Special Considerations for ACL Rehab in the Pediatric Patient

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Sports-related Pediatric Injuries

- Estimated between 100,000-200,000 ACL injuries annually, encompassing all ages
- Peaking in high school years
- Knee injuries account for 50-60% of adolescent sports-related surgical procedures
- More than 1/4 of those are ACL injuries
- Injury rate of 6-7 injuries per 100,000 athlete exposures
- Highest risk to those young athletes participating in cutting/pivoting type sports
- 21% re-injury rate in ages 20 and younger; 20% secondary injury rate
- Usually occur early in the return to play period

Youth Sports are Trending

- Increased participation in youth sports
  - 70% of all high school students participate in organized sports
  - Continuing trend, especially in females
- Earlier specialization in sports
- Higher levels of competition at an earlier age
- Year-round training at higher intensities
- Improved injury recognition

The Consequences

- Annual health care costs > $625 million
- Missing extended periods in sports
  - Loss of one’s self identity
- Potential loss of scholarship earnings
  - Trickle-down effect
- Lower academic performance
- Increased risk of subsequent and secondary injuries
- Chronic knee problems and long-term disability
  - Osteoarthritis (nearly 100x greater risk)
**Pediatric-specific Risk Factors**

- Growth plate vulnerability
- Adolescent growth spurt
- Differential growth
- Biological vs. Chronological age
- Female
  - Underdeveloped:
  - Strength and opposing muscle ratios
  - Coordination
  - Neuromuscular control
  - Skills
  - Perception

**General Guidelines for Rehab Progression**

- Supervised Physical Therapy for 4-7 months
  - 2-4x per week
  - Insurance limitations
- Performance-based Protocol
  - Utilize healing times as a guide for "earliest" advancement through phases but progressions not made without achievement of specific performance-based milestones

**Phase 0: Prehab**

- The "Everyone learns" Phase
- Pre-operative Evaluation
  - Baseline measurements
  - Screen for aberrant movement patterns
  - Protocol Review
  - Expectations and Goals
  - Education
  - Authorization

**Phase 0: Identifying Aberrant Movement Patterns**
Phase 0: Prehab

- Education and Instructions
  - Key post-operative goals
    - Graft protection: brace wear, crutch training, proper transferring, activity modification
    - Control pain and swelling: post-medication, cryotherapy, proper elevation, ankle pumping
    - Re-activation of Quad and achievement of full knee extension: heel propping, quad setting, no pillow under knee

Phase 1: Post-operative Weeks 0-4

- The “Boring but critical” Phase
- New objective measures taken at first post-op treatment visit

Goals to advance to phase 2:
- Continue goals discussed pre-operatively: graft and fixation protection, pain/swelling control, regain full knee extension and quad contraction
  - Goal is good quad set and ability to SLR without extensor lag
  - Active flexion to 120 degrees
  - Restore normal gait pattern on level surfaces in order to discharge crutches
  - Provide continued education on rehab progression

Phase 1: Post-operative Weeks 0-4

- Brace:
  - Unlocked to avoid post-operative stiffness and allow for proper gait pattern
  - Continued use of brace until cleared by therapist for good quad control
  - Locked into 10 degrees hyperextension for sleep if pt has difficulty maintaining extension

- Other Considerations:
  - School considerations
  - Compliance with HEP and with restrictions
  - Avoid strong hamstring stretching

Phase 1: Post-operative Weeks 0-4

- ROM/Flexibility Exercises:
  - Heel prop (with or without quad sets), prone heel, gastrosoleus stretches, gentle hamstring stretches
  - PROM (EOB) knee flexion, heel slides, prone quad stretch, stationary recumbent bike

- Gait Training:
  - Floor and treadmill, with and without crutches
  - Balance:
    - Weight shifting forward/backward and side-to-side

- Modalities:
  - NMES with quad setting, SLR and TKE

- Manual Therapy:
  - Soft tissue mobilization, patellofemoral repositioning, SLS, PROM
Phase 2: Post-operative Weeks 4-12

- The "Impatient Patient" Phase
- Special Considerations:
  - Protect patient from themselves
  - Review milestone achievements necessary to progress

- Goals to advance to phase 3:
  - Continue protection of graft and graft fixation
  - No patellofemoral pain
  - Flexion AROM ≥ 130 degrees
  - Decking box in toes patient is able to perform use side eccentric step downs from "x" position with front of weight on the box
  - Restore reciprocal stair ascent/descent pattern
  - Improve hip, quad, calf, core strength
  - Improve balance and proprioception
  - Begin treadmill jogging

- ROM/Flexibility:
  - Heel Prop or prone hang prn, gastroc/soleus/hamstring stretches
  - Heel slides; Prone quad stretch; hip flexor stretch
  - Stationary Bike (progress to upright bike if no patellofemoral symptoms)

- Strength:
  - Progress LE strengthening at all joints and core
  - Resisted OKC hamstring strengthening
  - CKC exercise progression
  - Repetition!!!

- Gait Training:
  - Maintain normalized gait pattern with discharge of brace
  - Begin treadmill jogging @ 10-12 weeks

- Balance:
  - SLS progressing
  - Surface
  - Position
  - Endurance
  - Multiple variables
  - Unilateral
  - Treadmill, a ways

- Cardiovascular fitness:
  - Stationary bike progressing time and resistance
  - Swimming
  - Treadmill walking or running (towards and backwards)

- Agility/Dynamometers:
  - Jump training
  - Temporal gait place
  - Shuffling, backward, jogging
  - Dynamic resistance

- Modalities:
  - Continue post treatment cryotherapy as needed for pain and swelling
  - Manual therapy:
    - Maintain patellofemoral mobility
    - Scar mobilizations as needed

Phase 2: Criteria to Jog

1) Able to SLS with eyes closed ≥ 60 seconds
2) Able to consistently demonstrate eccentric quad control, control for dynamic valgus at the knee and IR of the hip, and good trunk alignment with CKC single leg squat in multi-planes?
3) Proper landing form bilaterally and unilaterally when dropping from 6" step
Phase 2: Criteria to Jog

- Jogging

Phase 3: Post-operative weeks 12-20

- The "I'm out of shape" phase
- Goals to advance to phase 4:
  - Full ROM
  - Improve strength, endurance and proprioception to prepare for sport
  - Continue to address unilateral deficits
  - Continue to avoid over-stressing graft
  - Protect patellofemoral joint
  - Normalize running mechanics
Phase 3: Post-operative weeks 12-20

- ROM/Flexibility:
  - Progress stretching dynamic.
- Strength:
  - OKC quad strengthening 90°–30°
  - Continue core strengthening
- Balance:
  - Continue to advance balance/proprioception; incorporate sport if possible

Phase 4: Post-operative Months 5-6

- The "It’s gettin’ real" phase
- Goals to advance to phase 5
  - Symmetric performance of basic and sport-specific agility drills
  - Single limb hop for distance, three hop for distance, crossover hop and 6- or timed hop pays gait of uninvolved leg

- Begin sport-specific training no earlier than 5 months post-op

Phase 3: Post-operative weeks 12-20

- Cardiovascular fitness:
  - Bike/Swimming/Elliptical/Treadmill
  - Straight plane jogging on track
- Agility/Plyometrics
  - Ladder drills
  - DL/SL Hopping
  - Agility drills: butt kicks, maries, high knees, gassers
  - Single plane lateral motion drills

- Manual therapy:
  - Joint mobilizations as needed

Phase 4: Post-operative Months 5-6

- Flexibility:
  - Progress based on individual needs and deficits
- Strength:
  - Progress strengthening, bilaterally
  - Continue core strengthening
- Cardiovascular Fitness:
  - Progress running time and distance
  - Cycling, swimming

- Agility/Plyometrics:
  - Initiate plyometric program based on patient’s athletic goals
  - Agility progression: figure 8 running, shuttle running, cone drills, a wind slab jumping (height, distance, direction), cutting, advanced ladder drills, acceleration/deceleration drills
Phase 4: Hop Testing

- Can assess combination of
  - Muscle strength
  - Neurovascular control
  - Confidence in the limb
- Ability to tolerate loads related to sport-specific activities
- Best predictor of return to sport; age and maturity level

Phase 5: Months 6-7

- The “Prepped and ready” Phase
- Goals of final formal rehab phase:
  - Gradual, safe return to sports
  - Maintenance of strength, endurance and proprioception
  - Patient education with regards to possible limitations

Additional Challenges of the Pediatric Patient

- Attendance
- Maturity level; peer and social pressures
- Figuring out what motivates them
- How to get them to comply with a home program

References