Accelerated Rehabilitation Following ACL-PTG Reconstruction

I. Phase I – Preoperative Phase

Goals: Diminish inflammation, swelling, and pain
Restore normal range of motion (especially 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 to zero
- Passive knee flexion to tolerance
- Straight Leg Raises (3 Way, Flexion, Abduction, Adduction)
- 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

Immediate Post-Operative Phase (Day 1 to Day 7)

Goals: Restore full 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:
- EZ Wrap brace/Immobilizer applied to knee, locked in full extension during ambulation of Protonics

Weight Bearing:
- Two crutches, weight bearing as tolerated

Exercises:
- Ankle pumps
- Overpressure into full, passive knee extension
- Active and Passive knee flexion (90 degree by day 5)
- Straight leg raises (Flexion, Abduction, Adduction)
- 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)

Continuous Passive Motion:
- As needed, 0 to 45/50 degrees (as tolerated and as directed by physician)

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 zero 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 4 to 6 times a day

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)
- *Patellar mobilization
- *Ankle pumps
- *Straight leg raises (3 directions)
- *Mini squats and weight shifts
- *Quadriceps isometric setting

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

Continuous Passive Motion
- 0 to 90 degrees, as needed

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

Postoperative Day 4 to 7

Brace:
- EZ Wrap brace/Immobilizer, locked at zero 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 4-6 times per day, knee flexion 90 degrees by day 5, approximately 100 degrees by day 7

Exercises:
- Multi-angle isometrics at 90 and 60 degrees (knee extension)
- Knee Extension 90-40 degrees
- Overpressure into extension (full extension 0 degrees to 5-7 hyperextension)
- Patellar mobilization (5-8 times daily)
- Ankle pumps
- Straight leg raises (3 directions)
- Mini squats and weight shifts
- Standing Hamstring curls
- Quadriceps isometric setting
- Proprioception and balance activities

Neuromuscular training/proprioception:
- OKC passive/active joint repositioning at 90, 60 degrees
- CKC squats/weight shifts with repositioning on sports RAC

Muscle Stimulation:
- Electrical muscle stimulation (continue 6 hours daily)

Continue Passive Motion:
- 0 to 90 degrees, as needed

Ice and Elevation:
- Ice 20 minutes of every hour and elevate leg with knee full extension

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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 0-90 degrees
4) Good patellar mobility
5) Minimal joint effusion
6) Independent ambulation

Goals: Maintain full passive knee extension (at least 0 to 5-7 hyperextension)
Gradually increase knee flexion
Diminish swelling and pain
Muscle control and activation
Restore proprioception/neuromuscular control
Normalize patellar mobility

Week 2

Brace:
- Continue locked brace for ambulation

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

Passive Range of Motion:
- Self-ROM stretching (4-5 times daily), emphasis on maintaining full, passive range of motion

KT 2000 Test: (15 lb. Anterior-posterior test only)

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
- Hamstring Curls standing (active ROM)
- Bicycle (if ROM allows)
- Proprioception training
- Overpressure into extension
- Passive range of motion from 0 to 100 degrees
- Patellar mobilization
- Well leg exercises
- Progressive resistance extension program – start with 1 lb., progress 1 lb. per week

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Proprioception/Neuromuscular Training:

- OKC passive/active joint repositioning 90, 60, 30 degrees
- CKC joint repositioning during squats/lunges
- Initiate squats on tilt board use sports RAC with repositioning

Swelling control:

- Ice, compression, elevation

Week 3

Brace:

- Discontinue locked brace (some patients use ROM brace for ambulation)

Passive Range of Motion:

- Continue range of motion stretching and overpressure into extension (ROM should be 0-100/105 degrees)

Exercises:

- Continue all exercises as in week two
- Passive Range of Motion 0-105 degrees
- Bicycle for range of motion stimulus and endurance
- 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)
- Stair-Stepper machine
- Progress Proprioception drills, neuromuscular control drills
- Continue passive/active reposition drills on sports RAC (CKC, OKC)

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 0-125 degrees at 4 weeks

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

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Week 4

Exercises:

- Progress isometric strengthening program
- Leg Press (0-100 degrees)
- Knee extension 90 to 40 degrees
- Hamstring Curls (isotonics)
- 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
- Stair Stepper Machine
- 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

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
- Plyometric Leg Press
- Perturbation Training
- Isokinetic exercises (90 to 40 degrees) (120 to 240 degrees/second)

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- Walking Program
- Bicycle for endurance
- Stair Stepper Machine for endurance
- Biodex stability system
- Sports RAC Neuromuscular training on tilt board and Biodex stability

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
- Plyometric Training Drills
- 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^{o}/s (males) 55% at 180^{o}/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)
- 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

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- Lateral step ups
- Lateral lunges

- Neuromuscular training
  - Lateral step-overs cones
  - Lateral lunges
  - Tilt board drills
  - Sports RAC repositioning on tilt board

Week 14-16

- Progress program
- Continue all drills above
- May initiate lateral agility drills
- Backward running

V. RETURN TO ACTIVITY PHASE (Month 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

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