Run Faster - Finding your 'Inner Kangaroo'
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Can you run faster AND reduce injury risk?

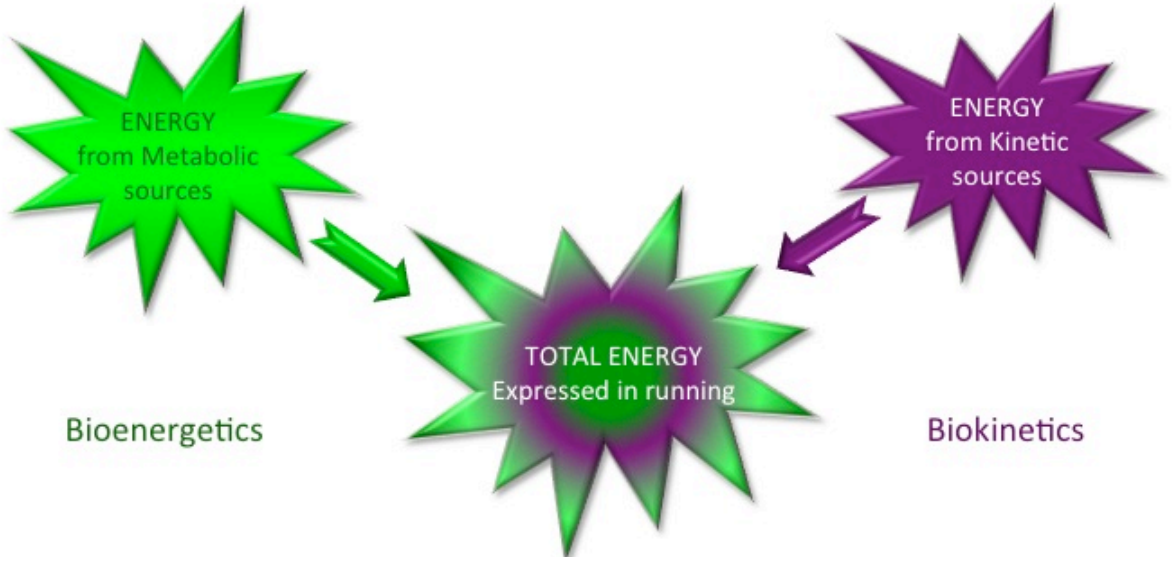
- Endurance running performance is concerned with energy production, management, utilization and expression
- Traditionally coaches have concentrated on developing energy through the bioenergetic or metabolic energy systems
- This has involved a focus on running, running and more running while all the time trying to remain healthy and uninjured
- Today we shall look at why and how you can increase the value-added contribution of biokinetic energy to your running
- Simply, the better the biokinetic energy production/contribution the less bioenergetic energy you will use to run the same speed
- OR - The better your biokinetic energy production and contribution the faster you will run for the same bioenergetic energy
- The added value is that what initiates and develops your 'Inner Kangaroo' also changes biomechanics to an injury-proofing form.

So, why are we here?

- This is not a rhetorical question – why are you and me here?
- Are you ready for a reality check?
- What we are currently doing for ourselves and our athletes is NOT WORKING
- Depending on which research you use: 40 - 80% of runners get injured
- Anything we can do to minimize the risk of injury is a positive action
- We all want healthy - high performing athletes.

Running Performance and Energetics

Endurance running performance is concerned with energy production, management, utilization and expression



Elasticity – 'Green' energy

- Utilizing 'free' elastic energy improves running economy
- Let's see if we can maximize running economy and performance while decreasing biomechanical stress and risk of injury
- How do we do this?

Look at these Factors

1. How should the body be aligned - posture
2. Where the foot should contact and how should the foot contact
3. How often should the foot contact
4. Can we do something besides running to improve performance?
5. Any drills that help cue this?

We know that materials can store energy and release it – Elastic Energy

Old view:

- Imagine the muscle-tendon system as a rubber band
- While stretching it energy will be stored (eccentric phase)
- This energy will be regained at shortening (concentric phase)

Current view:

- The muscle eccentric contraction phase is not so important as the elastic properties of the tendon
- The muscle now needs to be emphasised as being in isometric mode all through our movement and drills

- Essentially same rubber band analogy except there is a recognition that the muscle response and contribution is not as great as it was thought to be for creating force but is vital as a stablizer and resistance.

Negative Effects of 'Muscle Slack'

- 'Muscle slack' causes slow and long ground contacts
- If the muscle is not pre-activated and pre-tensed isometrically to remove muscle slack there is no storage of kinetic energy.

"Humans aren't descended from apes, but are a bad crossbreed of kangaroos and horses" - Frans Bosch, 2012

Choosing the Why, the What then the How to Develop and Improve

- We've seen that Frans Bosch started off with 3 functional building blocks for improving sprinting\
- He started off with 3 functional building blocks for improving sprinting:
  - ↓ Reduce and control muscle slack - the most important
  - ↑ Reactivity
  - ↑ Reflex Patterns.
- But is maximal velocity sprinting like the running that most of us do in 800m to Marathon?
- A world-class 100m sprinter takes 44-52 steps to cover the 100m race
- The model for sprinting can be less concerned with running economy due to the short duration - a 'dragster' model
  - We are concerned with running for distance over time - a '24-hour Le Mans' model where running economy is critical
  - The building blocks for improving stiffness, elastic response and running economy will be different for an 800m and longer runner vs. a 400m and shorter sprinter
  - We should not use 'sprinter models' for the 'why'- the 'what' and the 'how' of developing recreational or elite middle and long distance athletes.

What must we have or Develop?

- Mobility – enough motion to get your leg behind you when running
  - Hip extension
  - Ankle dorsi-flexion
  - Big toe dorsi-flexion
- Stability – enough stability to counter the forces affecting the body
  - Posture with core control
  - Muscle function
- Strength – the correct elements of strength
  - Improves running economy
  - Develop the Gluts to drive the body upward and forward
- Neuromuscular control – behaviour and skill
  - Maintaining posture
  - Pre-tense appropriate muscles.

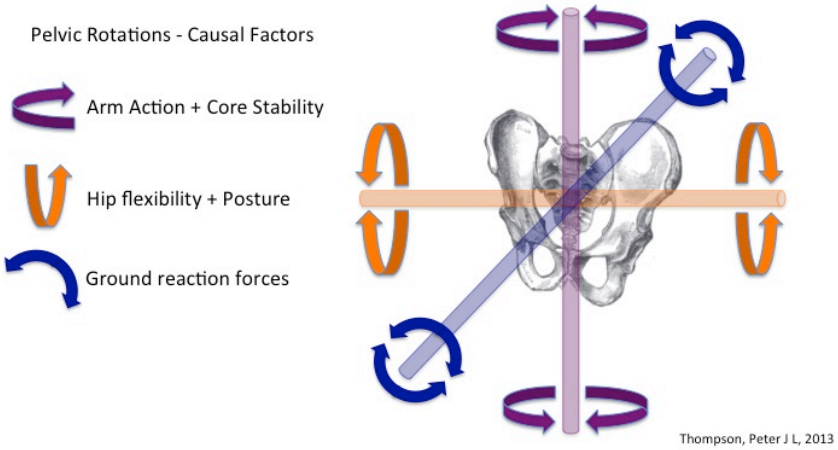
Mobility

- Most runners hit the ground too far in front of their Center of Mass CM
- First we must check if there is enough motion to get your leg behind you
- This involves functional movement assessments – not passive
- We need 'enough':
  - Hip extension
  - Ankle dorsi-flexion
  - Big toe dorsi-flexion
- We require full mobility of hip, ankle and ball of the foot
- Coaches have focused too much on 'triple extension' of hip, knee and ankle but most programs have missed that fact that knee extension is rarely a problem
- Limited hip extension is frequently a problem and big toe mobility will limit the function of the most active ankle.

Stability

- Lack of stability with compensatory movements
- Common mechanism of injury – IT band and knee

Controlling Your Pelvis



Your pelvis is capable of complex rotations involving 3 planes

Strength - How much strength do you need?

- Runners may move in one direction but are challenged with controlling forces from all directions
- Poor foundations can't generate stability!
- As speeds increase forces go up
- Now that you know this, are you ready and fit for it?
- Not just for 5 miles but for each and every mile - all year?
- Be strong enough to combat fatigue.

Weight Training and the Young Athlete?

- Young athletes can begin learning the 'skills of weight lifting' from the ages of 8-11 years and then start 'weight training' for strength gains once they are mature enough.

Developing Power

- Power – the key here is explosive movement ….. "POP!"
    - 'Ninja Jumps' - use the following progression:
        - Jump up - step down
        - Jump up - jump down
        - Height of jump should start at mid shin and build up to mid to upper thigh and to 3 x 10 reps max
    - Start on box - jump down and then up as quick as possible 3 x 5 reps
    - '4 square' jumps – see *'Anatomy for Runners'* for description 30 sec x 3 reps
    - Lateral jump – stand on one leg - jump as far laterally as possible - should be measured in feet not in inches! 2-4 x 6 reps
    - Med ball rotational throws – stand on one leg – rotate torso powerfully and throw ball as forceful as possible against a solid! wall 2 x 6 reps per side.

Summary

- Understand the challenges of running – what they are, why they are and how to modify
    - Elastic recoil is the goal - avoid heel contacts in all exercises - if so, reduce height or distance
    - Train for shorter ground contact times
    - Become NRG efficient as better energy transfer = less muscle cost
    - Don't over-stride but 'run inside the box' with a symmetrical pendulum action
    - Ground contact needs to be in correct location in relation to Center of Mass to optimize storage and release - Close to the body - good postural stability - hip extension
- Build a stable foundation for proper muscular recruitment sequencing:

  Smarter → Stronger → Stiffer spring.

- Understand the patience required to change some of your movement patterns and behaviors
- Be committed to a long-term movement improvement strategy working through mobility evaluation, posture, stability, strengthening and neuromuscular conditioning
- Identify what you can do today - now - to quickly improve your running mechanics with:
    - Posture
    - Running faster in all our runs - the faster we run the shorter the ground contacts and the greater the stiffness
    - Running on soft surfaces – increases stiffness
- Enjoy your running ……. and find your 'inner kangaroo'.

Essential Reading: *Anatomy for Runners* - Jay Dicharry, 2012

Addendum: Most coaches and athletes recognise that reactive or elastic strength capabilities contributing to biokinetic energy production are important in the 'power' events of athletics: the sprints, hurdles, jumps and throws. There is a common misconception, however, that the biokinetic role in 'endurance' activities is unimportant. The ability to apply force rapidly and accelerate your body mass is the rule rather than the exception in athletics. While the endurance events do require an emphasis on metabolic or bioenergetic capacity, they also involve repeated brief, explosive 'spikes' in power output each time the foot contacts the ground. It would be simplistic to think of endurance events as being just sub-maximal, so biokinetic needs must be considered for these athletes.

The elastic component is the sheathes of fascia which surround the bundles of muscle fibres and surround the muscle itself come together at the end of each muscle to form tendons which connect the muscle firmly to bones. All this connective tissue making up the muscle-tendon unit has tremendous elastic properties and can provide very quick forces, provided it is pre-tensed. These elastic tissues of the muscle-tendon unit respond to training in the same way as other tissues of the body do, by adapting to appropriate stresses from training. When we consider developing 'strength' we must consider the development of both the contractile component of the muscle and also the elastic component of the muscle-tendon unit if we are to develop and use the athlete's biokinetic capacities.

In addition to providing reactive force, the elastic properties of the muscle and tendon require little to no metabolic energy to operate. It is in effect an energy efficient option to producing powerful actions. This is why kangaroos are such efficient animals, because they increasingly use the kinetic, elastic component of contraction and less metabolic energy as their speed increases. In this way, they can easily cover vast distances at a considerable speed. For the human animal we find that, most obviously towards the end of a race, as energy levels reduce and acidosis builds up to inhibit the contractile component of muscular contractions, the role of reactive strength and the elastic component becomes increasingly important. This is because it can potentially still operate powerfully under these conditions - provided it has been developed.

When you are running, any lack of the necessary isometric core strength does not just lead to an absorption and wastage of energy. As we run, if the pelvis is not controlled and held isometrically in a neutral position, it will tend to rotate in one or more of three planes. If the lower back becomes 'swayed', the pelvic tilt causes changes to the lower limbs as the bones act as a system of connected levers – the lower kinetic chain. The result is rotation of the thigh bone - the femur, internal rotation of the shin bone – the tibia with, finally, a lowering of the longitudinal arch of the foot. In simple terms, it makes you flat-footed, causing an increasingly slow sinking each time the foot contacts the ground. Now, instead of the foot landing like a pre-tensed spring and reacting quickly with a short, explosive ground contact it is working against the running, jumping or throwing action we are striving to achieve.

If a runner's leg muscles are too 'stiff', too rigid, their body will 'jar' each time the foot contacts the ground and energy will not be returned. If the leg muscles are not sufficiently 'stiff' then the body will sink too much each time the foot contacts the ground. In this case, the eccentric stretching of the muscle will take so long that, again, energy is wasted and reactive strength will be poor. If, however, the leg muscles are optimally 'stiff' when the foot hits the ground the eccentric action of the muscles will now optimally store kinetic energy in the elastic component of the muscle-tendon unit. This optimal tension or stiffness permits the very quick return of energy called 'impulse'.

Squat jumps with weights can be used for advanced development of biokinetic capacities but avoid using too heavy a loading which would slow the movement. Squat jumps for power should use 30 to 40 percent of the athlete's one repetition maximum but also taking into account the athlete's body weight, since they are leaving the ground. If the athlete's body weight is 80kg and their one repetition maximum is 140kg, the total 'system maximum weight' is 220kg. Since forty percent of 220kg is 88kg, this particular athlete only needs to do carry 8kg over their body weight while performing jump squats.

For the skilled athlete, performance appears effortless, "like a stone skimming across the water". Part of this apparent effortless action is a direct result of the skilled expression of biokinetic energy. If two athletes have the equal bioenergetic capacities, the better performer will be the one who has the greater biokinetic capacity. Whatever event you compete in, the power that you create relates to the interplay of mobility, stability, strength, speed and skill. Developing your biokinetic contribution will make you more powerful, permit you to 'spare energy', just like a Kangaroo and boost your performances in training and competition.