

Running for the Juvenile Athlete

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Why talk about running technique at a juvenile athlete conference?

- Running forms the basis of many sports



Why talk about running technique at a juvenile athlete conference?

- Many sports have a focus on sports specific skills and not general movement skills



Why talk about running technique at a juvenile athlete conference?

- Schools make use of coaches who may be experts in their sport, but not necessarily skilled at analysing and optimising movements



Why talk about running technique at a juvenile athlete conference?



- Running is a coordination skill not just a sporting activity
- Training the neuromuscular pathways may give long-term running efficiencies



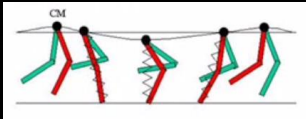
What are we going to talk about?

- What we know (or think we know) about running
- General concepts of running especially focusing on the stance phase and the effect of the swing phase on the stance phase
- Application of this knowledge to the juvenile athlete



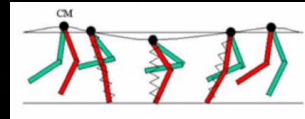
Mass Spring Model of Running

- CNS modifies / coordinates actions in the stance limb so leg behaves like a mechanical spring (Farly et al 1993, Ferris et al 1998)
- Tendons are the springs and muscles adjust the stiffness



Mass Spring Model of Running

- Variable stiffness of the springs allows for adaptation to different running conditions through controlling the vertical excursion of the centre of mass
- An increase in leg stiffness is associated with an increase in running economy

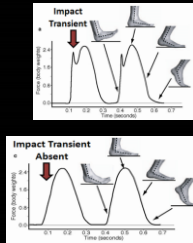


McMahon & Cheng (1990)
Kerdock et al (2002)



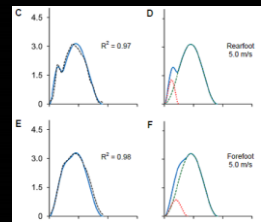
Double Mass Spring Model of Running

- Mass of legs move independently to mass of torso
- Vertical impact forces measured are a sum of the effects of the mass of the leg impacting the ground and the mass of the torso acting on the stance leg (Clark et al, 2014)



Double Mass Spring Model of Running

- Impulse in rear foot strike seems to be related to leg mass impact in front of the centre of mass
- Mid foot strike generally occurs closer to centre of mass than rear foot strike
- Large amount of variability between runners

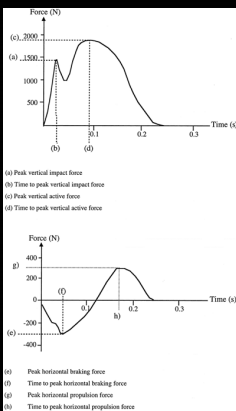


(Clark et al, 2014)



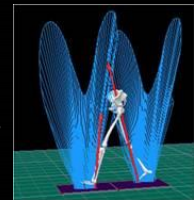
Impact Force of Running

- Impact force has vertical and horizontal components
- Vertical forces typically 5-10x greater
- Generally assumed that vertical forces are therefore most important



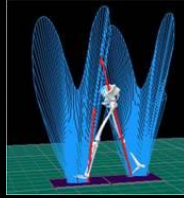
Impact Force of Running

- Very few studies investigating cause and effect of horizontal loading forces
- ? Anatomy is generally handles axial loading very well whereas horizontal impact causes shearing forces which are potentially more damaging (what about torsional forces?)



Impact Force of Running

- Research tends to focus on vertical impact forces
- Shoes and running techniques developed to reduce vertical impact forces
- Little evidence that vertical impact forces are associated with injury other than heel pain and tibial stress fractures



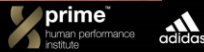
Impact Force of Running

- High braking force showed clear evidence for increasing Achilles injury risk
- High vertical forces showed strong evidence for reduced injury risk
- Theorised that higher vertical force results in a reduction in horizontal force
- Higher vertical force achieved by higher knee lift creating a longer downward drive. Foot then directed further backwards at impact thereby lowering braking force

Lorimer & Hume (2014)



Impact Force of Running



What does this all mean?

- Evidence that footwear and strike type may not be as important as has been thought
- Leg movement may be more important in determining impact than foot strike
- The closer the foot lands to the centre of mass, the less rate of loading and joint loads, also decrease in braking force

Heiderscheit (2011)



Foot Strike



- Rear foot / Mid foot / Fore foot strike
- Large degree in variability within strike patterns

Larson (2014)



Foot Strike

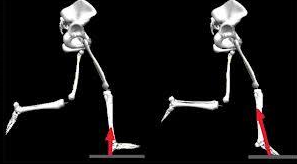
- Impact forces can be influenced by instructing habitual heel strikers to switch to a subtle heel strike
- Not all heel strikes are the same

Mercer & Horsch (2012)



Foot Strike

- Inefficiencies can exist in any foot strike pattern



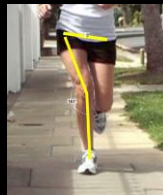
Foot Strike

- No difference in frequency of injury between strike patterns
Kleindienst (2003)
- No difference in incidence of injury between strike patterns
Walther (2005)
- Rear foot striking runners are more economical than mid foot strikers at speeds up to 15km/h (4min/km)
Oqueta-Alday et al (2014)



Common Running Errors

- Overstride
- "Heavy" foot strike
- Hips dropping to the side
- Excessive femoral internal rotation
- Excessive pelvic anterior or posterior rotation
- Foot crossover
- Foot strike in externally rotated position



Common Running Errors



Correction Considerations

- Strengthening does not result in fundamental modification of running mechanics
Willy & Davis (2011)
Wanters et al (2012)
- Gait retraining focussing on altering skill of running has shown to produce lasting changes in running mechanics



Correction Considerations

- Bringing attentional focus through an external focus cue appears to enhance motor learning
Wulf et al (2010)
- External focus promotes greater multi-segmental coordination and a more automatic process
Wulf (2002)
- Internal focus may increase co-contraction and reduce coordination
Zachry et al (2005)
- Absolute novices who are struggling to modify gait may respond to internal cues initially
Perkins-Ceccato et al (2003)



Running and the Juvenile Athlete



Correction Considerations

- Especially for younger children running mechanics are strongly affected by co-ordination
- Work on trunk and hip stability, control and posture before progressing to legs and then arms
- Skipping and running drills
- Begin with internal focus in the and progress quickly to external focus cues



Coaching / Correction Cues

1. Early foot lift

- Increases stride angle (improves efficiency)
- Improves cadence (helps to prevent overstriding)
- Helps to limit pelvis and leg rotational inefficiencies



Coaching / Correction Cues

2. Drive knee forwards

- Gives slightly higher knee lift
- Activates cross extensor reflex
- Helps to prevent overstride
- Increases vertical loading on foot strike and decreases horizontal loading – more spring and less brake



Coaching / Correction Cues

3. Run tall

- Lift the chest but still keep it in front of the hips
- Better integration of the diagonal slings as well as the anterior and posterior chains
- Frees up the hip and legs to function independently



Coaching / Correction Cues

4. Lift pelvis forwards and upwards

- Improves knee stiffness on stance leg
- Improved foot drive into ground on stance leg
- Gives better gluteal pre-activation on swing leg
- Helps to limit overstride



Thank You

