A FUNCTIONAL BIOMECHANICAL ANALYSIS OF AN ELITE CYCLIST

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INTRODUCTION: We are investigating possible causes of chronic back pain of an otherwise healthy elite cyclist while cycling. Asymmetry in the lower limbs and patterns of pelvic, hip, knee and ankle joint motion in gait and sports specific cycling movements were assessed.

METHOD: The athlete was a 27 year old male currently in full training who was complaining of chronic back pain. Anthropometry was limited to measures of the lower extremities. Gait was assessed during barefoot free-speed walking with six fixed cameras and two force platforms in the gait way. Orthotrak software (Motion Analysis Corp) was used to analyse gait in 3D at 200Hz. Cycling was assessed using his road-bike setup on a stationary roller. The protocol was a warm up, 15 minutes of cycling at 70% intensity, then 30 sec at 80% intensity. Video from the rear, at 50Hz, was taken of the last 30 seconds and subsequently analysed using siliconCOACH-Pro to compare left and right side motion. A 'Bike-fit II' check (siliconCOACH) was conducted on the cycle set-up.

RESULTS: Anthropometry found no leg length asymmetry but greater muscle girths on the right side. Gait analysis revealed unbalanced right hip internal rotation; varus knee joint motion with right knee being more dominant; excessive ankle pronation and higher plantar flexion during right and higher dorsiflexion during left stride. The analysis during 80% effort cycling revealed two marked asymmetries: The left pelvic marker was well below neutral while the right pelvic marker was close to the neutral line while pedaling, at release in the final phase of driving of the leg. Ankle range of motion was greater for the left than the right leg (See Figures 1 and 2).

Left  Right

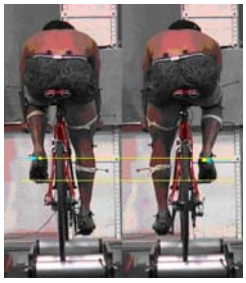
Left  Right

Figure 1. Markers showing the pelvic tilt and, Figure 2. Markers showing ankle motion while pedaling.

DISCUSSION: Anthropometry eliminated the concern for lower limb lengthasymmetry but found greater muscle girths on the right side. The greater cross-sectional area of the muscle was interpreted as the indicating that the right leg was stronger than the left. The gait and cycling analysis both revealed asymmetries; gait assessment showing unbalanced internal rotation of the right hip, and cycling excessive pelvic tilt to the left. As the left leg seems to be comparatively weaker than the right, it is likely that the left side generates extra force from muscle groups and stabilizers supporting the pelvis. This may be the reason that the left pelvis is sinking in one side with the left knee being forced to lift and provide the force in the final phase of pushing.

CONCLUSION: We concluded that the back pain and asymmetrical hip movement while cycling was due to muscle imbalance possibly as a result of a previous injury. However, initial testing of the hip motion isokinetically at a spectrum of velocities did not confirm a

muscle imbalance. We propose trialing video feedback in cycling training to reduce the motion asymmetry.

REFERENCES:

Motion Analysis Corporation, Santa Rosa, California, USA. BikeFit II. siliconCoach, Dunedin, NZ.