INTRODUCTION

Many triathletes complain of experiencing difficulties while running following cycling, but these difficulties are usually only felt in about the first kilometer of the run (Millet and Vleck, 2000). To improve performance in the run portion of a triathlon, it would be beneficial to minimize the negative effects from cycling. The purpose of this study was to compare the effects of two cycling positions, sitting up and spinning at the end of the cycling portion versus staying in the tucked riding position, on subsequent running mechanics.

Many studies have been done on the kinematic and physiological changes which occur during running following a bout of cycling (Quigley and Richards, 1996; Hue, et al., 2001; Hausswirth, et al., 1997), but no studies have examined a practical way to minimize the difficulties. The task of cycling is much different than running; one reason being that cycling is a non-weight bearing activity and running is a weight bearing activity in which the body experiences a large increase in impact forces. Another reason athletes may experience difficulties is because of blood flow redistribution time. The primary muscles used in cycling are different than the muscles primarily used in running; as the athlete transitions from one event to the other, there may be a delay in which the blood flow is being redirected to the working muscles (Anderson, 2003). A technique that is used by some triathletes to minimize the negative effects is to sit up and spin in a lighter gear towards the end of the bike portion of a triathlon. This may aid the athlete in the run portion of the triathlon, and examining this technique is beneficial because athletes can possibly utilize it to minimize the effects of the transition.

METHODS

Four college-age volunteers, who train by running and cycling, were used in this study. Informed consents were obtained, with approval from the University IRB. Two tests were conducted for each subject in a random order. A 5-minute warm up run was performed prior to each test. The subjects rode their own bike, mounted to a CycleOps Fluid II stationary trainer, for a 40-minute period, and then transitioned into a 5-minute run at a 5K pace; each subject rode and ran at their own chosen cadence. For the control (C), the subjects remained in the crouched position for the entire 40-minute ride with no change in posture, gear, or cadence on the bike before transitioning into the run. For the treatment (T), during the last 5-minutes of the cycle portion, the subjects sat in a more upright position and pedaled at a faster cadence in a lighter gear before transitioning into the run. Data was collected and analyzed during the first and last portion of each run (labeled C1, C2, T1, T2); for each condition, 4 trials were collected for each subject, over about a 100 m stretch (four cameras set at 20 m distances). Maximum stride length (defined as right heel to left heel displacement), average trunk angle (absolute angle from the right horizontal), and thigh-knee angle (absolute thigh angle from right horizontal and relative thigh to shank angle) were measured for each trial.
A 2D motion measurement system was used for digitizing (60Hz); data was low-passed filtered (6 Hz, Butterworth), and analyzed for the above variables.

RESULTS

Means and SDs across all subjects are seen in Table one. The maximum stride length between all conditions was found to be statistically significantly different ($F = 5.79$, $df = 3$, $p = .001$). Post hoc comparisons showed only C1 to be statistically larger from the other conditions.

Table 1. Average Stride Lengths and Trunk Angles Across Subjects.

<table>
<thead>
<tr>
<th>Stride Length</th>
<th>Trunk Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>mean</td>
<td>mean</td>
</tr>
<tr>
<td>Control1</td>
<td>1.02</td>
</tr>
<tr>
<td>Control2</td>
<td>0.97</td>
</tr>
<tr>
<td>Treat1</td>
<td>0.97</td>
</tr>
<tr>
<td>Treat2</td>
<td>0.97</td>
</tr>
</tbody>
</table>

Average trunk angles showed no significant differences. However, a trend in C1 and C2 was seen with a more forward leaning posture, while the angle during T1 and T2 was more erect.

The high-knee angle diagrams demonstrated differences within each subject. Averaged across subjects, the T2 diagram showed greater hip flexion over the other conditions (Figure 1), indicating a greater range of motion of the hip. For C1, FS occurred on average with less hip flexion, but similar hip extension and knee motion to the other conditions.

DISCUSSION AND CONCLUSIONS

The statistically significant difference of C1 when compared to the rest of the conditions shows that there was a change in the running step length after cycling, while the run during T1 was much more similar to the latter runs of C2 and T2. It is apparent that there is a possibility of the treatment influencing the subsequent run due to the similarities of step length. It is inconclusive whether each subject likely reached a steady state by the end of both conditions, though the similar step length of C2, T1 and T2 gives some indication of this.

REFERENCES


