Transitioning the Injured Runner Back to the Road and Track
Combined Sections Meeting 2016
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Kari Brown Budde, DPT, SCS
Endurance Athletes Physical Therapy and Sport Performance
Columbus, OH

Paul Drumheller, MPT, OCS, SCS, CSCS
3Dimensional Physical Therapy & Sports Conditioning
Tacoma, WA

Brian J. Eckenrode, PT, DPT, OCS
Assistant Professor
Department of Physical Therapy
Arcadia University
Glenside, PA

Eric Greenberg PT, DPT, SCS, CSCS
Clinical Assistant Professor
Department of Physical Therapy
Stony Brook University
Stony Brook, NY
Disclosures:
Presenters have no financial disclosures.

Learning Objectives:
Upon completion of this session, learners should be able to:
- Describe the differences in biomechanics and intervention techniques between long distance runners and sprinters.
- Design an appropriate rehabilitation plan and return to sport following a running-related injury utilizing current evidence-based practice.
- Examine objective and functional testing criterion to prepare an evidence-based and individualized return-to-running rehabilitation program following injury.
- Understand the differences between distance runners and sprinters in injury patterns and progression back to sport.

Course Description:
Injury rates among runners have been reported to be high especially among those with a prior injury. Rehabilitation of runners often provides a challenge to the practicing physical therapist due to the many factors involved in the recovery. Injuries to the sprinter require additional considerations for the management and recovery in these athletes. The transitional phase back to running can facilitate or hinder recovery and requires a unique expertise and knowledge base regarding specific exercise principles for both the distance runner and sprinter. This session will utilize a case-based format to demonstrate the systematic and criterion-based approach to return patients to running and sprinting. Clinical decisions based upon tissue-healing time frames and objective testing techniques will be discussed to convey these concepts and assist in the demonstration of a safe and appropriate rehabilitation progression. Comparisons and differences will be drawn between both distance runners and sprinters. The format for this session will include lecture and interactive discussions between presenters and attendees.

Timed Outline
00:00-00:05 Introduction/Incidence and associated risk factors
00:05-00:25 Biomechanics of running versus sprinting
00:25-00:50 Recovery and rehabilitation for the runner and sprinter
00:50-01:15 Functional testing and return to running progression based on program design and principals of musculoskeletal tissue loading
01:15-01:40 Differences in training programs for the runner and sprinter
01:40-02:00 Case examples and application of principals/Q&A
I. Introduction
   a. Participation rates
      i. Runners
      ii. Track and Field
      iii. Definitions of Runner Populations (Kluitenberg et al, Sports Med 2015)

<table>
<thead>
<tr>
<th>POPULATION</th>
<th>DEFINITION</th>
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<tbody>
<tr>
<td>Track: Sprinters</td>
<td>Track athletes competing in distances of up to 400m</td>
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<tr>
<td>Track: Middle-Distance</td>
<td>Track athletes competing in distances of 800-3000m</td>
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<tr>
<td>Track: Long-Distance</td>
<td>Track athletes competing in 5000 or 10,000m in races</td>
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<td>Novice Runners</td>
<td>Runners with no regular running within the previous year</td>
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<td>Recreational Runners</td>
<td>Non-competitive runners or runners participating in road races shorter than 10km</td>
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<td>Cross-Country</td>
<td>Runner competing in cross-country races</td>
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<td>Road: Long-Distance</td>
<td>Runners competing in races between 10km and less than a marathon</td>
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<td>Marathon</td>
<td>Runners competing in a marathon</td>
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<tr>
<td>Ultra-Marathon</td>
<td>Runners competing in races longer than a marathon</td>
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b. Injury Rates
   i. Training errors account for 60–70% of all running injuries
   ii. Annual injury incidence between 61% and 76% for track and field
   iii. Injury time-loss and injury specifics
   iv. Sex and injury
      1. Females higher incidence of RRI compared to males
      2. Female track and field athletes
   v. Age and injury
      1. Track and field athletes older than 30 years are at an elevated risk for injuries and time-loss
      2. Physiological changes occur in the aging athlete
II. Biomechanics
   a. Differences between walking and running
      i. Critical velocity at which walking changes to running in normal healthy adults is approximately 2.5 m/s
   b. Kinetics
      i. Vertical ground reaction
         1. Greater impact peak and rate in injured runners
         2. Vertical impact peak lower in runners with midfoot and forefoot strike patterns
   c. Kinematics
      i. Sagittal plane
         1. Normative ROM values
         2. Running vs. Sprinting
         3. Strike pattern
      ii. Frontal plane
         1. Normative ROM values
     iii. Transverse plane
   d. Muscular control and power
      i. Running vs. Sprinting
   e. Speed
      i. Speed = Stride length x Stride frequency
      ii. Sprint model (Hay & Reid, 1988)
         1. Stride length
            a. Take off distance
            b. Flight distance
            c. Landing distance
         2. Stride rate
            a. Ground time
            b. Flight time

III. Other considerations
   a. Sprinter-specific
      i. Curve running
         1. Maximum running speed on a flat curve is significantly slower relative to straight plane running
         2. Attenuation of sprint speed is more pronounced as the radius of curvature is reduced
         3. Biomechanical changes
      ii. Banked tracks
      iii. Starting position
         1. Block start
            a. Tibia angle ~45 degrees
            b. Torso in line with tibia
            c. End of push off torso slightly inclined, tibia perpendicular
         2. Set position
b. Shoewear
   i. Running shoes
      1. Highly variable
   ii. Track spikes
      1. Taper angle
      2. Sprint spikes
      3. Distance spikes

IV. Conclusions
Recovery and rehabilitation for the runner and sprinter

Kari Brown Budde, PT, DPT, SCS
Endurance Athletes Physical Therapy and Sport Performance
Columbus, OH

I. Injuries
   a. Distance Runners
   b. Sprinters

II. Recovery
   a. Time from injury
   b. When to determine need for Rehab vs Recovery

III. Rehabilitation and Intervention
   a. Time from injury
   b. Tissue healing status
   c. Distance – specific

IV. Case
The Transitional Phase: Functional testing and progressive return to running in the rehabilitation of distance runners and sprinters

Eric Greenberg, PT, DPT, SCS, CSCS
Clinical Assistant Professor
Stony Brook University
Stony Brook, NY

I. Determination of readiness to return to running is a blend of time and criterion based measures
   a. Multifactorial Approach
      i. Assist clinical decision making
      ii. Goal development
      iii. Establish trust/limit frustration
      iv. Efficient and Practical
   b. Time based on physiologic tissue healing
      i. Tissue Type
      ii. Location
      iii. Stage of Healing
   c. Demands of Running Activity
      i. Continuum of Demands
      ii. Distance Running: Unilateral control of the body with ability to sustain repetitive, reciprocal loads for long durations at a submaximal intensity
      iii. Sprinting: Unilateral control of the body with ability to sustain high and fast, reciprocal loads for short durations at a maximal intensity
   d. Criterion Based Measures
      i. Subjective reports
      ii. Musculoskeletal Impairments
      iii. Functional Testing

II. Criterion Based Measures for initiating a running program
   a. Subjective Reports
      i. Pain levels
      ii. No locking or instability
      iii. Psychological readiness
   b. ROM/Flexibility
      i. Normalized ROM/flexibility at impaired region
      ii. Distance Runner- Adequate foot attenuation at foot and ankle and kinetic chain
      iii. Sprinter- Proximal Flexibility at hip and pelvis/ full AROM
   c. Muscle Capacity
i. Distance Runner- Frontal and Transverse plane hip control, endurance and strength
ii. Sprinter- Proximal power and limn deceleration
d. Functional Testing:
i. Distance Runner
   1. Static Unilateral control: SLS
   2. Dynamic Unilateral control: timed lateral step down test
   3. Unilateral control with increased loading- multidirectional hopping
ii. Sprinter
   1. Unilateral control at increased swing limb velocities: Swing test
   2. Unilateral Anaerobic power: Unilateral box jump and Hop testing
   3. Tolerate Skipping: A skips and B skips

III. Return to Running programs
   a. Individualized based on athlete’s goals, prior level, time from injury
   b. Allow time for tissue adaptation
      i. Envelope of Function
   c. Examples of different programs
      i. Distance Runner
      ii. Sprinter
   d. Progression based on response to running
      i. Pain Monitoring Model
Differences in training programs for the runner and sprinter

Paul Drumheller, MPT, OCS, SCS, CSCS
3Dimensional Physical Therapy & Sports Conditioning
Tacoma, WA

I. Distance:
   a. Differences between high mileage and cross training (HITT)
   b. Increase strength before adding a lot of miles?
   c. Weight training for distance running
   d. Lactate threshold training
   e. Ways to alter training to decrease ground reactive forces
      i. Increase cadence, Increase trunk lean, Change position of foot at initial
         contact (midfoot to forefoot strike pattern)
   f. Interval training to improve running economy

II. Sprint:
   a. Can’t beat genetics
   b. Train to go fast
   c. Work to rest ratios
   d. Strength before power
   e. Power – Plyometrics
   f. Assisted and resisted running

III. Case Study of minimal but proper training for ½ and full ironman competition.
References


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Wyland TP, Van Dorin JD, Reyes GC. POST-ACTIVATION POTENTATION EFFECTS FROM ACCOMMODATING RESISTANCE COMBINED WITH HEAVY BACK SQUATS ON SHORT SPRINT PERFORMANCE. *Journal of strength and conditioning research/National Strength & Conditioning Association*. 2015. 38.