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## Rehabilitation Following Acute ACL, PCL, LCL, PL & Lateral Hamstring Repair

### PREOPERATIVE PHASE

**Goals:** Diminish inflammation, swelling, and pain  
Restore normal range of motion (gradual knee extension)  
Restore voluntary muscle activation  
Provide patient education to prepare patient for surgery

**Brace** – Elastic wrap or knee sleeve to reduce swelling

**Weight Bearing** – As tolerated with or without crutches

**Exercises:**

- \*Ankle Pumps
- \*Passive knee extension (gradual progression)
- \*Passive knee flexion to tolerance
- \*Straight Leg Raises (3 Way, Flexion, Abduction), Pillow Squeezes
- \*Quadriceps Setting
- \*Closed kinetic chain exercises: mini squats, lunges, step-ups

**Muscle Stimulation** – Electrical muscle stimulation to quadriceps during voluntary quadriceps exercises (4 to 6 hours per day)

### **Neuromuscular/Proprioception Training -**

- Eliminate quad avoidance gait
- Retro stepping drills
- Joint repositioning on Sports RAC
  - Passive/active reposition at 90, 60, 30 degrees
  - CKC squat/lunge repositioning on screen

**Cryotherapy/Elevation** – Apply ice 20 minutes of every hour, elevate leg with knee in full extension (knee must be above heart)

**Patient Education** – Review postoperative rehabilitation program  
Review instructional video (optional)  
Select appropriate surgical date

### **I. IMMEDIATE POST-OPERATIVE PHASE (Day 1 to Day 7)**

**Goals:** Gradual passive knee extension  
Diminish joint swelling and pain  
Restore patellar mobility  
Gradually improve knee flexion  
Re-establish quadriceps control  
Restore independent ambulation

### **Postoperative Day 1**

**Brace** – brace/Immobilizer applied to knee, locked at 20 degrees of flexion for ambulation & sleeping

**Weight Bearing** – Two crutches, weight bearing as tolerated

- Exercises:**
- \*Ankle pumps
  - \*Overpressure into passive knee extension
  - \*Active and Passive knee flexion (90 degree by day 5)
  - \*Straight leg raises (Flexion, Abduction), Pillow Squeezes
  - \*Quadriceps isometric setting
  - \*Hamstring stretches
  - \*Closed kinetic chain exercises: mini squats, weight shifts

**Muscle Stimulation** – Use muscle stimulation during active muscle exercises (4-6 hours per day)

**Passive Motion** – As needed, 20 to 60 degrees (as tolerated and as directed by physician) maintain anterior tibial force during passive knee flexion

**Ice and Evaluation** – Ice 20 minutes out of every our and elevate with knee in full extension

**Postoperative Day 2 to 3**

**Brace** – EZ Wrap brace/Immobilizer, locked at 20 degrees extension for ambulation and unlocked for sitting, etc.

**Weight Bearing** – Two crutches, weight bearing as tolerated

**Range of Motion** – Remove brace perform range of motion exercises 6-8 times per day  
Perform frequent bouts of ROM to regain knee flexibility

- Exercises:**
- \*Multi-angle isometrics at 90 and 60 degrees (knee extension)
  - \*Knee Extension 90-40 degrees
  - \*Overpressure into extension (knee extension should be at least 0 degrees to slight hyperextension)
  - \* Emphasize restoring knee extension
  - \*Patellar mobilization
  - \*Ankle pumps
  - \*Straight leg raises, Pillow Squeezes
  - \*Mini squats and weight shifts
  - \*Quadriceps isometric setting

**Muscle Stimulation** – Electrical muscle stimulation to quads (6 hours per day)

**Passive Motion** – 20 to 70 degrees with anterior tibial force

**Ice and Evaluation** – Ice 20 minutes out of every hour and elevate leg with knee in full extension

**Postoperative Day 4 to 7**

**Brace** – brace/Immobilizer, locked at 20 degrees extension for ambulation and unlocked for sitting, etc.

**Weight Bearing** – Two Crutches weight bearing as tolerated

**Range of Motion** – Remove brace to perform range of motion exercises 6-8 times per day, knee flexion 75 degrees by day 5, approximately 80 degrees by day 7

- Exercises:**
- \*Multi-angle isometrics at 90 and 60 degrees (knee extension)
  - \*Knee Extension 90-40 degrees
  - \*Patellar mobilization (5-8 times daily)

- \*Ankle pumps
- \*Straight leg raises, Pillow Squeezes
- \*Mini squats and weight shifts
- \*Quadriceps isometric setting
- \*Proprioception and balance activities

**Neuromuscular training/proprioception** – OKC passive/active joint repositioning at 90, 60 degrees

CKC squats & weight shifts

**Muscle Stimulation** – Electrical muscle stimulation (continue 6 hours daily)

**Passive Motion** – 20 to 70 degrees, as needed

**Ice and Elevation** – Ice 20 minutes of every hour and elevate leg with knee full extension

## II. EARLY REHABILITATION PHASE (Week 2-4)

### **Criteria to Progress to Phase II**

- 1) Quad Control (ability to perform good quad set and SLR)
- 2) Full passive knee extension
- 3) PROM 20-75 degrees
- 4) Good patellar mobility
- 5) Minimal joint effusion
- 6) Independent ambulation

**Goals:** Gradual increase to full passive knee extension  
Gradually increase knee flexion  
Diminish swelling and pain  
Muscle control and activation  
Restore proprioception/neuromuscular control  
Normalize patellar mobility

### Week Two

**Brace** – Continue locked brace for ambulation

**Weight Bearing** – As tolerated (goal is discontinue crutches 10-14 days post-op)

**Passive Range of Motion** – Self-ROM stretching (6-8 times daily)

**Exercises:**

- \*Muscle stimulation to quadriceps exercises
- \*Isometric quadriceps sets
- \*Straight Leg raises (4 planes)
- \*Leg Press (0-60 degrees)
- \*Knee extension 90-40 degrees
- \*Half squats (0-40)
- \*Weight shifts
- \*Front and side lunges
- \*Uni-cam bicycle (low intensity cycling)
- \*Proprioception training
- \*Passive range of motion from 20 to 75 degrees
- \*Patellar mobilization

- \*Well leg exercises
- \*Progressive resistance extension program – start with 1 lb., progress 1 lb. per week

**Proprioception/Neuromuscular Training**

- \*OKC passive/active joint repositioning 90, 60, 30 degrees
- \*CKC joint repositioning during squats/lunges

**Swelling control** – Ice, compression, elevation

**Week Three**

**Brace** – Unlock brace (some patients use ROM brace for ambulation)

**Passive Range of Motion** – Continue range of motion stretching and overpressure into extension (ROM should be 10-90 degrees)

- Exercises:**
- \*Continue all exercises as in week two
  - \*Passive Range of Motion 10-90 degrees
  - \*Bicycle for range of motion stimulus and endurance (emphasize ROM on bike)
  - \*Pool walking program (if incision is closed)
  - \*Eccentric quadriceps program 40-100 (isotonic only)
  - \*Lateral lunges (straight plane)
  - \*Front Step Downs
  - \*Lateral Step-Overs (cones)
  - \*Progress Proprioception drills, neuromuscular control drills
  - \*Frequent bouts of ROM exercises

**III. PROGRESSIVE STRENGTHENING/NEUROMUSCULAR CONTROL PHASE (Week 4-10)**

**Criteria to Enter Phase III**

- 1) Active Range of Motion 0-115 degrees
- 2) Quadriceps strength 60 % > contralateral side (isometric test at 60 degree knee flexion)
- 3) Unchanged KT Test bilateral values (+1 or less)
- 4) Minimal to no full joint effusion
- 5) No joint line or patellofemoral pain

**Goals:** Restore full knee range of motion (0 to 125 degrees)  
 Improve lower extremity strength  
 Enhance proprioception, balance, and neuromuscular control  
 Improve muscular endurance  
 Restore limb confidence and function

**Brace** – No immobilizer or brace, may use knee sleeve to control swelling/support

Range of Motion – Self-ROM (4-5 times daily using the other leg to provide ROM), emphasis on maintaining zero degrees passive extension  
 - PROM 10-105 degrees at 4 weeks

KT 2000 Test – (Week 4, 20 lb. anterior and posterior test)

**Week 4**

- Exercises:**
- \*Progress isometric strengthening program
  - \*Leg Press (0-100 degrees)
  - \*Knee extension 90 to 40 degrees
  - \*Hip Abduction and Adduction
  - \*Hip Flexion and Extension
  - \*Lateral Step-Overs
  - \*Lateral Lunges (straight plane and multi-plane drills)
  - \*Lateral Step Ups
  - \*Front Step Downs
  - \*Wall Squats
  - \*Vertical Squats
  - \*Standing Toe Calf Raises
  - \*Seated Toe Calf Raises
  - \*Biodex Stability System (Balance, Squats, etc)
  - \*Proprioception Drills
  - \*Bicycle
  - \*Pool Program (Backward Running, Hip and Leg Exercises)

**Proprioception/Neuromuscular Drills**

- Tilt board squats (perturbation)
- Passive/active reposition OKC
- CKC repositioning on tilt board with sports RAC
- CKC lunges with sports RAC

**Week 6**

**KT 2000 Test** – 20 and 30 lb. anterior and posterior test

- Exercises:**
- \*Continue all exercises
    - \*Pool running (forward) and agility drills
    - \*Balance on tilt boards
    - \*Progress to balance and ball throws
    - \*Wall slides/squats
    - \*PROM 0 to 125

**Week 8**

**KT 2000 Test** – 20 and 30 lb. anterior and posterior test

- Exercises:**
- \*Continue all exercises listed in Weeks 4-6
  - \*Leg Press Sets (single leg) 0-100 degrees and 40-100 degrees
  - \*Wall squats
  - \*Perturbation Training
  - \*Walking Program
  - \*Bicycle for endurance
  - \*Initiate isolated hamstring strengthening
  - \*Biodex stability system
  - \* PROM 0 to 135

**Week 10**

**KT 2000 Test** – 20 and 30 lb. and Manual Maximum Test

**Isokinetic Test** – Concentric Knee Extension/Flexion at 180 and 300 degrees/second

**Exercises:**

- \*Continue all exercises listed in Weeks 6, 8 and 10
- \*Continue Stretching Drills
- \*Progress strengthening exercises and neuromuscular training

**IV. ADVANCED ACTIVITY PHASE (Week 10-16)**

**Criteria to Enter Phase IV**

- 1) AROM 0-125 degrees or greater
- 2) Quad strength 75% of contralateral side, knee extension flexor:extensor ratio 70% to 75%
- 3) No change in KT values (Comparable with contralateral side, within 2 mm)
- 4) No pain or effusion
- 5) Satisfactory clinical exam
- 6) Satisfactory isokinetic test (values at 180 degrees)
  - Quadriceps bilateral comparison 75%
  - Hamstrings equal bilateral
  - Quadriceps peak torque/body weight 65% at 180°/s (males) 55% at 180°/s (females)
  - Hamstrings/quadriceps ratio 66% to 75%
- 7) Hop Test (80% of contralateral leg)
- 8) Subjective knee scoring (modified Noyes System) 80 points or better

**Goals:** Normalize lower extremity strength  
 Enhance muscular power and endurance  
 Improve neuromuscular control  
 Perform selected sport-specific drills

**Exercises:**

- \*May initiate running program (weeks 10-12) if good quad control and ROM
- \*May initiate light sport program (golf)
- \*Continue all strengthening drills
  - Leg press
  - Wall squats
  - Hip Abd/Adduction
  - Hip Flex/Ext
  - Knee Extension 90-40
  - Hamstring curls
  - Standing toe calf
  - Seated toe calf
  - Step down
  - Lateral step ups
  - Lateral lunges
- \*Neuromuscular training
  - Lateral step-overs cones
  - Lateral lunges
  - Tilt board drills

**Week 14-16**

\*Progress program

- \*Continue all drills above
- \*May initiate lateral agility drills
- \*Backward running

**V. RETURN TO ACTIVITY PHASE (Week 16-22)**

**Criteria to Enter Phase V**

- 1) Full Range of Motion
- 2) Unchanged KT 2000 Test (within 2.5 mm of opposite side)
- 3) Isokinetic Test that fulfills criteria
- 4) Quadriceps bilateral comparison (80% or greater)
- 5) Hamstring bilateral comparison (110% or greater)
- 6) Quadriceps torque/body weight ratio (55% or greater)
- 7) Hamstrings/Quadriceps ratio (70% or greater)
- 8) Proprioceptive Test (100% of contralateral leg)
- 9) Functional Test (85% or greater of contralateral side)
- 10) Satisfactory clinical exam
- 11) Subjective knee scoring (modified Noyes System) (90 points or better)

Goals: Gradual return to full-unrestricted sports  
 Achieve maximal strength and endurance  
 Normalize neuromuscular control  
 Progress skill training

**Tests** – KT 2000, Isokinetic, and Functional Tests before return

- Exercises**
- \*Continue strengthening exercises
  - \*Continue neuromuscular control drills
  - \*Continue plyometrics drills
  - \*Progress running and agility program
  - \*Progress sport specific training
    - Running/cutting/agility drills
    - Gradual return to sport drills

**6 MONTH FOLLOW-UP**

Isokinetic test  
 KT 2000 test  
 Functional test

**12 MONTH FOLLOW-UP**

Isokinetic test  
 KT 2000 test  
 Functional test