Anterior Cruciate Ligament Rehabilitation

Rehab Summit
Omni Orlando Resort at ChampionsGate
Speaker: Terry Trundle, PTA, ATC, LAT
ACL – Graft Selection

1. Autograft
   Bone-Patella Tendon – Bone
   Hamstrings: Semitendinosus – gracilis

2. Allograft
   Bone-Tendon-Bone
   Achilles Tendon with bone
   Anterior Tibialis

3. Contra-Lateral Transplant

Coocaro J, Wilmarth MA. Use of an Accelerated ACL Rehabilitation Program For Patients with ACL Reconstruction Using an Anterior Tibialis Allograft: A Case Report. Orthopedic Practice. 2006 18(3); 20-25
Phases of ACL Rehab

- I Pre-Functional
- II Return to Function
- III Return to Activity
ACL: Pre-Functional Phase I

- Early motion – full passive extension
- Leg Control – Extension mobilization
- Pre-functional Recruitment i.e. co-contraction
- Normal Patella Mobility
- Normal Gait – No Flexed Knee Ambulation
- Begin Core Stabilization
- Closed Kinetic Chain (Progression)
- Balance – Proprioception
- Hamstrings Strengthening (Eccentric)

Core Stabilization

PHASE I

• Multi-directional hip strengthening – Standing SLR X 4

• Bridging

• Swiss ball – Assisted to unassisted Positional Extension-Quad sets

• Seated on ball leg raises

Hamstrings - Revisited

• Based on EMG studies
  – Hamstrings are more active at the hip during forward and backward walking, running and cycling
• Most hamstring injuries occur during the late swing phase of running
• Hamstrings create a posterior directed force on the tibia when the flexion angle is 30° or greater
• Hamstrings function as an eccentric control of hip flexion

Functional Phase II

EXERCISES

• Advanced core stabilization – Hamstrings – Bridge Roll
• P.R.E. hamstrings and quadriceps: short arc range of 90° - 45°, Mini-squats, lunges; lateral and retro step-ups
  • Unilateral wall slides
• Leg press (double and Single) – total gym
• Total leg strengthening including hip and ankle
• Closed chain progression: balance vectors
• Isokinetics if available – high speed training
• Retro treadmill – Elliptical – Retro stepper
• Single leg proprioception – uneven surface

Anterior Translation - ATT

- Least Amount of ATT – 75 Deg. Knee Flexion
- Maximum Amount of ATT 45 – 15 Deg. Flexion
  (Based on Maximum Isometric Quadriceps Contraction)

Exercises that are high in Co-Contraction

• Squats 0° - 30°
• Lateral Lunges
• Balances on uneven surfaces
• Slide board – Fitter
• High speed Isokinetics
Quadriceps – Best Exercises

- Squat beyond 60°
- Leg Press 45° - 100°
- Single Leg Squat
- Wall Slide
- Leg Extension 60° - 0°
- Lateral Step-ups – Quad dominant 8:1 Q/H

Reference:
K. Wilk – AJSM – 1996, Follow-up Presentation APTA
PT 2005, Boston, MA
Quick Summary on Quadriceps Training

• Level One: Low Demand
  – Mini squats series

• Level Two: Moderate Demand
  – Lateral step-ups
  – Leg press 45° and higher

• Level Three: High Demand
  – Squats with increased flexion moments
    Add wide stance
Open- or Closed-Kinetic Chain Exercises After Anterior Cruciate Ligament Reconstruction?

- OKC and CKC Exercises both produce strains on the ACL in terminal extension
- OKC with increase of resistance does increase ACL strain
- CKC does not increase the ACL strain with increase load

Clinical Application of the Research

• OKC short arc flexion moment angle continues to be suggested (90° – 40°)

• Increase external compression (weights) with increase strain on the ACL toward extension

• Early use of CKC is still recommended
ACL: Return to Activity Phase III

- Preturbation Training
- Total Leg Strengthening
- Plyometric Activity – double to single leg
- Sports specific training

FUNCTIONAL LOWER EXTREMITY TESTING

• Balance testing – eyes open and closed
• Balance vector testing
• Leg press test
• Isolated strength assessment (Isotonic vs. Isokinetic)
• Return to Sports – Functional Testing
  • Jump test – Double leg
  • Hop test – Time and distance – Single leg

Reference: Reid A, Birmingham TB, Stratford PW, Alcock GK, Griffin RJ. Hop Testing Provides a Reliable and Valid Outcome Measure During Rehabilitation After Anterior Cruciate Ligament Reconstruction. Phys Ther (87) 337-349; 2007
Closed Kinetic Chain Clinical Progression Lower Extremity

Pre-Plyometrics

• Balance activities with eyes closed (30 sec)
• Slide board (LMT)
• Continue selected single leg unlevel balance activities – Squat Control (30 sec)
• Lunges with weights

Plyometric Training

Progressive in nature
- Increased number of exercises
- Increase repetitions and sets
- Decrease rest periods
  - Straight jumps -> Sagittal
  - Lateral jumps -> Frontal
  - Combination -> Transverse
- Frequency – three times a week
- Intensity – double leg jumps to single leg jumps
- Low intensity – 100 - 200 fast contacts
- Moderate intensity – 200 - 400 fast contacts
- High intensity – 400 – 600 fast contacts
## ATHLETIC REHAB INSTITUTE

### FUNCTIONAL PROGRESSION

<table>
<thead>
<tr>
<th>Program</th>
<th>Duration</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk Program</td>
<td>20 Minutes</td>
<td>Treadmill-Retro (Backwards)</td>
</tr>
<tr>
<td>Jog Program</td>
<td>Goal 10-15 Minutes</td>
<td>Mix of Retro and Forward</td>
</tr>
<tr>
<td>Running Program</td>
<td>Straight Running 3-5 miles at 7/8 min/mile on track</td>
<td>Goal: increase to sprint (Add any equipment once patient can sprint)</td>
</tr>
</tbody>
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[www.kneeman.net](http://www.kneeman.net)
Closed Kinetic Chain Clinical Progression Lower Extremity

Return to Sports – Agility Drills
• Box Runs
• Lateral Running – Carioca
• Retro Sprinting
• Figure Eight – Lateral Cut
• Vertical Jumps – Plyometrics (Advanced)

What changes the protocol?

• Meniscal Repair - Transplantation
Meniscal Repair - Transplantation

• Weight Bearing Precautions

• Protective Active Hamstrings
  – Posterior Medial Horn repair

• Delayed Closed Kinetic Chain activity