Platforms

Do Recommended Return to Sports Criteria predict Successful Sports Participation in Young Athletes after ACL Reconstruction? (Laura C. Schmitt, Matthew Ithurburn)

Does Timing of Neuromuscular Training Affect Kinesiophobia, Knee Function, and Return to Sport Outcomes? (Celeste Dix, Lynn Snyder-Mackler)

The Impact of Quadriceps Strength Symmetry at Return-to-Sport on Longitudinal Function in Young Athletes after ACL Reconstruction (Alex Altenburger)

Psychological Factors are Related to Symmetry after ACL Reconstruction (Ryan Zarzycki)

Case Study

Soccer player attempting to return to sport after ACL Reconstruction

Point/Counterpoint: Rehabilitation after ACL Reconstruction

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“Accelerated” Rehabilitation after ACL Reconstruction

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I. Immediate Post-Operative Rehabilitation Considerations
   A. Control pain & swelling
   B. Restore full passive knee extension symmetrical to non-involved knee
   C. Re-establish quadriceps control
   D. Restore patellar mobility
   E. Gradually improve knee flexion
   F. Restore normal ambulation

II. Weight Bearing Considerations
   A. Initial ambulation is WBAT with post-operative brace locked in full
      extension for 1st week
   B. Progress to WBAT with brace unlocked during 2nd post-operative week
      (exception is brace remains locked in full extension for 4 to 6 weeks
      following meniscus repair)
   C. Criteria for discontinuing use of crutches
      1. No/minimal pain & swelling (“quiet knee”)
      2. Full knee extension without extensor lag
      3. 90 to 100° knee flexion
      4. Able to ambulate with normal “heel-toe” gait without assistive devices

III. ROM Considerations
   A. Critical milestones for ROM
      1. Full passive and active extension symmetrical to non-involved knee
         within 1 week post-op
      2. 90 to 100 degrees of flexion within 2 weeks (flexion limited to 90° for 4
         to 6 weeks following meniscus repair)
      3. Full flexion by 8 weeks
   B. Initial ROM activities
      1. Passive knee extension (prone hangs)
      2. Hamstring/calf stretch
      3. Active-assisted & active knee flexion
IV. Quadriceps and Hamstring Exercises
   A. Initial quadriceps exercises include:
      1. Quad sets & straight leg raises
      2. Mini squats & wall slides
      3. Step-ups
      4. Open chain knee extension from 90 to 60° with cuff weights (begin once active flexion greater than 90 to 100°)
   B. Initial hamstring exercises (delayed for 4 – 6 weeks following autograft hamstring harvest)
      1. Isometric hamstring sets
      2. Prone & standing knee flexion – 0 to 90° with cuff weights
   C. Later stage quadriceps & hamstring exercises
      1. Open chain knee extension
         a. Limit to 90 – 60° for 6 weeks
         b. 90 – 45° after 6 weeks
         c. Full arc after 3 months
      2. Open chain knee flexion
      3. Close chain exercises – leg press, squats

V. Trunk & Hip Abductor & External Rotator Muscles

VI. Proprioception & Dynamic Stability
   A. Standing balance progression
   B. Anterior-posterior & medial-lateral roller board perturbations
   C. Tilt board perturbations

VII. Return to Sports
   A. Factors to Consider
      1. Time/graft healing
         a. Phases include:
            (1) synovial envelopment
            (2) revascularization, cellular proliferation & collagen formation
            (3) maturation and remodeling
         b. Time frame not well known in humans and likely highly variable between individuals
      2. MRI evidence of graft healing
         a. Signal intensity
         b. UTE T2* relaxation time
      3. Bone plug/soft tissue healing in bone tunnels likely longer than expected (Tashman & Harner 2014)
   B. Functional Progression
      1. Walking
      2. Running
3. Low-level agility drills
4. Jumping (2 legs)
5. Cutting, pivoting, hopping (1 leg)
6. Sprinting
7. Return to practice
8. Return to games/competition

C. Graft Considerations & Return to Sports - Generalizations

<table>
<thead>
<tr>
<th>Graft Type</th>
<th>Running</th>
<th>Low-Level Agility</th>
<th>Jumping</th>
<th>Cutting, Pivoting &amp; Hopping</th>
<th>Return to Sports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autograft BPTB</td>
<td>4 months</td>
<td>5 months</td>
<td>7 months</td>
<td>8 months</td>
<td>9 months</td>
</tr>
<tr>
<td>Autograft Hamstring/Quad</td>
<td>5 months</td>
<td>6 months</td>
<td>8 months</td>
<td>9 months</td>
<td>10 months</td>
</tr>
<tr>
<td>Allograft BPTB</td>
<td>6 months</td>
<td>7 months</td>
<td>9 months</td>
<td>10 months</td>
<td>12 months</td>
</tr>
<tr>
<td>Soft Tissue Allograft</td>
<td>7 months</td>
<td>8 months</td>
<td>10 months</td>
<td>11 months</td>
<td>&gt;12 months</td>
</tr>
</tbody>
</table>

D. Testing Criteria for Progression of Functional Training
1. Neuromuscular control
   a. Single leg squat/step up test
   b. Step & hold test
2. Quadriceps strength
   a. Isometric or isokinetic strength test
   b. Repetition maximum test
3. Functional testing & performance
   a. Hop tests
   b. Running/agility tests
   c. Successful performance of preliminary functional activities
4. Absence of symptoms
   a. Pain (soreness rules)
   b. Swelling (sweep test)
   c. Instability
E. Criterion Based Progression for Functional Training and Return to Sports

<table>
<thead>
<tr>
<th>Time Post-Op</th>
<th>Running</th>
<th>Low-Level Agility</th>
<th>Jumping</th>
<th>Cutting, Pivoting &amp; Hopping</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6 months</td>
<td>10 times to 45°</td>
<td>10 times to 45° with 75% added weight</td>
<td>10 times to 60° with 85% added weight</td>
<td>10 times to 60° with 90% added weight</td>
</tr>
<tr>
<td>5 - 7 months</td>
<td>10 times to 45°</td>
<td>10 times to 45° with 75% added weight</td>
<td>10 times to 60° with 85% added weight</td>
<td>10 times to 60° with 90% added weight</td>
</tr>
<tr>
<td>7 - 9 months</td>
<td>10 times to 45°</td>
<td>10 times to 45° with 75% added weight</td>
<td>10 times to 60° with 85% added weight</td>
<td>10 times to 60° with 90% added weight</td>
</tr>
<tr>
<td>8 - 10 months</td>
<td>10 times to 45°</td>
<td>10 times to 45° with 75% added weight</td>
<td>10 times to 60° with 85% added weight</td>
<td>10 times to 60° with 90% added weight</td>
</tr>
</tbody>
</table>

Quadriceps Strength

<table>
<thead>
<tr>
<th>Quadriceps Strength</th>
<th>Time Post-Op</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 80%</td>
<td>4-6 months</td>
</tr>
<tr>
<td>≥ 85%</td>
<td>5 - 7 months</td>
</tr>
<tr>
<td>≥ 85%</td>
<td>7 - 9 months</td>
</tr>
<tr>
<td>≥ 90%</td>
<td>8 - 10 months</td>
</tr>
</tbody>
</table>

Functional Performance

<table>
<thead>
<tr>
<th>Functional Performance</th>
<th>Running</th>
<th>Jumping</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 minutes fast walking</td>
<td>Running 1-2 miles</td>
<td>No compensati on with full effort agility</td>
</tr>
</tbody>
</table>

References:


I. Introduction: Regardless of what we are doing with ACL Prevention and Rehabilitation, it’s not working very well!

II. Epidemiological incidence of ACL injuries seems to be increasing, rather than decreasing even with all the various ACL prevention programs (Medline search-12/1/15: 18,865)

III. Regardless of the myriad of ACL rehabilitation programs that are described, and everyone gets all their patients better, the literature does not support the great outcomes many try to describe (Medline search-12/1/15:2,893)

IV. Most patients that are discharged from physical therapy, still have significant residual deficits in their quadriceps which also translates into functional deficits as well (Medline search-12/1/15: 92)

V. Many patients discharged back to activity, have a re-injury of the same knee or the contralateral knee (Medline search-12/1/15: 18)

VI. Many patients that are returned back to sports cannot return back to their previous level of sports (Medline search-12/1/15: 652)

VII. Many patients, even after their best surgery and best rehabilitation, still have early onset osteoarthritic changes compared to the contralateral knee and a matched cohort (Medline search-12/1/15: 1,851)

VIII. So what do we need to do in the rehabilitation of patients following ACL injuries? (Medline search-12/1/15:845)

IX. Non-operative treatment for the “copers” (Medline search-12/1/15: 49)

X. Instead of accelerating the rehabilitation to get patients back to activity quicker (especially to beat the competitive clinic down the street of to keep up with the Jones’)(what some very high visibility clinics promote as their outcomes), perhaps we need to slow down the rehabilitation and discharge to let the subjective, objective, and functional tests, and the patient’s biology (Medline search-12/1/15:117)
XI. Perhaps we need to evaluate the patient’s biology more effectively before we discharge them and return them back to activity (Medline search-12/1/15:121)

XII. Perhaps we need to evaluate the rehabilitation programs to regain the power of the quadriceps. It is obvious that all the “hyped” closed kinetic chain and functional rehabilitation programs haven’t done the job! (Medline search-12/1/15:14/39/65/674)

XIII. Perhaps we need to go back to the basics: Is it time to go back to the open kinetic chain rehabilitation techniques to regain the isolated power of the quadriceps? (Medline search-12/1/15:53)

XIV. How about TLS establish 40 years ago? Today's buzzword is regional interdependency!

XV. What does the research demonstrate about using the integrated approach of OKC and CKC exercises in a rehabilitation program and the outcomes? (Medline search-12/1/15:17)

XVI. Rehabilitation Revolution: What should we be doing???? (Medline search-12/1/15:0)

XVII. References:

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