

Physiological responses to motor learning strategies to retrain running gait: A pilot study

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Running gait retraining has been proposed as a rehabilitation strategy for running-related overuse injuries (Barton et al., 2016, *British Journal of Sports Medicine*, 50, 513-526) and uses motor learning strategies to facilitate changes in running gait. Whilst risk-reducing effects in biomechanical indicators of overuse injury have been evidenced, the concurrent effects on physiological responses are unclear. The aim of the study was to develop an insight into the physiological responses to running gait retraining strategies commonly used in injury rehabilitation. With institutional ethics approval, nine recreational, rearfoot striking runners (mean \pm SD age: 24 \pm 5 years; height 1.70 \pm 7.4m; body mass 68.3 \pm 6.2kg) completed three conditions of treadmill running (six min) at 10 km \cdot hr⁻¹, with a five-min rest period between conditions. A normal running condition and two intervention conditions using the verbal cues of “run quietly” (external focus of attention, EFOA) and “run like you are trying to squash oranges” (analogy motor learning, AML) were completed in a randomised order. The verbal cues were presented every 30s. Mean oxygen consumption and heart rate during the final two min and mean central (cRPE) and peripheral (pRPE) ratings of perceived exertion were obtained during each condition. The AML condition produced the greatest increase in oxygen consumption (2.8%; effect size [ES] 0.51) and heart rate (3.3%; ES 0.53) compared to the normal condition (34.2 vs. 33.2ml \cdot kg⁻¹ \cdot min⁻¹). The EFOA condition had similar oxygen consumption (33.3ml \cdot kg⁻¹ \cdot min⁻¹; -0.1%; ES 0.04) and heart rate (0.7%; ES 0.11) to the normal condition. Oxygen consumption and heart rate were greater in the AML condition than the EFOA (2.9%; 0.81 ES and 2.7%; 0.91 ES, respectively). The AML and EFOA conditions had elevated pRPE (5%) compared to normal condition (11.4, 11.4 and 10.9 respectively), as well as cRPE (12.4, 12.0 and 11.6 respectively; 6.9 and 3.4%). An analogy learning strategy was found to have larger effects on physiological indicators of running performance during gait retraining than an external focus of attention, possibly due to underlying biomechanical alterations evidenced in the analogy learning strategy (Gittoes et al., 2017 *British Association of Sport and Exercise Science Conference*). The respective effects were reflected in perceived central effort levels and partially reflected in perceived peripheral muscular effort levels. Clinicians implementing running gait retraining to reduce biomechanical risk indicators are encouraged to use analogy cues, but to consider reducing running workload due to the physiological responses associated with this motor learning strategy.