Positive running, a model for high speed running Frans Bosch

- positive running posture sums up the right technique for top speed
- building blocks in running: Pelvic rotation for- and backward and hamstring function
- control of anterior-posterior pelvic rotation is crucial for hamstring function
- ground-reaction-force and the whip from the hip

Positive running posture sums up the right technique for top speed
the worlds best sprinters run more positive posture than the “also participating”

Building blocks in running: Pelvic rotation for- and backward and hamstring function

Toe off pelvic rotation is controlled by positive running
arm-action  vertical  GRF  positive running

positive running  negative running
increasing forward rotation pelvis
reduced scissors action
foot placement in front of the hip

big pendulum
small pendulum
The most difficult moment in the running-cycle: reversing the pendulum.

- Right leg
- Abdominals
- Iliopsoas
- Rectus

- Right leg
- Hamstrings
- Erector
- Gluteus
Control of anterior-posterior pelvic rotation is crucial for hamstring function.
Energy in the running-cycle

At high speed large quantities of energy are transported from one leg to the other by elastic stretch. (4-5 times per second)

reversing the pendulum

End of stance; low EMG activity

hamstring load  scissors motion
Anterior and posterior tilt of the pelvis plays an important role in making the Hamstring work in its optimum length.
Anterior and posterior tilt of the pelvis plays an important role in making the Hamstring work in its optimum length. Iliopsoas is crucial in Hamstring load >> there is no such thing as an overactive iliopsoas.
If at the end of stance the pelvis rotates forward too far, it will have to be rotated back during the Hamstring loading phase. Resulting in loss of speed efficiency and increasing Hamstring injury risk.

Ground-reaction-force and the whip from the hip

- force direction mainly vertical
- horizontal component limited by relative speed of the ground
- short ground-contact

- extreme acceleration and deceleration of the legs

limitation for maximum speed
The problem for running faster is not just applying more force, but more force in shorter time. At higher speed => less vertical oscillation. At higher speed => shorter contact times.
The problem for running faster is not just applying more force, but more force in shorter time.

**Solution; Just paw back?**

We conclude that human runners reach faster top speeds not by repositioning their limbs more rapidly in the air but by applying greater support forces to the ground.

Weyand et al. 2000

leg speed is not limiting

Spring mass model is too simple to represent reality, because horizontal force application is left out

max strength is not limiting
The problem for running faster is not just applying more force, but
more force in shorter time and in the right direction.

Solution; preparing the status
of the next stance leg
before initial contact

>> “the whip from the hip”

The Whip from the Hip

The results of this study emphasize the importance of pre-activity and
the activity of the leg extensor muscles during the braking phase of
running. Their activity is in many cases well above that recorded during
maximal voluntary contractions, suggesting that such contractions
cannot be used as an indicator of the full activation potential of human
skeletal muscle. Thus, features of central programming and reflex
regulation seem to differ between isometric maximal voluntary
contractions and stretch – shortening cycle exercises such as running

Changes in muscle activity with increasing running speed
HEIKKI KYROLAINEN, JANNE AVELA, & PAAVO V. KOMI
slack > time before elastic stretch

regulating stiffness
Energy transport during squat jump

1. Gluteus motor function
2. Hamstrings directing GRF
3. Rectus and gastrocnemius transporting energy to ground
slack
energy transport

not just energy transport
that is very fast, but also at the right angle of hip, knee and ankle
Energy transporting muscles

Kangaroo => optimum build for energy-transport

Human => poor build for energy-transport

Angle between Femur and foot optimal for energy transport; a key for talent?

CM
direction GRF
The timing of all these aspects has to be perfect to get optimum force and direction of force in stance. Getting the status of the to be stance-leg right prior to contact is complicated coordination. Status stance-leg prior to Initial Contact is key to short contact times. “The whip from the hip” technique provides that status.

Spring in the step synchronized with energy-transport

Toe up when bringing the foot to the ground and then push the forefoot into the ground

hip >> knee >> ankle extension
Toe up when bringing the foot to the ground and then push the forefoot into the ground
hip >> knee >> ankle extension
conclusion;

“whip from the hip” technique helps applying force to the ground earlier in stance.

“whip from the hip” is a pattern that can be applied in many movement patterns.