping, skipping rope, front, lateral and diagonal hops, single leg, vertical height for power, etc., education and performance of deceleration activities for return to sport. (promoting knee flexion vs hip and trunk flexion to decelerate)
- Low impact aerobic or step classes.
- 16 weeks – straight line jogging, return to running program
- Introduce plyometric exercises by 4 to 5 months.
- Should be incorporating physiotherapy into a gymnasium program.
- Pool work can include flutter kick and progress to using flippers.
- CORE exercises

Stage V

Time Period: 5 - 6 months

Goal: Return to sport, 6-9 months depending on sport

Activity:

- Can begin open chain leg extensions for quadriceps at 5 months.
- Emphasis on plyometric and sport specific skills.
- Return to training.

- Sport specific skills and cardiovascular fitness must be excellent before return to competition.
- Pass Functional testing and sport specific drills
- Advise specific modifications to return to sport e.g.;

Larger centers are slowing return to full sport to 10-12 months


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