SPECIFICITY: BRICK TRAINING FOR THE BIKE TO RUN TRANSITION IN TRIATHLON

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Practicing the transition in triathlon makes sense according to the principle of specificity. The purpose of this study was to examine the effect of workouts that target the bike-run transition. Subjects (N=12) performed two types of workouts to examine the effects of brick workouts as opposed to single event training on the bike-run transition. Our results indicate that the brick workouts had a positive effect on the transition, however, more needs to be known about the mechanism behind the effect of brick workouts for both competitive and novice triathletes.

KEY WORDS: ApEn, brick, movement, nonlinear.

INTRODUCTION: Transitioning from biking to running during a triathlon can be a difficult endeavor for a novice or even a professional triathlete. In the triathlete community, “brick” workouts, are workouts in which individuals practice biking and running, one after the other, repeatedly. The reasoning behind this is to get the body used to that transition and allow the body to make the necessary adaptations to make this transition as easy as possible. Although the principle of specificity indicates that brick workouts make sense, we could find no research to support the use of brick workouts. Therefor the purpose of this research was to document the effect of brick workouts on the bike-run transition.

METHOD: Participants and Grouping: Seven male and five female college-aged triathletes (age: 21.3 (2.0), body mass: 67.3kg (11.7), height: 167.9cm (6.9)were split into two random groups (experimental brick training group & control training group).
Procedures: Maximal oxygen uptake (VO_{2Max}) was recorded prior to, and following the training program in order to ensure standardized fitness between groups. Triathletes in both groups engaged in 6 weeks of triathlon preparation using one of two training methods at the same relative intensities which varied between 60-85% of max Heart rate. Brick training – subjects practiced the run-bike transition by performing one hour brick workouts twice a week for one hour. Traditional Training – subjects practiced both a bike and a run workout each week for one hour each on separate days. All triathletes’ lower extremity kinematics were filmed during both pre and post training at the bike-run transition. For both tests, participants cycled for 40 minutes at a relative intensity based upon max heart rate, and were then filmed for the first minute of the following run. To aid in digitizing retroreflective markers were fixed to known body landmarks of the lower extremity. Markers were placed on the ASIS, lateral epicondyle of the knee, lateral malleolus and tip of the foot. Self-reported miles and minutes of training outside of the 6 week training protocol for both biking and running were monitored and were similar between the groups.
Analysis: Linear analysis of knee angle was performed by calculating the average of both range and coefficient of variability for each group in ten second increments during the first minute of running after 40 minutes of cycling both pre and post training. The non-linear analysis, ApEn was calculated based upon each group’s first minute of running as a whole during each phase. ApEn values are range from 0 to 1 with 0 representing completely deterministic behavior and 1 representing completely random behavior
Statistical Analyses: A 2x2 factorial ANOVA was used to examine the pretest-post test measures as well as between the brick training and traditional training groups. The dependent Variables were the knee angle range (max – min knee angle displacement during first minute of post-transition running), Knee angle coefficient of variability (position variability/mean position during first minute of post-transition running) We also used a non

linear tool, Approximate Entropy (ApEn), to examine knee angle temporal predictability (Stergio and Decker 2011).

RESULTS: No overall group changes in VO_{2Max} were observed during the study. In addition, group exercise outside of the training protocol did not vary between groups. Traditional analysis of knee angle range and coefficient of variability showed no measureable difference for the two conditions within groups (Figures 1 & 2). However, the non-linear measurement of ApEn (Figure 3) showed a difference between pre and post training within the brick training group, t (5) = -3.49, p=0.017, but not for the traditional training group, t (5) = 0.49, p=0.640.

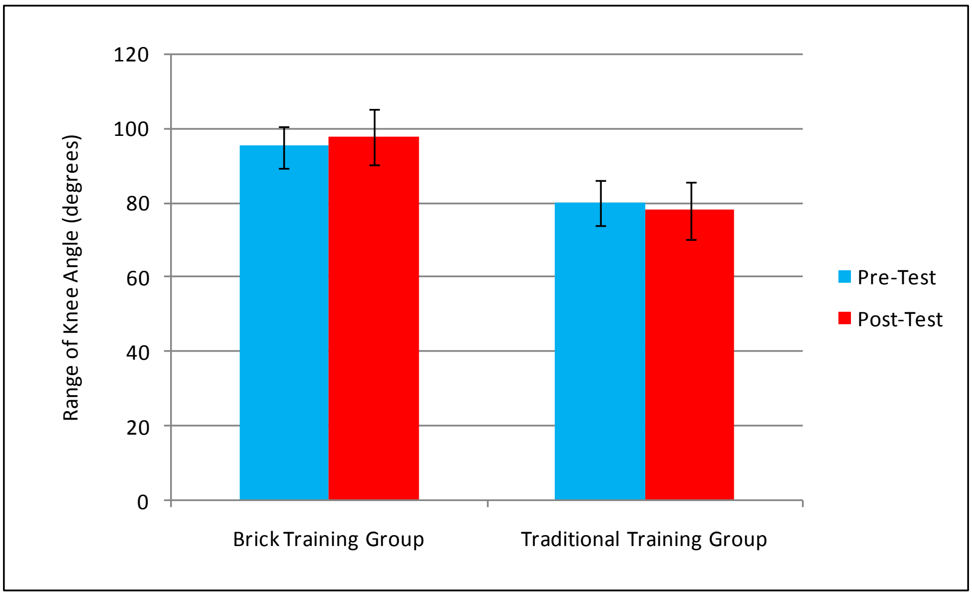

Figure 1: Knee Angle Range

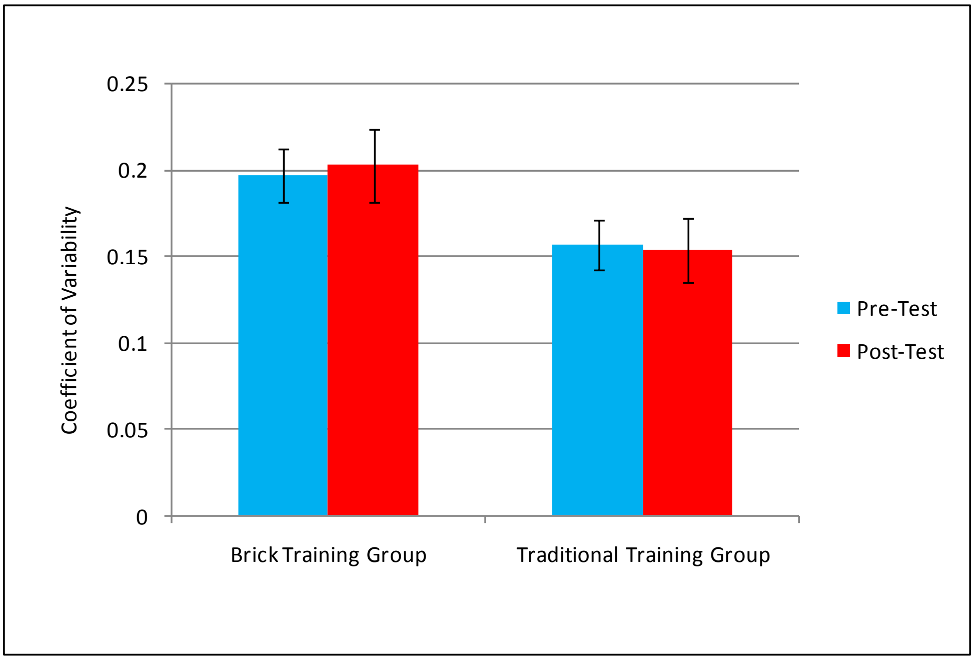

Figure 2: Knee Angle Coefficient of Variability

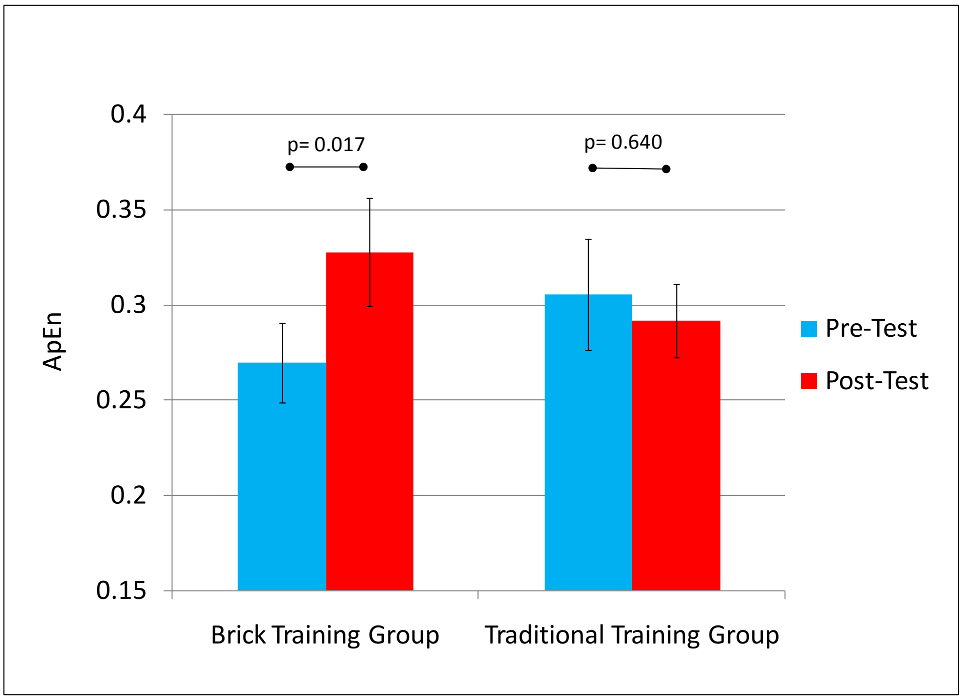

Figure 3: Knee Angle ApEn

DISCUSSION: ApEn has been used to examine temporal structure in the continuous behavior of many biological and movement systems (heart rhythms, postural sway, walking gate). A decrease in ApEn values has been shown in some cases to indicate pathological conditions. For instance, measurements of heart rate complexity proceeding atrial fibrillation have been studied and exhibit decreased ECG ApEn prior to atrial fibrillation (Tuzcu, 2006). In addition, compromised physiology of many systems, including sinus rhythms of heart rate, have been associated with decreased ApEn values amongst the sick and elderly (Pincus, 1994).

Studies of postural control have found that after a cerebral concussion, an athlete's center of pressure oscillations, measured by ApEn are significantly decreased, even up to 96 hours post-injury as compared with their preseason ApEn scores, even when the athlete appears steady (Cavanaugh, 2006). This can be considered a new tool in further assessing an athlete's return to play status that seems to be more sensitive than traditional concussion evaluation techniques

In regards to walking gate, local dynamic stability showed decreased variability when assessed using the Lyapunov Exponent (LyE) amongst ACL reconstruction patients (Stergiou, 2004), and a decreased step width variability amongst young individuals performing attention demanding tasks has also been exhibited (Grabiner, 2005).

Predominately, research from the use of ApEn has indicated that healthy behaviors exhibit increases in temporal variability compared to pathologic behaviors. Increases in temporal variability are indicative of improved overall performance, and increased ApEn with triathletes that perform brick workouts may have the same beneficial results. A limitation to this study is that we didn't quantify any beneficial effect of brick training on the actual performance in a triathlon. Any beneficial effect on performance would be hard to quantify because the bike-run transition is only a small part of an entire triathlon. Additionally, triathlons use different routes making comparisons between triathlons difficult. One further limitation is the small subject sample.

CONCLUSION: This decrease in knee angle temporal predictability found after training for the transition through brick workouts may reflect an increase in fluidity and flexibility of movement. Although speculative, increasing knee angle ApEn could also be beneficial in increasing one's potential for adaptability during the run after the transition. It is important to mention that linear analysis was unable to detect these subtle changes that occur resulting from brick training. Non-linear analysis can detect this hidden information readily and may help to explain why so many triathletes participate in brick training. Upon further investigation, ApEn could be applied as a training tool for triathletes.

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