Running Analysis: Sprint

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Objectives

1. Understand basic sprinting mechanics and utilization of acceleration training in programs
2. Rehabilitation approach to mimic higher level activity and reducing re-injury rate
3. Transition from therapy to optimal human performance

The Lost Art

What is Acceleration

• Definition: Increase in rate of speed
• Physics: the rate of change of velocity per unit of time
  – Newton’s 2 and 3 Laws
    • \( F = ma \)
    • Equal and opposite reaction (horizontal ground force)
• Simple terms: Going from point A to point B as explosive and quickly as possible.

The Performance Pyramid

As described by Greg Cook / Functional Movement Systems

Skill
Sport Specific

Performance
Endurance, Strength, Speed, Power, Agility, Coordination

Movement
Movement Quality Influenced by Velocity and Stability

Force Velocity Curve

- Normal Strength: (Start or Goal)
- Strength Speed: (Low Power Lifts or Power Clean or Pull)
- Speed Strength: (Fast Sprints or Jump Speed)
- ballistic / explosive: (Mobil Tyre or Depth Jump)
- Sprinting
Force Velocity Curve
With Strength Training

Power/Intensity Variation

Energy Systems
- Systems
  - ATP-PC
    - 1 to 10 seconds
  - Anaerobic Glycolysis
    - 30 secs to 1 min
  - Aerobic/Oxidative
    - 2 mins or more
- Varies Intensity
  - Adaptation (Train stimulus, adapt, change stimulus)

Metabolic Stress

Mechanical Stress

Acceleration Mechanics
- Arm action (pinch pennies)
  - Loose
- Leg Drive
  - Piston like
- Angles (body lean)
  - 45 degrees or more
- Weight distribution in the feet
  - Kinesthetic awareness

Positioning
Poor Mechanical Stress
Proper Mechanical Stress
Hamstring Injuries

- Strains account for 12-16%
- A high 22-34% re-injury rate (Morein et al 2015)
- Risk of injury is at its highest in the late swing phase and is higher for the biceps femoris than for the medial hamstrings (Guex et al 2012)
- Hamstring torque increases with increased hip flexion

General Strengthening

- Glute/Back Bridge Series
  - DL/SL/Eccentric
  - PB Hip Ext with Leg Curls DL and SL
- Nordic Hamstring Curls
- Prone Physio-ball (aka hissy fits)
  - higher bicep femoris EMG activity (Tsaklis et al 2015)

Rehab Approach

- Techniques
  - IASTM
  - TPR/ART
  - Supple Leopard (Self myofascial techniques)
- The more you can move from clinician facilitated to athlete facilitated
- Input to the system

Soft Tissue

- Mobility = strength + flexibility
  - Voodoo Bands
  - Super Bands
  - Brettzel Stretch (global mobility)
- Lengthen the tissue to own the new ROM

Stability

- Stability = End Range strengthening
  - Can use core assist such as a kettlebell or bands
  - Can also be bodyweight such as DNS posture exercises
- Goal is to transition through the neurodevelopmental sequence from NWB to WB.
Supine Position

KB Triple Flexion With ASLR

Side-lying Position

Vaso Strap Star Extension

Half Kneel

Half Kneel Lift With Rear Foot Elevated

Single Leg Stance

Single Leg Stance lift With End Range Psoas Activation
Common Mistakes
- Quad dominate
- Forward Trunk Lean

Common Mistakes
- Trunk Flexion
- Trunk Extension

Transition
- Wall Drill
- Versa Climber

Horizontal Ground Force
- Hamstrings and Hip extension play a predominate role in sprinting for force production (Morin et al 2015)
- Fatigue in the hamstrings become limiting factor (Morin et al 2015)
  - Train energy systems
- Force production introduction
  - Low level plyometrics and repeated force.
Force Introduction

Kettlebell Swing

Jump Rope

Sled Work

Single Leg Bounding

Hill Work

Review

• Acceleration is all about:
  – Train to be Human
  – Creating Angles
  – Creating Separation
  – Explosive off the start (Sense of Urgency)

• Intent

References

References


Survival of the Fastest