Integration of Strength & Conditioning to Rehabilitation for Lower Extremity Injuries

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Objectives

Upon completion of this workshop, the participants will be able to:

- Identify and demonstrate movements and techniques that are critical to the development of a comprehensive lower extremity RTP protocol.
- Adequately assess and correct movement and technique of a patient undergoing lower extremity rehabilitation.
- Design a long-term lower extremity rehabilitation plan integrating appropriate strength and conditioning principles and functional exercises.
What is the goal? Why?

- Athlete / patient’s goals
- Long term
- For the month
- For the week
- For the session
- Of the specific exercise
Functional Anatomy

- Central Nervous System designed to perform integrated movement patterns through muscle synergies in all 3 planes (not isolated)

- Systems vs. segmented body parts
  - Local muscular system (stabilization) - e.g. core = transverse abdominus, multifidi, internal oblique, diaphragm, pelvic floor muscles
  - Global muscular systems (movement) - CNS optimizes muscle synergies
    - Deep Longitudinal System
    - Posterior Oblique System
    - Anterior Oblique System
    - Lateral Subsystem
Deep Longitudinal System
Posterior Oblique System
Anterior Oblique System
Lateral Subsystem
Phases of Rehabilitation  
(Reiman & Lorenz)

**Immediate (Inflammation)**
- **Goals:** Protect integrity of tissue, restoration of ROM, decrease pain and inflammation
- **Criteria for Progression:** Minimal pain with exercises, ROM $\geq 75\%$ unaffected side, proper muscle firing patterns

**Intermediate (Repair)**
- **Goals:** Continued protection, restoration of function of body part/region
- **Criteria for Progression:** Close to full ROM/muscle length/joint play, 60\% strength of primary involved musculature compared to unaffected side

**Advanced (Remodeling)**
- **Goals:** Restoration of muscle endurance and strength, neuromuscular control/balance/proprioception
- **Criteria for Progression:** Strength $> 70$-80\% of unaffected side, demonstration of proper form of initial agility drills, plyometrics

**Return to Sport**
- **Goals:** Return to previous function level (or better) in athlete’s sport, prevent re-injury
- **Criteria for Clearance:** Usually strength $>$90\% of unaffected side, demonstration of symmetry and no avoidance in sport-specific activities
The Rehabilitation Program

- Warm up
- “Activation”
- “Rehab Exercises”
- Balance
- Core
- “Cardio”
- Speed, Agility, Quickness
- Upper Body
- Return to Sport

Sample Program

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>R</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm Up</td>
<td>Bike 10’, foam roll</td>
<td>Row 3’, foam roll</td>
<td>Dynamic warm up</td>
<td>Bike 10’, foam roll</td>
<td>Row 5’, foam roll</td>
</tr>
<tr>
<td>Activation</td>
<td>Clam shells; Deadbugs</td>
<td>SL Supine bridge, Superman</td>
<td>Glute bridge, Palloff press</td>
<td>Band good mornings, Hamstring pull downs</td>
<td></td>
</tr>
<tr>
<td>DL Push</td>
<td>Front Squat (strength)</td>
<td>Deadlift (strength)</td>
<td>Reverse Lunge (hypertrophy)</td>
<td>Hamstring curls (hypertrophy)</td>
<td></td>
</tr>
<tr>
<td>SL Push</td>
<td>Step Downs (supplement strength)</td>
<td>Deadlift (strength)</td>
<td>Reverse Lunge (hypertrophy)</td>
<td>Hamstring curls (hypertrophy)</td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>½ kneeling MB throws</td>
<td>Kettle bell swings</td>
<td>Snap downs</td>
<td>Kettle bell swings</td>
<td></td>
</tr>
<tr>
<td>Core</td>
<td>Side planks</td>
<td>Landmine rotations</td>
<td>Hanging knee raises</td>
<td>MB Core Circuit (on sideline at pain)</td>
<td></td>
</tr>
<tr>
<td>Balance</td>
<td>SL - Airex Pad</td>
<td>SL Stick Reach Across</td>
<td>SL - Pod deck</td>
<td>SL - Pod deck</td>
<td>Balance obstacle course</td>
</tr>
<tr>
<td>Cardio</td>
<td>Upper body cardio circuit: 5 pull ups, 10 push ups, 15 walking burpees, 5 rounds, rest 1:00</td>
<td>Bike sprints (20), 1:00 active rest x5 sets, rest 1:00</td>
<td>Swim workout (Shallow)</td>
<td>MB Core Circuit (on sideline at pain)</td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td>...</td>
<td>Upper body lift</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
Warm Up

- Get blood flowing - bike, elliptical, rower, dynamic movements
- Mobilization - foam roll, manual therapy (soft tissue), joint mobilizations

**Goal**: Decrease pain to be able to complete session
“Activation”

- Breathing!, core setting, glutes - think stability
  - Deadbugs / Anti-Rotation Deadbugs
  - Bird-Dogs
  - Palloff press
  - Clam shells
  - Glute bridge variations
  - Hamstring bridge variations
  - Monster walks

- Can be in beginning or superset with functional movements
- “Remember the feeling of this movement”
Rehab is strength training.
Strength training is rehab.
Progressive Overload

- **NSCA**: “The systematic increase in training frequency, volume, and intensity in various combinations.”

- **NASM**: “Implies that there must be a training stimulus provided that exceeds the current capabilities of the human movement system to elicit the optimal physical, physiological and performance adaptations.

**SAID Principle** - Specific Adaptations to Imposed Demands - the body will adapt to the stresses placed upon it.
Program Variables

- Reps
- Sets
- Training intensity
- Tempo
- Training volume
- Rest interval
- Frequency
- Duration
- Exercise selection

Strength Training Phases
- Stabilization/Endurance
- Hypertrophy
- Strength
- Power

Rehab Phases
- Immediate
- Intermediate
- Advanced
### Program Variables

<table>
<thead>
<tr>
<th>Phase</th>
<th>Reps</th>
<th>Sets</th>
<th>Intensity</th>
<th>Tempo</th>
<th>Rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stabilization/Endurance</td>
<td>12-20</td>
<td>1-3</td>
<td>50-70%</td>
<td>Slow (4/2/1)</td>
<td>:30-:60</td>
</tr>
<tr>
<td>Hypertrophy</td>
<td>6-12</td>
<td>3-5</td>
<td>75-85%</td>
<td>Moderate (2/0/2)</td>
<td>:45-:90</td>
</tr>
<tr>
<td>Maximal Strength</td>
<td>1-5</td>
<td>4-6</td>
<td>85-100%</td>
<td>Moderate/Fast</td>
<td>3:00-5:00</td>
</tr>
<tr>
<td>Power</td>
<td>1-10</td>
<td>3-6</td>
<td>30-45%</td>
<td>Fast/Explosive</td>
<td>3:00-5:00</td>
</tr>
</tbody>
</table>

- **Training volume** - amount of work performed in given time period (day, week, month, cycle, year) (includes non-AT room physical activity)
- **Frequency** - number of sessions per week (includes non-AT room physical activity)
- **Duration** - time of one session or time spent in one phase (most adaptations to stimulus will be in 4 weeks)
- **Exercise Selection** - single joint <-> multi-joint <-> total body
Exercise Selection

- Push
- Pull
- Double Leg
- Single Leg
- Open Kinetic Chain (OKC)
- Closed Kinetic Chain (CKC)
- Power
- Multi-Directional
Exercise Selection

- **Push**
  - Squat
  - Lunge
  - Leg press

- **Pull**
  - Deadlift
  - RDL
  - Hamstring curl

- **Double Leg**
  - Squat
  - Deadlift

- **Single Leg**
  - Lunge
  - Step up
  - Staggered stance RDL

- **Open Kinetic Chain (OKC)**
  - Leg extension
  - Hamstring curl

- **Closed Kinetic Chain (CKC)**
  - Squat
  - Deadlift

- **Power**
  - Jumps
  - Medicine ball throws
  - Olympic lifts

- **Multi-Directional**
  - Lateral lunge
  - 90 degree step up
  - Sport specific

*Supersets / Compound sets*
Balance

- Early rehab phases - in beginning
- Intermediate/Advanced phases - challenge when fatigued
- Get creative, incorporate sports, competition
Core

- Anti-Rotation/Stiffness
- Rotation
- Dynamic Rotation
- Stability
- Dynamic Stability
- Functional
Cardiorespiratory

2. Interval training - more oxygen that is consumed, the less reliant on anaerobic breakdown therefore less lactic acid production and more efficient lactic acid removal = better recovery
3. Train all systems.
4. Progress to intervals based on athlete sport.
   
   e.g. mile test- have athlete do 8 x200m runs, then add speed with whatever rest they need, over time, decrease rest times, increase running distances until they get to 1x1600m

> Get creative with “cardio”- doesn’t have to be bike, rowing, elliptical
Speed, Agility, Quickness

- Focus on technique
- Make connection between strengthening and SAQ movements (e.g. hinge, 90 degree step ups)
- Vary distance of sprints
- Ladders, hurdles, zig zags
- Controlled > Reaction > Uncontrolled reaction
Upper Body

- Maintain/build upper body strength
- Continue lifting with team
- Upper body challenges (e.g. pull ups)
Flexibility Training

- Proper flexibility program also requires implementation of a corrective strengthening program to enhance ROM
- Research - Static stretching negatively influences strength. So, stretch at end of session
Return to Sport Activities

- Sport Drills
- Integrate into non-contact practice
- Rehab on side of field during practice
- Team specific running tests

**Integrate sport throughout entire rehab (e.g. seated ball handling drills, single leg balance field hockey pass)**
## Periodization

### Microcycle
- One week
- Alternate push / pull days
- Alternate high impact / low impact
- Active recovery

### Mesocycle
- 1-3 months
- E.g. Rehab protocols
- Stabilization/Endurance > Hypertrophy > Strength > Power
- Immediate > Intermediate > Advanced

### Macrocycle
- Year / Rehab duration

**What is the goal of each cycle?**
Movement Quality

- Explain why you chose an exercise, what muscles he or she should be feeling
- Excellent movement before adding intensity (weight)
- Cues - KISS Principle
  - Core:
    - “Core tight”
    - “Imagine someone is going to punch you in the stomach, that’s how tight your core should be”
    - “Fill your whole cylinder that is your core with air and hold that tight”
  - Hips:
    - “Imagine you tear off two paper towels and you stand with one foot on each, now try to tear them apart” (external rotation)
    - “Like you’re doing a clam shell”
    - “Spread the floor apart”
    - “Knees out”
    - “Squeeze your butt”
Functional Movement Cues

- **Squat**
  - Deep breath in
  - Core tight
  - Feet little wider than your shoulders, slightly turned out
  - Knees out, tear the paper towels
  - Sit your butt back, like port-a-potty
  - Bend your knees
  - Feel whole foot
  - Keep your core tight
  - Keep driving knees out as stand back up
Deadlift / RDL (Romanian Deadlift)

- Deep breath in
- Core tight
- Feet just under your shoulders, slightly turned out
- Knees out, tear the paper towels
- Knees “unlocked”
- Reach your butt back, like trying to shut door
- Chest up
- Feel whole foot
- Keep your core tight
- Go down until you feel stretch in hamstrings
- Push hips forward back to standing, squeeze butt at top
Functional Movement Cues

- Other?
- Deep breath in
Assessments

- Strength testing (isokinetic, manual muscle)
- Hop Tests (Single- forward, lateral, Triple, 6m timed, Crossover)
- Y balance
- Lateral Step Down
- Pro Agility
Interdisciplinary Approach

- Patient-centered care
  - AT usually first to care, last one there
  - Coordinator of care
  - Communication with:
    - Patient / parents, family
    - Physician (EPIC)
    - Physical therapist(s) (EPIC)
    - Sports performance coaches (Team Buildr)
    - Behavioral health specialists
    - Nutrition specialists
Psychosocial Considerations

- Biopsychosocial model
- Emotion-focused coping strategies
  - Diaphragmatic breathing techniques
  - Muscle relaxation techniques
  - Facilitating social support
  - Mental imagery
  - Cognitive restructuring
- Problem-focused coping strategies
  - Patient education
  - Goal setting
  - Challenging rehabilitation sessions
  - Peer modeling
- Patient Reported Outcomes Measures (PROMs)
To wrap it up...

- Is your program progressive?
- Is it systematic?
- Is it sports-specific?
- Is it integrated?
- Is it proprioceptively challenging?
- Is it based on functional anatomy principles?

- Multiplanar
- Multidimensional
- Use entire muscle-contraction spectrum
- Use the entire contraction-velocity spectrum
- Manipulate all acute training variables (sets, reps, etc.)
Finally

- Try it yourself!
- Last set, best set
- Adapt and improvise
- Must continue once cleared to return to sport

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References


