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Anterior Cruciate Ligament Reconstruction Protocol

Revised 2023

*****Please refer to written prescription for any special instructions for each case*****

The following protocol utilizes a blend of both criteria and timeframes as the determinants for advancement. It is recognized that many patients will be pain free relatively early in their rehabilitation and want to advance to higher level activities as a result. In spite of rapid functional progress, it is important to respect the biological healing component of recovery and limit advancement if the timeframe for a given stage has not been completed. Overall, this protocol targets gradual return to full activity beginning at 9-12 months if all criteria are met.

If ACL reconstruction and meniscal repair, the following modifications are necessary:

- **Week 0 to 4:**
 - Ambulation/brace use: TTWB
 - Knee PROM restricted 0-90°
- **Week 4+:**
 - TTWB → WBAT (continue crutch / assistive device use as needed)
 - Brace on and locked in full extension (-10° on brace) during ambulation
- **Week 6+:**
 - Unlock post-op brace for ambulation (start with 30°, gradually open) if able to perform 10 repetitions of SLR without quadriceps lag
 - Wean from and discontinue post-op brace if criteria met:
 - Knee flexion ROM ≥ 100°
 - Perform 3 single-leg squats to 30° on involved side with adequate frontal plane control
 - May initiate isolated hamstrings activation
 - May squat below 60° (hold on squatting below 90° until after week 12)

Weeks 0 to 1: (Initial PT evaluation to be scheduled within 2 weeks of surgery date)

Goals:

- Weight-bearing: TTWB
- Brace use: locked in full extension (-10° on brace) at all times, including ambulation and sleep
- Pain and effusion management
- Achieve and maintain full knee extension ROM
- Initiate knee flexion ROM
- Restore optimal patella mobility
- Restore quadriceps muscle activation and strength
- Initiate and progress proximal strengthening

Interventions:

- Effusion management (elevation, cryotherapy, compression, ankle pumps)
- PROM/Flexibility:
 - CPM machine if provided (start at 0-30° and increase 10° daily, within ROM restrictions)
 - Prone hangs and/or Extension with heel prop
 - Wall slides and/or Heel slides
 - Seated active assisted knee flexion (meniscus repair: no active hamstring with knee flexion stretches)
 - Hamstring/Calf stretches (non-weight bearing)
- Patella mobilization (all directions as needed)

- Quadriceps setting
- NMES/FES to quadriceps
 - Suggested settings: 20-50 sec OFF, 10 sec ON, 2 sec RAMP, 10-15 mins total, 75 Hz pulse rate, 400 μ sec pulse width, symmetrical waveform
 - Achieve an amplitude (in mA) for strong muscle contraction
- SLR x4 with brace locked in extension (flexion, abduction, adduction, extension)
- Daily home exercise program
 - Include home NMES device 2-3 times per day (**until no quad lag present**)

Weeks 2 to 4:

Goals:

- Weight-bearing: TTWB \rightarrow WBAT (continue crutch / assistive device use as needed)
- Brace Use: brace on and locked in full extension at all times including ambulation and sleep
- Minimize pain and effusion
- Maintain full knee extension ROM
- Progress knee flexion ROM
 - Achieve 90° by end of week 2
 - Achieve 120° by end of week 4
- Emphasize involved quadriceps activation
- Progress involved lower extremity/ proximal strength and core/trunk muscle activation
- Initiate proprioception/balance activities

Interventions (in addition to those listed in previous weeks):

- Gait training
- Scar mobilization/massage
- Initiate stationary bike as able for mobility
- Partial-squats (0-60°)
- Leg press (0-60°)
- Step-ups
- Core, hip and ankle strengthening
- Balance/proprioception activities

Weeks 4 to 12:

Goals:

- Normalize gait
 - **At week 4:** Unlock post-op brace for ambulation (start with 30°, gradually increase) if able to perform SLR without quadriceps lag (10 repetitions)
 - Discontinue use of brace at night if able to achieve and maintain full extension
 - Wean from and discontinue post-op brace if criteria met:
 - Knee flexion ROM \geq 100°
 - Perform three single-leg squats to 30° on involved side with proper frontal plane control
- Restore full knee ROM
- Emphasize involved quadriceps strengthening
- Progress involved lower extremity/ proximal strength and core/trunk stabilization
- Improve neuromuscular control, proprioception/balance and muscular endurance exercises
- Improve cardiovascular conditioning
- **May initiate and gradually increase open chain knee extension from 90-45° at weeks 6 and through full range at week 10**

Interventions: (in addition to those listed in previous weeks):

- Gait training (at week 4 during supervised physical therapy may WBAT without brace)
- Functional Strengthening:

- Bilateral → unilateral squats (to 90°) bridges, lunges (multi directional), lateral step-downs, step-ups, deadlifts, single-leg RDL
- Isolated strengthening/Weight machines:
 - Bilateral → unilateral leg press, wall sit, LAQs/knee extension machine (90-45° at week 8, full range at week 12), hamstring curls (week 6 if meniscus repair performed); side steps, retro treadmill pushes
- Balance (progression of surfaces, distractions, and visual input)
- Core stabilization
- Cardiovascular endurance: Stationary bike, elliptical, Stairmaster, and fast paced walking
- Daily home exercise program

CRITERIA TO ADVANCE – 3-month assessment

- **Surgeon clearance** (assessment to be completed at CHOP sports PT location prior to surgeon office visit)
- **Full knee ROM**
- **Minimal effusion**
- **Isokinetic strength testing** - Quadriceps and hamstring peak torque and total work $\leq 25\%$ deficit at 180°/sec
- **Lateral step-down test (Set step height to achieve ~60° knee flexion):** $\leq 3/6$ errors
- **Y balance test (anterior reach only):** ≤ 4 cm difference as compared to uninvolved

Weeks 12 to 16:

Goals:

- Initiate straight ahead running (if above criteria are met) - begin with walk/jog progression
- Initiate double-leg jumping under the guidance of physical therapist
- Emphasize involved quadriceps strengthening
- Normalize hamstring to quadriceps ratio bilaterally (goal is $>60\%$)

Interventions (in addition to those listed in previous weeks):

- Progress mobility, strength, endurance, neuromuscular control, and proprioception/balance as indicated
- Running progression
 - Start with a level surface
 - Focus on a pain free and symmetrical gait pattern
- Plyometric progression
 - Begin with double-leg jumping, focusing on soft/symmetrical landings
 - Progress double-leg jumps (height/distance, multiple jumps in same direction, varying surfaces, jumping over/onto objects)
- Daily home exercise program

Months 4 to 6:

Goals:

- Gradual progression to lateral running/agility activities (pain free and appropriate quality of movement)
- Gradual plyometric progression from double-leg to single-leg jumping (pain free and appropriate quality of movement)
- Improve cardiovascular endurance to age and activity appropriate level

Interventions: (in addition to those listed in previous weeks):

- Continue to progress strength, endurance, neuromuscular control, and proprioception/balance as indicated
- Plyometric progression
 - Progress double-leg jumps (height / distance, multiple jumps in same direction, varying surfaces, hopping over/onto objects)
 - Progress to single-leg jumping once patient demonstrates normal and symmetrical neuromuscular control with all double-leg jumping and single-leg squats (progress to multi directional when appropriate)

- High intensity aerobic/anaerobic training (progress resistance, speed, time)
- Daily home exercise program

CRITERIA TO ADVANCE – 6 month assessment

- **Surgeon clearance** (assessment to be completed at CHOP sports PT location prior to surgeon office visit)
- **No pain or swelling in the involved knee**
- **Isokinetic strength testing:** Quadriceps and hamstring peak torque and total work $\leq 15\%$ deficit at $180^\circ/\text{sec}$
- **Lateral step-down test (Set step height to achieve $\sim 60^\circ$ knee flexion):** $\leq 1/6$ errors
- **Y balance test (all directions):**
 - Composite score $\geq 90\%$
 - ≤ 4 cm difference for anterior reach, ≤ 6 cm difference for posteromedial and posterolateral reach as compared to uninjured limb
- **Functional hop testing battery:** $\geq 85\%$ limb symmetry, pain free and good neuromuscular control
 - Single hop for distance
 - Triple hop for distance
 - Crossover triple hop for distance
 - Timed 6 meter hop
 - Unilateral vertical jump for height
- **Drop vertical jump using Landing Error Scoring System (LESS):** < 4 errors

Months 6 to 9:

Goals:

- Initiate sport specific agility/pivoting drills
- Promote sport specific fitness
- Improve muscular strength, power, and endurance
- Improve neuromuscular control and dynamic stability
- Prepare athlete for return to sport progression

Interventions (in addition to those listed in previous weeks):

- Education of lower extremity injury prevention program
- Emphasize symmetrical movement pattern/weight acceptance, and good neuromuscular control during all exercises, including plyometric and agility training
- Controlled sport specific agilities and sport specific drills with equipment (progressing to different planes and changes in direction, non-contact activities)
- Focus on demonstrating good tolerance for individual non-contact sport specific activities without knee pain/effusion, perceived instability, or asymmetrical movement patterns

CRITERIA TO ADVANCE – 9 to 12 month assessment/return to sport criteria

- **Surgeon clearance** (assessment to be completed at CHOP sports PT location prior to surgeon office visit)
- **No pain or swelling in the involved knee**
- **Isokinetic strength testing:** Quadriceps and hamstring peak torque and total work $\leq 10\%$ deficit at $180^\circ/\text{sec}$
- **Lateral step-down test (Set step height to achieve $\sim 60^\circ$ knee flexion):** $\leq 1/6$ errors
- **Y balance test (all directions):**
 - Composite score $\geq 90\%$
 - ≤ 4 cm difference for anterior reach, ≤ 6 cm difference for posteromedial and posterolateral reach as compared to uninvolved limb
- **Functional hop testing battery:** $\geq 90\%$ limb symmetry, pain free and good neuromuscular control
 - Single hop for distance
 - Triple hop for distance
 - Crossover triple hop for distance
 - Timed 6 meter hop
 - Unilateral vertical jump for height
- **Drop vertical jump using Landing Error Scoring System (LESS):** < 2 errors
- **Tuck jump:** < 6 errors (if patient age and skill level appropriate)

Once return to sport criteria are met, the patient will be advised to follow a specific and gradual return to sport progression program which will be provided by surgeon or physical therapist.

Months 9 to 12:

- If all criteria are not met, surgeon/physical therapist will make recommendations for retesting on an individual basis.

Interventions (in addition to those listed in previous weeks):

- Issue CHOP Return to Sport Progression, injury prevention program/final home exercise program

Sports Medicine and Performance Center at the Children's Hospital of Philadelphia

Specialty Care Center in King of Prussia
550 South Goddard Blvd
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215-590-6919

Specialty Care Center in Chalfont
500 W Butler Pike
Chalfont, PA 18914
215-590-6930

Buerger Center for Advance Pediatric Care
3500 Civic Center Boulevard
Philadelphia, PA 19104
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Specialty Care at Virtua
200 Bowman Dr. Suite D-260
Voorhees, NJ 08043
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This protocol is designed to be administered by a licensed physical therapist and/or certified athletic trainer. Please do not hesitate to contact our office should you have any questions concerning the rehabilitation process.