

**Accelerated Rehabilitation
Programme for Arthroscopic
Anterior Cruciate Ligament (ACL)
Reconstruction**

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Introduction

Anterior cruciate ligament (ACL) reconstruction has become one of the most commonly performed surgical procedures to the injured knee joint. The rationale for surgical treatment is to stabilise an unstable joint, or potentially unstable joint, with the aim of preventing giving way of the joint under load. Joint stabilisation has been shown to decrease meniscal and articular cartilage damage, which potentially decreases the incidence and severity of later osteoarthritic change.

Surgical techniques have advanced greatly over the past decade along with post-operative management protocols. This, in part, has been driven by patient non-compliance with traditional protocols.

Accelerated rehabilitation protocols have been developed and in this paper are defined as – immediate full weight bearing, immediate full extension and immediate active and passive mobilisation of the knee joint.

As surgical techniques have become more accurate and less invasive with the advent of arthroscopic techniques, post-operative morbidity has decreased. This has had two effects. Firstly, it has reduced the period of hospitalisation and subsequent rehabilitation. Secondly, it has increased the number of patients to which surgical management is realistically possible. Numerous studies have shown that regardless of surgical technique, reduction in post-operative morbidity is possible with an accelerated rehabilitation protocol. The aim is to outline our current regime.

This paper follows the current regime utilised by Dr Leo Pinczewski in over 3,000 mid-third patellar tendon reconstructions and 2,000 multiple strand hamstring tendon reconstructions. It is with his kind permission that we have implemented this programme for our patients.

Aims of Physiotherapy

Physiotherapy should ideally commence pre-operatively. Patients who have a pain free, mobile, healthy joint recover far quicker and with less complication than those with surgery carried out on acutely painful joints.

Even patients with chronic injuries benefit from pre-operative assessment and pre-operative “programming”. It has been our experience that if patients have learnt the exercises required pre-operatively they have fewer problems with these exercises post-operatively.

Accelerated ACL Rehabilitation Programme

Physiotherapy is commenced in the acute post-operative stage the same day. Over the next three to six months the following are treatment goals.

1. Diminish post operative pain and swelling.
1. Restore a full range of motion
1. Restore muscle tone and strength
1. Proprioceptive retraining allowing a safe return to work and sport

It is essential that the patient is aware that he/she has an active part in their own rehabilitation and is aware of the workload involved.

The rehabilitation programme is not a recipe and should be modified for the patient's goals and individual characteristics which include their (1) age, (2) associated pathology, e.g. meniscal suture, meniscectomy, osteoarthritis, chondral damage, microfracture and (3) acute or chronic injury with or without associated collateral ligament damage, necessitating brace immobilisation.

Rationale of Programme Designs

This programme has been based on the following known information regarding anterior cruciate ligament reconstructive surgery.

1. Early mobilisation has advantages such as maintenance of articular cartilage nutrition, retention of bone mineralisation and helps to prevent arthrofibrosis. Braces, if used, should be aimed at obtaining full extension.
2. Progressive controlled loading of the graft provides a stimulus for collagen healing and regeneration. This is a needed stimulus for growth. It is very difficult to overload a graft placed in the correct isometric and anatomic position.
3. Weight bearing has not been shown to be detrimental to the graft and progression to full weight bearing is allowed as rapidly as pain permits.
4. It is assumed that the technical aspects of the surgical procedure allow for immediate graft fixation sufficient to allow aggressive mobilisation. This fixation to bone improves with the passage of time as the attachment "ligamentises". It is also based on the assumption that the graft is probably never stronger than the day it is implanted.
5. Kinematic research has shown that open chain extension exercises cause significantly more anterior tibial displacement (and force on the graft) than closed chain activities.

6. With injury to the joint resulting in the loss of the anterior cruciate ligament's function, there is also a significant loss to the joints mechanoreceptors. Therefore, a large emphasis must be placed on proprioceptive retraining prior to the return to unrestricted sporting activities.

The Staged Programme

STAGE 1

Time Period: Day 1 to Day 10-14

AIM:

1. Post-operative pain relief and management of soft tissue surgical trauma.
2. Get the patient off crutches and walking normally.

GOALS:

1. Wound healing.
2. Manage the graft donor site morbidity, i.e. pain and swelling.
3. Decrease joint swelling.
4. Restore full extension.
5. Establish muscle control.

POSSIBLE COMPLICATIONS:

1. Infection - the patient complains of a constant, severe pain. The patient is sweaty, ill and has a tense effusion.
2. Post operative haemorrhage into the graft donor site. This results in a red, hot, tender area
3. Hamstring strain or pain.
4. Deep venous thrombosis. The patient has calf, popliteal, thigh or groin pain and tenderness, with associated swelling of the limb.
5. Stiffness due to early arthrofibrosis or reflex sympathetic dystrophy.

TREATMENT GUIDELINES:

1. Reduction of swelling and pain using ice, elevation, co-contractions.
2. Partial weight bearing to full weight bearing as pain and swelling allows.
3. Active range of motion aiming for full extension by 14 days. Flexion will come without a great effort.
4. Patella mobilisations to maintain patella mobility.
5. Gait retraining with full extension at heel strike.

Due to post operative pain and swelling, early return of co-ordinated muscle function may be encouraged with the use of biofeedback and selective muscle stimulation if necessary. Caution should be taken following patellar tendon grafts in stimulating the quadriceps mechanism as patella fracture has been reported.

Early 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 is initiated immediately to minimise painful adhesions. Hamstring tears with the patient reporting a 'pop' about the posteromedial thigh is common within the first 14 days and even within the first 6 weeks.

Early 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 4-6 weeks. At 10-14 days post operatively, the dressings will be removed and the wound checked.

NB: Quadriceps exercises are to be closed chain only during the first four stages.

STAGE 2

Time period: 2-6 weeks

Hamstring and Quadriceps Control

AIM:

1. To return the patient to normal function.
2. Prepare the patient for Stage 3.

GOALS:

1. Obtain a full unrestricted range of motion.
2. Develop good muscle control and early proprioceptive skills.
3. If not done sooner, restore a normal gait.
4. Reduce any persistent effusion.

POSSIBLE COMPLICATIONS:

1. Stiffness
2. Recurrent hamstring strain
3. Increasing laxity of the graft.
4. Graft failure.

TREATMENT GUIDELINES:

1. Aim for a full range of motion using active and passive techniques.
2. 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.

3. Commence swimming once the wound has healed.
4. Gym equipment can be introduced gradually such as stationary bike, stepper, leg press, mini trampoline.
5. If swelling is persistent, continue with the use of a pressure pump, ice and static quadriceps exercises. Hold back on gym activities until the effusion is settling.
6. Hamstring strengthening automatically progresses with the increased complexity and repetitions of co-contractions. Open chain hamstring exercises are also included at this stage although often they are painful. It is important to concentrate on hamstring stretches and to incorporate resistance gradually to prevent recurrent injury.

Weeks 3-4:

Low resistant (e.g. 1-2Kg ankle weight) bilateral hamstring curls are progressed to low resistant unilateral curls as pain allows.

Weeks 4-6:

Care must be taken as hamstring straining may occur and impede further progression. Low resistance, high repetition weights aim to increase hamstring muscle 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.

NB: With the accelerated programme patients can feel very confident by 6 weeks. However, it must be stressed that the graft is still not mature and they must be aware of their functional restrictions to avoid the risk of graft failure.

STAGE 3

Time Period: 6-12 weeks

Proprioception

AIM:

Improve neuromuscular control and proprioception.

GOALS:

1. Continue to improve total leg strength.
2. Improve endurance capacity of muscles.

3. Improve patient confidence.

POSSIBLE PROBLEMS:

1. Arthrofibrosis
2. Patello-femoral irritability.
3. Chronic inflammation.
4. Graft laxity and rupture.

TREATMENT GUIDELINES:

1. Progress co-contractions to more dynamic movements, e.g. step lunges, half squats.
2. Proprioceptive work should be more dynamic, e.g. lateral stepping, slide board etc.
3. Can begin jogging in straight lines on the flat.
4. 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.
5. Start cycling on normal bicycle.
6. Continue with static control but emphasise endurance, e.g. wall squats.
7. Consider pelvic and ankle control plus cardiovascular fitness.
- 8.

NB: Still no open chain quadriceps exercises. Solo sports such as cycling, jogging and swimming are usually permitted with little or no restrictions during this stage.

STAGE 4

Time Period: 12 weeks to 5 months

Sport Specific

AIM:

Prepare to return to sport.

GOALS:

1. Incorporate more sport specific activities.
2. Introduce agility and reaction time into proprioceptive work.
3. Increase total leg strength.
4. Develop patient confidence.

POSSIBLE PROBLEMS:

1. Patello-femoral irritability.

TREATMENT GUIDELINES:

1. Progressing of general strength work, e.g. half squats with resistance, leg press, leg curls, wall squats, step work on progressively higher steps, stepper and rowing machine.
2. Proprioceptive work should include hopping and jumping activities and emphasise a good landing technique. Incorporate lateral movements.
3. Agility work may include shuttle runs, ball skills, sideways running, skipping rope, etc.

4. Low impact and step aerobics classes help with proprioception and confidence.
5. Pool work can include using flippers.
6. 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.

NB: The above activities are gradually introduced throughout Stage 4.

STAGE 5

Time Period: 5-6 months

Return to Sport

GOALS:

Return to sport safely and with confidence.

TREATMENT GUIDELINES:

1. Can safely do open chain quadriceps work, (i.e. leg extensions).
2. Continue progression of plyometrics and sport specific drills.
3. Return to training and participating in skill exercises.
4. Continue to improve power and endurance.
5. 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.
6. Skiing - stay on groomed slopes and avoid moguls and off piste initially. Racers may initially lower their DIN setting on the bindings.

Appendix

Co-Contraction Exercises

In relation to the knee these exercises ensure that both the hamstring muscle group and the quadriceps muscle group contract simultaneously to achieve a bracing effect on the knee joint.

Not only will these two groups be contracting, however, but stabilisers above and below will also contract such as gluteals, psoas, TFL, adductors and calf muscles.

To initially teach a co-contraction, it is easiest to place a rolled pillow under the knee and ask the patient to push into the pillow. This will switch on the hamstrings and gluteals. They should then tighten the quadriceps. A co-contraction should initially be held for approximately 15 seconds.

Open -v- Closed Chain Exercises

Closed kinetic chain exercises are performed with the foot placed on a surface (e.g. floor, step, pedal) and the entire limb is bearing an axial load. Joint compression occurs when the limb is loaded by body weight and this provides inherent joint stability and allows more strenuous strengthening without the degree of shearing forces, or anterior tibial displacement that occurs with conventional open kinetic chain exercises.

Closed chain exercises performed with co-contraction of hamstrings and quadriceps also lessen the patello-femoral joint surfaces.

The closed exercises place functional stresses on the joint and entire limb. These exercises can easily be designed to be specific to normal weight bearing activities used for ACL as well as sport.