TECHNICAL
CONSIDERATIONS FOR THE
MEN'S SPRINT HURDLES
OVERVIEW

General Observations
Applied Functional Anatomy
Hurdle Skill Components
Key Performance Indicators
Unfortunately, like in many other endeavors, we too often cling to what we know rather than constantly examine and evaluate what we are doing to get the results we are achieving. This all important self-evaluation enables us to selectively discard ineffective practices and replace them with better ones.

Gary Winckler
.limiting variables

- Height of barriers
  - 42” hurdles
  - Average height of elite hurdler is 5’11-6’1

- Distance to hurdle one & between subsequent hurdles
  - 13.72m/9.14m
  - Not sufficient distance or time to apply large amounts force
    - Average step length during in 1st 10m of 100m sprint....
    - Average stride length at max velocity approx. 2.30m-2.50m....average stride length between hurdles 1.85m
Criteria for Success... Objectives

- Develop highest attainable velocity
  - Poor: 7.69m/s; Ave.: 8.34m/s; Good: 8.99m/s
    (*Elite approx. (9.33 m/s)

- Maintaining highest velocity (rhythm)

- Ability to navigate the ground

- Technical competency
What can we influence...what can we coach

- Max Strength
- Rate of Force Dev.
- Muscle Elasticity
- Leg Stiffness
- Joint Stiffness
- Force application
- Max Velocity
- Proprioception
- Coordination
- Hurdle skill
Applied Functional Anatomy
# Mono & Biarticular Muscles

<table>
<thead>
<tr>
<th>MONOARTICULATING (MA)</th>
<th>BIARTICULATING (BA)</th>
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<tbody>
<tr>
<td>Short head of Bicep Femoris</td>
<td>Psoas Major</td>
</tr>
<tr>
<td>Vastus muscles</td>
<td>Hamstrings</td>
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<tr>
<td>*Gluteus Maximus</td>
<td>Bicep Femoris</td>
</tr>
<tr>
<td>*Tensor Fasciae Latae</td>
<td>Semimembranosus</td>
</tr>
<tr>
<td>Adductors</td>
<td>Semitendinosus</td>
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<td>Soleus</td>
<td>Rectus Femoris</td>
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<td>Gracilis</td>
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<td>Gastrocnemius</td>
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Stability and leverage

Force & work generators

Lose tension in quick movements
High speed movements
Energy Transfer...
Save energy by allowing
concentric work to be
done at one end and
eccentric at another
Transfer energy while
resisting moments
across adjacent joints
(isometric function)
“Effects of timing of
muscle activation on
performance in
human vertical jump”
Navigating the ground
42 Steps....10 hurdles

“Teach landings before take-offs”

Stable yet dynamic
Foot function
- 12 bones, 14 phalanges, 108 ligaments, 20 muscles
- Very little movement outside of the ankle
- Receptors in sole of foot similar in function to that in the hand; provide essential information

“Plantar feedback contributes to the regulation of leg stiffness” Fiolkowski et. al., 2005.
- Tibial nerve block
- Afferent ~ Efferent
- Significant drop in leg stiffness
Spring model
Creating leg & joint stiffness
Spring function
In support phase energy is stored and then released by muscle, tendons & ligaments
Knee Dynamics

Stiffness around joint is significant...will vary throughout stance
Acted on by ankle and hip
Directs force as oppose to generating force
35 muscles originate or end

Energy generators (Glutes)/amplifiers

Relatively limited movement within pelvis

Oscillation & orientation allow for force/energy absorption and distribution

Pelvis stability is paramount for optimum translation of elastic energy into force/movement
Hurdle Skill Components

Application of the sprint model
Take Off & Penultimate
The Pitch
Hurdle Clearance
Interhurdle Sprinting
Application of the Sprint Model
Penultimate Step & Take Off
Penultimate Step & Take Off

Aggressive run at the hurdle
*Pelvic orientation
Minimizing vs. Optimizing ground contact times
Minimizing losses in velocity...”braking”
Maximizing GRF
...Magnitude vs. Direction
Penultimate Step & Take Off
Penultimate Step & Take Off

Active recovery of the thigh of penultimate step
Rapid switch from open chain to closed chain
Transfer of energy via pelvic musculature to take-off leg
Active (force full) extension of contra-lateral (Take off leg) hip
Penultimate Step & Take Off

- Again…teach landings before take-offs
- Effective coordination of dorsi to plantar flexion
- Optimum release of elastic energy
Undesirable model...

...etc...etc...
Encourage large angle of separation between legs
Lead knee is driven up and at the hurdle
Avoid premature termination of take-off (don’t rush the trail leg)
“Lean” at the point of contact…then waist…if necessary
Hurdle Clearance... *The Pitch*
Hurdle Clearance... The Pitch
A management of rotations
Angle of trajectory determined by take off distance relative to COM….& barrier
Facilitated by large hip extension at take off…*Extensor Reflex*
Hurdle Clearance

The body likes to be in balance... *Timing is everything* 

Lead arm... bent or straight? 

Long smaller lever (arm) vs. shorter larger lever (trail leg) 

Trail arm... how does one evaluate it’s effectiveness? How much does it matter? 

How much or how little trunk flexion is necessary for effective flight?
Trunk extension vs. Hip extension

Anticipate the ground

“Delayed” run off

Tension or stiffness in ankle = same result at knee
Step Length vs. Step Frequency

Step management in many ways is intuitive

A skill to be developed i.e., 20-30m fly’s with reduced step length
Interhurdle Sprinting... The Shuffle

1st Step 17% of dist 65% of max. stride
2nd Step 22.5% of dist 85% of max. stride
3rd Step 21% of dist 80% of max. stride

Steps between hurdles are approx. 77% of the ave. stride at Vmax

Interhurdle sprinting very specific skill
Can be impaired by competitive sprinting (ie., Tramel)
Interhurdle Sprinting: Spinal Engine & The Pelvic “Junction”

Pelvis stability not rigidity
“Transverse plane hip oscillation”
Rapid repeated extension & flexion of hips
Elastic capacity of pelvic musculature
Interhurdle Sprinting...
The Shuffle

Stepping down on each contact

Enhanced by a parallel (or close to) lower leg to the track

Increased knee flexion results in casting of the lower leg
Key Performance Indicators (KPI)

1.) Air Time: toe off to touch down

2.) Flight Distance: distance from toe off to touch down

3.) Pelvic Projection: vertical displacement from mid stance to apex

4.) Apex Displacement: distance from hurdle to highest point of flight path.

5.) Hurdle Cycle Split: duration of time between one complete hurdle sequence
Questions for exploration…

Why haven’t we’ve seen the growth similar to that in other sprint events?

Who are great “ground” hurdlers and who are great “air” hurdlers?

Lead arm; what does it do and what characteristics does it require.

Trail arm; what does it do and what characteristics does it require?

Torso in and out of the hurdle and torso on the ground?
Thanks...
Randy Ballard
“Dr.” Andy Eggerth
Carl Valle
Tony Veney
Gary Winckler
...etc...etc...
Thank you...

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Penultimate Step & Take Off

- VIDEO OF TRIPLE JUMP....IF POSSIBLE

A subtle manipulation of forces at take off....

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