Is your posture making you more injury prone when running? (PDF Download)

The lumbo-pelvic hip complex (LPHC) is one of 5 anatomical kinetic regions (feet/ankles, knees, LPHC, shoulders, head and cervical spine). LPHC proficiency can be observed through an athlete's ability to consciously control the pelvis relative to the lower back (lumbar spine) over an appropriate range of motion. Therefore, scenarios may present when the lower back arches (lumbar extension) and the pelvis tilts anteriorly…and this is OK! (sometimes). Harnessing this conscious control of the LPHC opens the door for the athlete to explore their environment across a wide range of movements and through many degrees of freedom.

The antithesis of the above is that when a lack of control of the pelvis and rib cage occur, this not only limits an athlete's potential to explore positions/movements, but reinforces poor technique that is both detrimental to performance (dynamic movement e.g. high speed running) and health (i.e. injury). The caveat to poor LPHC control is that it can often take the fall for what is happening both up and down the kinetic chain. This is because in practice the body is very effective at distributing stress – "The bliss of motor abundance" (Bernstein/Latash). Unfortunately, this leaves areas of weakness particularly susceptible to injury. For example, reduced overhead mobility or limitations in hip extension can present with thoraco-lumabar junction shearing and L5 shearing (pars) respectively. This is where developing a robust and comprehensive screening protocol is paramount as well as ensuring the athlete is exposed to movements in 360 degrees of motion (sagittal, frontal and transverse planes).

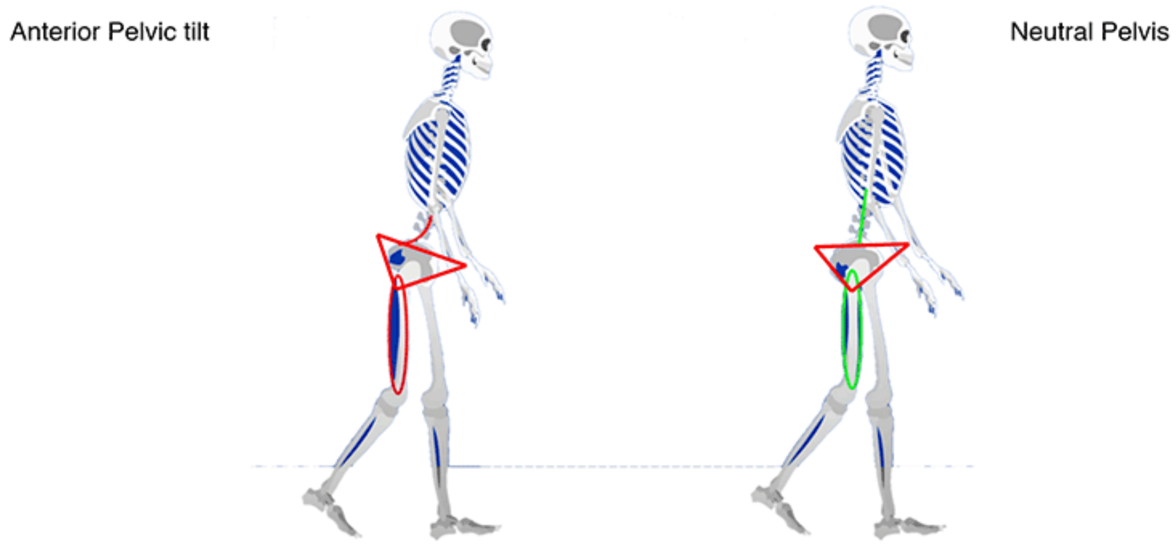

Figure 1. Anterior pelvic tilt vs neutral pelvis and its implications on the hamstring's muscles

During locomotion (walking/running/sprinting) the pelvis acts as the key anatomical lever and energy transfer structure between the two limbs (Dorn et al., 2012). As a result pelvic tilts, specifically anterior tilts (APT) can accompany undesirable kinematics downstream. Tilting the pelvis anteriorly increases the lengthening demand on the hamstrings due to the greater moment arm being generated (anterior iliac spine closer to the thigh) (Nagahara et al., 2018). Therefore the pelvis should be considered an important structure in incidence of hamstring-related injuries that occur at high-speed. Athletes with an APT during a sprint will generally display less knee drive from the swing leg, and the stance leg getting too far behind (favouring backside mechanics = not ideal for expressing speed). Similarly, these athletes will struggle with the downward strike due to both posture and pelvic positions being compromised. Failure to achieve an upright posture during max velocity sprinting prevents the knee rising high, consequently the foot does not have the time and/or space to swing through in preparation for ground contact. Athletes with an APT will appear to 'over-rotate' exhibiting tendencies to project diagonally due to a noticeable premature heel strike pattern which is unfavourable during max speed, where forces must be directed vertically.

That being said, the ability to anteriorly tilt the pelvis remains an important requisite of sprinting. This is because APT facilitates leg interaction and compensates for the lack of increase of hip extension change needed to achieve high velocities. Training programmes should initially expose athletes to motor control around the pelvis and then integrate a system that escalates task constraints in accordance with the control-chaos continuum when introducing running. Additional emphasis should also be placed on the development of strength and endurance in key locomotive positions (e.g. hip lock). The latter being particularly crucial since both local muscle (Hart et al., 2009) and running-induce fatigue (Small et al., 2009) have been shown to increase trunk flexion and pelvic anteversion at the end of each half of a football match. Programmes should account for this by including exercises to reinforce self-organisation to advantageous attractor states.

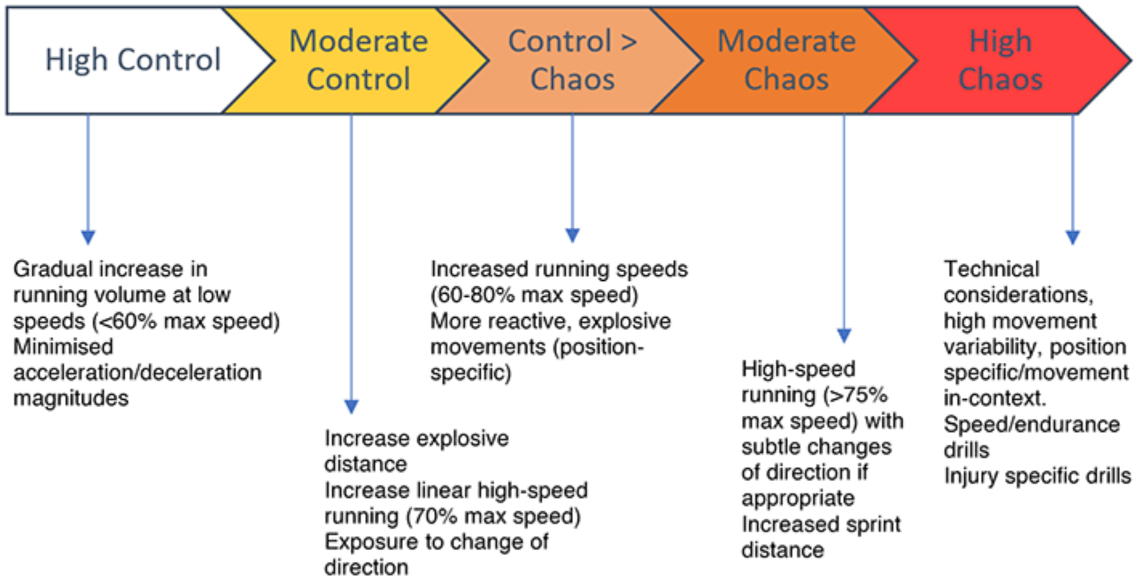

Figure 2. The control-chaos continuum

References

Dorn, T. W., Schache, A. G., & Pandy, M. G. (2012). Muscular strategy shift in human running: Dependence of running speed on hip and ankle muscle performance. *Journal of Experimental Biology, 215*(11), 1944–1956. https://doi.org/10.1242/jeb.064527

Hart, J. M., Kerrigan, D. C., Fritz, J. M., & Ingersoll, C. D. (2009). Jogging kinematics after lumbar paraspinal muscle fatigue. *Journal of Athletic Training, 44*(5), 475–481. https://doi.org/10.4085/1062-6050-44.5.475

Nagahara, R., Matsubayashi, T., Matsuo, A., & Zushi, K. (2018). Kinematics of the thorax and pelvis during accelerated sprinting. *The Journal of Sports Medicine and Physical Fitness, 58*(9), 1253–1263. https://doi.org/10.23736/S0022-4707.17.07137-7

Small, K., McNaughton, L., Greig, M., Lohkamp, M., & Lovell, R. (2009). Soccer fatigue, sprinting and hamstring injury risk. *International Journal of Sports Medicine, 30*(8), 573–578. https://doi.org/10.1055/s-0029-1202822