THE EFFECTS OF HEEL LIFTS ON MUSCLE ACTIVITIES OF FEMALE NON-HABITUAL HIGH-HEELS WEARERS

Thanaporn Tunprasert (1), Alison Hatton (1), Michaela Long (1), Sherlon Ferguson (1), Charlie Bacon (1)

1. University of Brighton, UK

Introduction

A heel lift is a device that can increase the height of the heel area of the foot further than that provided by the existing height of the shoe. Heel lift orthoses are commonly prescribed as part of conservative treatment plans for pathologies such as Achilles tendinopathy [1], but the exact biomechanical mechanisms by which orthoses assist in rehabilitation are not fully understood. It is plausible that altered muscle activity in the gait cycle correlates with the addition or height changes of heel lift. The triceps surae (TS) is attached to the calcaneus by the Achilles tendon. Interventions aimed at reducing demands of this tendon during rehabilitation by use of heel lifts may also affect the muscle activities of the involved muscles, which can be illustrated by electromyography (EMG). The TS (ankle plantarflexor) is usually consistently active in stance, having a phasic relationship with the tibialis anterior (TA) (ankle dorsiflexor) [2]. These muscles all play a vital role in locomotion and foot stability during gait and by their phasic nature, possibly affecting each other or the Achilles tendon [3]. However, previous studies show inconsistent and conflicting evidence about the exact nature of changes in muscle activity in relation to employment of heel lifts [4].

Our study aimed towards therapeutic implications by employing 6mm and 12mm high density tapered heel lifts which are commonly prescribed in a clinical setting, focusing on females who do not habitually wear high heels, in order to further our clinical understanding of the effects of heel lifts on muscle activities in the lower leg.

Methods

A total of 11 healthy female non-habitual high-heels wearers (age= 24±4 yrs, height= 165.08±5.57 cm, weight= 70.33±15.39 kg), without any musculoskeletal, neurological or systemic conditions that may affect a normal walking gait, participated in the study. Surface EMG was used to measure the muscle activities of gastrocnemius medialis (GM), gastrocnemius lateralis (GL), soleus (SL) and tibialis anterior (TA) muscles under three different conditions: walking with barefoot (BF), with 6mm heel lift and with 12mm heel lift. To simulate even surface mobility and to achieve a consistent average walking speed, participants were asked to walk on the treadmill at an average speed of 4.5kmph.

Results

<table>
<thead>
<tr>
<th>Muscle</th>
<th>% change (BF to 6mm)</th>
<th>SD and range</th>
<th>% change (BF to 12mm)</th>
<th>SD and range</th>
</tr>
</thead>
<tbody>
<tr>
<td>GM</td>
<td>-11.15</td>
<td>13.40 5.89, -43.18</td>
<td>-10.77</td>
<td>35.69 54.80, -92.98</td>
</tr>
<tr>
<td>GL</td>
<td>8.68</td>
<td>63.77 195.17, -46.06</td>
<td>-9.97</td>
<td>22.04 17.96, -56.01</td>
</tr>
<tr>
<td>SL</td>
<td>-5.31</td>
<td>32.50 78.83, -56.89</td>
<td>-8.60</td>
<td>37.03 72.68, -80.20</td>
</tr>
<tr>
<td>TA</td>
<td>14.66</td>
<td>87.95 276.29, -46.56</td>
<td>12.81</td>
<td>72.06 164.09, -92.38</td>
</tr>
</tbody>
</table>

Table 1: Percentages of change in EMG activities from BF and 6mm heel lift conditions, and from BF to 12mm heel lift conditions, including the standard deviations (SD) and the ranges of the percentages of change. Positive results indicate an increase in EMG activities whilst negative results indicate a decrease in EMG activities between the conditions.

Discussion

In the management of Achilles tendinopathy, heel lifts are normally employed with a purpose to help reduce the demands on the AT. The overall decreases in the % change results of the posterior muscles (i.e. GM, GL and SL) shown in this study could suggest that, in order to perform the same walking activity, less muscle contractions are required with the use of heel lifts. However, there is no significant difference found between “% change (BF to 6mm)” and “% change (BF to 12mm)”, which suggests that both heel lift heights have similar effects in relation to the reduction of the posterior muscles’ EMG activities. Despite its potential benefits, increased heel heights could also impair the balance of the body [5]. This has raised a question concerning clinicians’ justifications when employing different heights of heel lifts in their Achilles tendinopathy management regimes. Similar studies should be performed with participants who have Achilles tendinopathy to further our understanding of the subject in the pathological population.

References