Gait Retraining for Runners: In Search of the Ideal

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Alberto Salazar is under a microscope at the moment. As head coach of the Oregon Project, the world of track and field is watching to see whether his unconventional training of the US's promising elite distance runners will be successful. Specifically, Salazar is changing running form or posture in attempt to maximize mechanical efficiency, with the ultimate goal of improving performance and reducing injury risk.

For physical therapists, modifying technique is not a novel concept; however, our motives are typically focused on symptom and injury reduction rather than purely performance (eg, instruction in proper lifting techniques to minimize loading of the back, or corrected sitting posture at work to reduce the effect of repetitive strain). These specific modifications are based on minimizing tissue load, while still enabling successful completion of the task. Applying this same rationale to an activity in which up to 80% of participants are injured annually would seem to be a good thing.[13]

Yet the idea of using gait retraining in patients without neurological injury/pathology is rather uncommon.[12] However, a few researchers have investigated specific walking retraining strategies to reduce knee joint loading, with the goal of applying these techniques to individuals with knee osteoarthritis.[1,6,9,10,14] This has led some to use the same concept on runners with patellofemoral pain, with a corresponding improvement in gait and symptoms.[4,11]

The initial positive outcomes of gait retraining for injured runners have provided several directions for future research. At the forefront is the need to identify the primary biomechanical factors that can and should be changed; in other words, defining those biomechanical aspects of the running form that are contributing to the symptoms/injury that, when changed, have positive clinical outcomes. Various kinematic (hip adduction,[11] stride length,[8] and foot strike pattern [heel, midfoot, forefoot][4]) and kinetic (tibial accelerations[5]) parameters have been altered with reported benefits. But given the interdependence of these factors, it is difficult to change one without inducing change in at least one other. In the current issue of *JOSPT*, a case series is described in which foot-strike pattern and stride length were modified in 3 runners with patellofemoral pain to improve pain and function.[4] Was it the avoidance of a heel-strike pattern or the shortened stride length that was responsible for the reduced loading and corresponding clinical gains? A recent study suggests that foot strike pattern is a poor predictor of vertical impact loading, with a variable response observed across individuals.[2] Conversely, the reduction in vertical displacement of the whole body's center of mass that accompanies a shortened stride length produces a significant decrease in mechanical energy absorption, particularly at the knee.[8] While it is unlikely that a single parameter of importance could be identified as appropriate for all runners, narrowing the field to those which have the greatest and most consistent effect is warranted.

Once the biomechanical factors that should be targeted for clinical change are identified, their influence on metabolic energy cost and performance is needed. It is generally believed that runners use the least amount of metabolic energy (as measured by oxygen consumption) when they run using their preferred pattern.[3] Forcing a runner to run at something other than preferred has the potential effect of increasing oxygen consumption, at least in the short term, and thereby reducing performance. The sensitivity of this relationship seems to be most apparent in higher level runners who have had several years and miles to optimize their technique; recreational runners, which likely comprise the vast majority of our patient population, handle subtle changes in running pattern with a minimal effect on oxygen consumption.[7] If an increased oxygen cost is observed, it is reasonable that this will reduce to baseline values the more the runner uses the modified pattern. However, this relationship is certainly dependent on the specific parameter changed and the magnitude of its change.

The optimal retraining protocol required to achieve generalizable change remains unknown. Several recent studies have used multiple sessions over several weeks in a laboratory setting with verbal, visual, or auditory cues and feedback.[4,5,11] To enable the runner to self-evaluate and correct as necessary, progressively less feedback was provided over the retraining period. While this approach has produced observable changes in the specific retraining environment, the extent to which carryover is evident in other environments, such as outdoors, is not known. Similarly, while the runners can reproduce the trained running style when asked, indicating they have learned it, do they in fact choose to use this running style during normal, unobserved training? If a reduction in symptoms occurs with retraining, compliance is more likely; however, in the absence of symptoms, as would be the case for injury prevention, compliance may be limited. In addition, depending on the magnitude of change, a period of transition may be necessary for the tissues to accommodate to the altered loading. How long that period needs to be to allow safe transition is unknown and is likely not constant across individuals.

Arguably the most important issue with respect to running gait retraining is determining who would benefit from it: injured runners, noninjured runners, or both. In a runner with current injury or one frequently prone to injury, reducing the mechanical load to the involved tissues through targeted gait retraining would seem to have obvious merit. If the runner is symptomatic, the response to the gait change may be immediate and provide a basis with which to judge effectiveness. The recommended gait change may only need to be of short-term duration; temporarily "bracing" the mechanics to unload aggravated tissues as part of the overall treatment plan. Conversely, a long-term gait change may be warranted if the mechanics are believed to be injury producing, as may be the case for runners with chronic reinjuries.

Recommending long-term gait retraining to noninjured runners with the goal of preventing injury is a more challenging proposition. Without having the symptom history to guide the approach, we would essentially be recommending runners conform to a pattern that attempts to minimize specific biomechanical loads. This approach would need to be done within the context of the individual's musculoskeletal state. For example, what is ideal for a young adult is likely not the case for a masters-level runner, given the effects of age on tissue tolerances. While a basic biomechanically efficient running pattern can be defined, it will likely need to be tailored to the individual; the assumption that all runners could match the same pattern would be unrealistic. Finally, determining the success of gait retraining with noninjured runners requires the long-term approach of measuring injury rates over subsequent years. This would be a rather daunting undertaking, considering the potential confounding variables.

Gait retraining as part of the treatment of injured runners has shown early promising results. Through continued investigation and application, the questions raised above will likely be answered, as will the Salazar experiment at the 2012 Olympic Games. ◉

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