E R I N R A T A H I
ORTHOPAEDIC SURGEON

Spine-Shoulder-Hip-Knee

Physiotherapy Protocol:

Anterior Cruciate Ligament Reconstruction
Rehabilitation Guidelines (MOON Protocol)

Indications for surgery
The main indication of ACL reconstruction surgery is symptomatic instability following ACL injury. The aim of ACL reconstruction surgery is to restore the functional stability of the knee without compromising other joint functions.

Possible complications:
- Infection
- Bleeding
- Nerve damage
- Deep vein thrombosis
- Pulmonary embolism
- Persistent / recurrent pain
- Recurrent symptoms including locking, swelling, instability
- Failure of graft
- Patella fracture
- Persistent / recurrent joint crepitus
- Altered sensation in the knee post-operatively

Surgical techniques :
Various techniques may be used eg. Patella tendon or hamstring graft. The graft substance could be:
Autograft : involves the grafting of bone or tissue from the patient's body. The patella tendon and hamstrings are autografts used.
Allograft : is the use of bone or tissue from a donor's (typically a cadaver's body) body.

Expected outcome:
- Improved knee stability
- Improved function / mobility
- Reduced pain
- Full recovery and return to sport may take up to twelve months

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PHASE 0: Pre-operative Recommendations

- Normal gait
- AROM 0 to 120 degrees of flexion
- Strength: 20 SLR with no lag
- Minimal effusion
- Patient education on post-operative exercises and need for compliance
- Educated in ambulation with crutches
- Wound care instructions

Post-operatively
Always check operation notes and post-op instructions.
Discuss any deviation from routine guidelines with the surgeon.

PHASE 1: Immediate Post-operative Phase
(Approximate timeframe: Surgery to 2 weeks)

GOALS

- Full knee extension ROM
- Good quadriceps control (≥ 20 no lag SLR)
- Minimize pain
- Minimize swelling
- Normal gait pattern

Crutch Use: WBAT (weight bearing as tolerated) with crutches (beginning the day of surgery)

Crutch Discontinue Criteria: Normal gait pattern
Ability to safely ascend/descend stairs without noteworthy pain or
Instability (reciprocal stair climbing)

Knee Immobilizer: None (Exception: First 24 hours after a femoral nerve block)

EXERCISE SUGGESTIONS

ROM

- *Extension:* Low load, long duration (~5 minutes) stretching (e.g., heel prop, prone hang minimizing co-contraction and nocioceptor response)
- *Flexion:* Wall slides, heel slides, seated assisted knee flexion, bike: rocking-for-range
- Patellar mobilization (medial/lateral mobilization initially followed by superior/inferior direction while monitoring reaction to effusion and ROM)

Muscle Activation/Strength

- Quadriceps sets emphasizing vastus lateralis and vastus medialis activation
- SLR emphasizing no lag
- Double-leg quarter squats
- Standing theraband resisted terminal knee extension (TKE)
- Hamstring sets
- Hamstring curls
- Side-lying hip adduction/abduction (Avoid adduction moment in this phase with concomitant grade II – III MCL injury)
- Quad/ham co-contraction supine
- Prone Hip Extension
- Ankle pumps with theraband
- Heel raises (calf press)

Scar Massage (when incision is fully healed)

CRITERIA FOR PROGRESSION TO PHASE 2

- 20 no lag SLR
- Normal gait
- Crutch/Immobilizer D/C
- ROM: no greater than 5º active extension lag, 110º active flexion

PHASE 2: Early Rehabilitation Phase
(Approximate timeframe: weeks 2 to 6)

GOALS

- Full ROM
- Improve muscle strength
- Progress neuromuscular retraining

EXERCISE SUGGESTIONS

ROM

- Low load, long duration (assisted prn)
- Heel slides/wall slides
- Heel prop/prone hang (minimize co-contraction / nociceptor response)
- Bike (rocking-for-range → riding with low seat height)
- Flexibility stretching all major groups

Strengthening

Quadriceps:

- Quad sets
- Mini-squats/wall-squats
- Steps-ups
- Knee extension from 90º to 40º
- Leg press
- Shuttle Press without jumping action

Hamstrings:

- Hamstring curls
- Resistive SLR with sports cord

Other Musculature:

- Hip adduction/abduction: SLR or with equipment
- Standing heel raises: progress from double to single leg support
- Seated calf press against resistance

Neuromuscular training

- Wobble board
- Rocker board
- Single-leg stance with or without equipment (e.g. instrumented balance system)
- Slide board
- Fitter

Cardiopulmonary

- Bike
- Elliptical trainer
- Stairmaster

CRITERIA FOR PROGRESSION TO PHASE 3

- Full ROM
- Minimal effusion/pain
- Functional strength and control in daily activities
- IKDC Question # 10 (Global Rating of Function) score of ≥ 7 *(See last page)*

PHASE 3: Strengthening & Control Phase
(Approximate timeframe: weeks 7 through 12)

GOALS

- Maintain full ROM
- Running without pain or swelling
- Hopping without pain, swelling or giving-way

EXERCISE SUGGESTIONS

Strengthening

- Squats
- Leg press
- Hamstring curl
- Knee extension 90º to 0º
- Step-ups/down
- Lunges
- Shuttle
- Sports cord
- Wall squats

Neuromuscular Training

- Wobble board / rocker board / roller board
- Perturbation training
- Instrumented testing systems
- Varied surfaces

Cardiopulmonary

- Straight line running on treadmill or in a protected environment (NO cutting or pivoting)
- All other cardiopulmonary equipment

CRITERIA FOR PROGRESSION TO PHASE 4

- Running without pain or swelling
- Hopping without pain or swelling (Bilateral and Unilateral)
- Neuromuscular and strength training exercises without difficulty

PHASE 4: Advanced Training Phase
(Approximate timeframe: weeks 13 to 16)

GOALS

- Running patterns (Figure-8, pivot drills, etc.) at 75% speed without difficulty
- Jumping without difficulty
- Hop tests at 75% contralateral values (Cincinnati hop tests: single-leg hop for distance, triple-hop for distance, crossover hop for distance, 6-meter timed hop)

EXERCISE SUGGESTIONS

Aggressive Strengthening

- Squats
- Lunges
- Plyometrics

Agility Drills

- Shuffling
- Hopping
- Carioca
- Vertical jumps
- Running patterns at 50 to 75% speed (e.g. Figure-8)
- Initial sports specific drill patterns at 50 – 75% effort

Neuromuscular Training

- Wobble board / rocker board / roller board
- Perturbation training
- Instrumented testing systems
- Varied surfaces

Cardiopulmonary

- Running
- Other cardiopulmonary exercises

CRITERIA FOR PROGRESSION TO PHASE 5

- Maximum vertical jump without pain or instability
- 75% of contralateral on hop tests

PHASE 5: Return-to-Sport Phase
(Approximate timeframe: weeks 17 to 20)

GOALS

- 85% contralateral strength
- 85% contralateral on hop tests
- Sport specific training without pain, swelling or difficulty

EXERCISE SUGGESTIONS

Aggressive Strengthening

- Squats
- Lunges
- Plyometrics

Sport Specific Activities

- Interval training programs
- Running patterns in football
- Sprinting
- Change of direction
- Pivot and drive in basketball
- Kicking in soccer
- Spiking in volleyball
- Skill / biomechanical analysis with coaches and sports medicine team

RETURN-TO-SPORT EVALUATION RECOMMENDATIONS:

- Hop tests (single-leg hop, triple hop, cross-over hop, 6 meter timed-hop)
- Isokinetic strength test (60°/second)
- Vertical jump
- Deceleration shuttle test

RETURN-TO-SPORT CRITERIA:

- No functional complaints
- Confidence when running, cutting, jumping at full speed
- 85% contralateral values on hop tests