CENTRAL COAST
BONE AND JOINT

Dr Simon Hutabarat

POST-OPERATIVE REHABILITATION PROTOCOL
ACL RECONSTRUCTION

RATIONALE OF REHABILITATION

Based upon the following assumptions:

Prehabilitation

- Only operate on pain-free mobile joints - minimizes complications
- May take weeks or months
- Prehabilitation advantages the patient but preparing a pain free joint with full ROM and optimal strength
- Patients are better able to manage postoperative exercises if they have learnt them before surgery

Stage 1: Acute Post-Op 0-14 days

- ACL sees minimal force in ADL and closed chain exercises
- Surgery has placed the ACL graft in the functionally anatomic position
- Immediate weight bearing 1 RCT
  ↓pf pain, ↑VMO strength and does not ↑laxity (Tyler Clin Orth, 1998)
- CPM offers no advantage 6 RCT
- Rehab must respect fixation choice
  Chosen fixation allows for immediate mobilisation
- Graft tissue is probably never stronger than the day it is implanted

Stage 2: Muscular control 2-6 weeks

- In a anatomically correct position the ACL graft will allow a full ROM without excessive loading
- EMG biofeedback is beneficial 1 RCT
  ↑quads strength at 3 months, earlier full extension (Draper 1990)
- Bracing offers no advantage 11 RCT
  No difference injuries, pain, laxity, ROM at 6 weeks

Stage 3: Proprioception 6-12 weeks

- Laxity should not be assessed until full ROM
- The prime determinant of laxity is graft position
- It is not the therapist that makes your reconstructions lax
- Resumption of <u>solo</u> sports skills will improve confidence and proprioception without risking graft (assuming adequate strength)
- Fixation improves with time
  Hamstring graft ST to bone healing in 8-12 weeks (longer for allograft)
- Open Chain Exercises 5 RCT
  Early open chain = ↑laxity + ↑pf pain (Bynum, 1995)

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Closed chain 6 weeks then open chain = ↑quads, ↑return to sport, = laxity (Mikkelsen, 2000)
Start 40-90º progress to 10-90º over 6 weeks
Beware highly increased pf forces, desist if patellofemoral symptoms develop

Stage 4: Sport Specific 3-5 months

- Graft maturation continuing
- Proprioceptive recovery vital and takes time and practice and practice and practice
- For jumpers practice good landing technique
  ↑knee flexion, ↓valgus rotation and toe land

Stage 5: Return to sport 6 months +

- Normal graft strength and stiffness 8 months
- Gross histology graft remodeled by 12 months
- Maturation of the ultra-structure continues > than 3 years
- Modification to sports
  Return to sports at ↓ level
  Short sprigs with soccer for 1st season
  Groomed slopes and low DIN settings for skiers
  Play within confidence level
  Surfing: take care with valgus position and rotation eg snaps, see Mick Fanning injury South Africa youtube
- "PEP" program
  Warm up with strengthening, plyometrics, agility drills
  PEP program RCT 1435 female soccer (Gilchrist AJSM 2008)
  ↓non contact ACL injury by 70%
  Prior ACL injury - ↓ non contact ACL injury by 5x
- Joint injury results in impaired muscle function for at least 18 months
  Slower muscle reaction times
  Altered muscle recruitment order patterns and spinal reflexes (Wojtys 2000) in 25 ACL rec vs 40 normal
- Knee normal = Which knee? Approx 18 months coincides with muscular fxn
- Rate of another ACL injury > 12 months is 1% per knee per year (equal graft and opposite ACL) (Salmon et al Arthroscopy, 2005)

PROTOCOL

Prehabilitation

Aims:	- Prepare the patient for surgery
Goals:	- Full ROM - Painfree mobile joints - Teach simple post-op exercises
Treatment Guidelines:	- Operate on pain free mobile joints - minimizes complications and speeds recovery - May take many months - Do not be pressured by patient into early surgery. - Pre-programming post operative rehabilitation is beneficial at every level - Patients are better able to manage postoperative exercises if they have learnt them before surgery

Stage 1: Acute Recovery Day 1 to 10-14

Aims:	- Postoperative pain relief and management of soft tissue trauma - Progress off crutches and normal gait
Goals:	- Wound healing - Manage the graft donor site morbidity, i.e. pain and swelling - Decrease joint swelling - Restore full extension (including hyperextension) - Establish muscle control
Treatment Guidelines:	- Decrease swelling & pain with ice, elevation, co-contractions and pressure pump - Partial weight bearing to full weight bearing as pain allows - Aim for a full range of motion using active and passive techniques - Patella mobilisations to maintain patella mobility - Gait retraining with full extension at heel strike - Return of co-ordinated muscle function encouraged with biofeedback. Active quadriceps strengthening is begun as a static co-contraction with hamstrings emphasising VMO control at various angles of knee flexion and progressed into weight bearing positions - Gentle hamstring stretching to minimise adhesions - Active hamstring strengthening begins with static weight bearing co-contractions and progresses to active free hamstring contractions by day 14 - Resisted hamstring strengthening should be avoided for at least 6 weeks

Stage 2: Hamstring and Quadriceps Control 2-6 Weeks

Aims:	- To return the patient to normal function - Prepare the patient for Stage 3
Goals:	- Develop good muscle control and early proprioceptive skills - If not done sooner, restore a normal gait - Reduce any persistent or recurrent effusion
Treatment Guidelines:	- Progress co-contractions for muscle control by increasing the repetitions, length of contraction and more dynamic positions, e.g. two leg quarter squats, lunges, stepping, elastic cords - Gym equipment can be introduced gradually such as stepper, leg press, mini trampoline, cross trainer - If swelling is persistent, continue with pressure pump and ice - Hamstring strengthening progresses with the increased complexity and repetitions of co-contractions. Open chain hamstring exercises are commenced although often they are painful

- Care must be taken as hamstring straining may occur
- Low resistance, high repetition weights aim to increase hamstring endurance
- Continue with intensive stretching exercises

Week 6:

- Eccentric hamstring strengthening is progressed as pain allows. Hamstring curl equipment can be introduced
- Consider beyond the knee joint for any deficits, e.g. gluteal control, tight hamstrings, ITB, gastrocs and soleus, etc.

Stage 3: Proprioception 6-12 weeks

Aims:	- Improve neuromuscular control and proprioception
Goals:	- Continue to improve total leg strength - Improve endurance capacity of muscles - Improve confidence
Treatment Guidelines:	- Progress co-contractions to more dynamic movements, e.g. step lunges, half squats - Proprioceptive work more dynamic, e.g. lateral stepping, slide board etc. - Can begin jogging in straight lines on the flat - Progress resistance on gym equipment such as leg press and hamstring curls. Hamstring strengthening programme aims for a progression in both power and speed of contraction - Start cycling on normal bicycle - Consider pelvic and ankle control plus cardiovascular fitness - Solo sports such as cycling, jogging and swimming are usually permitted with little or no restrictions during this stage - Open chain exercises commence (if no patellofemoral symptoms) 40-90º progressing to 10-90º by 12 weeks

Stage 4: Sport Specific 12 Weeks - 5 Months

Aims:	- Prepare to return to sport
Goals:	- Incorporate more sport specific activities - Introduce agility and reaction time into proprioceptive work - Increase total leg strength - Develop patient confidence
Treatment Guidelines:	- Progressing of strength work, e.g. half squats with resistance, leg press & curls, wall squats, step work on progressively higher steps, stepper & rowing machine - Proprioceptive work should include hopping and jumping activities and emphasise a good landing technique. Incorporate lateral movements - Agility work may include shuttle runs, ball skills, sideways running, skipping, etc. - Low impact and step aerobics classes help with proprioception and confidence - Pool work can include using flippers - Sport specific activities will vary for the individual, e.g. Tennis - lateral step lunges, forward and backwards running drills: Skiing - slide board, lateral box stepping and jumping, zigzag hopping; Volleyball or Basketball - vertical jumps.

Stage 5: Return To Sport 5-6 Months

Goals:	- Return to sports safely and with confidence
Treatment Guidelines:	- Continue progression of plyometrics and sport specific drills - Return to training and participating in skill exercises - Continue to improve power and endurance

- Advice may be needed as to the need for modifications to be able to return to sport, e.g. Football - start back training in running shoes or short sprigs. Will usually return to lower grades initially; Skiing - stay on groomed slopes and avoid moguls and off piste initially. Racers may initially lower their DIN setting on the bindings.
- Train in PEP program for warm up to reduce further ACL injury:

1.Warm-up (50 yards each):
- Jog line to line of soccer field (cone to cone)
- Shuttle run (side to side)
- Backward running

2. Stretching (30 s x 2 reps each):
- Calf stretch
- Quadricep stretch
- Figure 4 hamstring stretch
- Inner thigh stretch
- Hip flexor stretch

3. Strengthening:
- Walking lunges (20 yards x 2 sets)
- Russian hamstring (3 sets x 10 reps)
- Single toe-raises (30 reps on each side)

4. Plyometrics (20 reps each):
- Lateral hops over 2 to 6 inch cone
- Forward/backward hops over 2 to 6 inch cone
- Single leg hops over 2 to 6 inch cone
- Vertical jumps with headers
- Scissors jump

5. Agilities:
- Shuttle run with forward/backward running (40 yards)
- Diagonal runs (40 yards)
- Bounding run (45-50 yards)

Ref: Gilchrist et al AJSM 2008

NB There are **2 high risk groups for re-injury**, patients under 21 years and patients with mildly increased laxity (Pinczewski et al AJSM 2007). Both these groups have a significantly increased risk of re-injury therefore we advise refraining from full competitive sports for the full 12 months in these patients

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OUTLINE OF THE SURGICAL PROCEDURE

The knee joint is examined via the arthroscope. Meniscal surgery is performed as required and the ruptured ACL stumps are removed.

Allograft tendon (usually tibialis posterior) is utilised from tissue bank. The tendon is doubled over to create a 2 strand graft. The tunnels for the graft are drilled through the tibia and femur and the graft pulled into place in an anatomic position.

The graft is secured with an interference screw and staple in the tibia and an Endobutton in the femur. Full ROM is achieved prior to final tibial fixation. A Lemaire augmentation may be utilised in selected cases. The wounds are closed then closed.

Braces are not used routinely postoperatively and patients may weight bear as tolerated immediately after surgery. For the vast majority of patients this is a day surgery procedure.

Video links:

ACL: https://youtube.com/watch?v=DVlv2pur1Sg&feature=share
Lemaire: https://youtu.be/XKfEM2oK4gU

UPDATED Dr Simon Hutabarat (3/3/2021)