EXAMINING THE EFFECTS OF ALTERING HIP ANGLE ON GLUTEUS MEDIUS AND TFL MUSCLE ACTIVATION INTERPLAY DURING COMMON NON WEIGHT-BEARING HIP REHABILITATION EXERCISES

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INTRODUCTION
It is common clinical practice to incorporate non weight-bearing (NWB) exercises aimed at challenging gluteus medius (GMed) in the early stages of rehabilitation of lower extremity and low back injuries. GMed activity in NWB hip rehabilitation exercises has typically been compared to weight-bearing exercise conditions [1,2] or loaded versions of the same unloaded NWB exercise [3]. Little is known of the effects of altering hip angle when performing these exercises. Specifically, muscle activation levels of GMed and its interplay with other synergists, such as tensor fasciae latae (TFL), have not been investigated. One study [2] incorporated two variations (i.e., 30 and 60 degrees of hip flexion) of the side-lying clamshell exercise and found similar GMed activity, but synergists were not examined. The objective of this study was to assess the effect of altering hip angle during the side-lying clamshell and side-lying hip abduction exercises on the relative muscle activation profiles of GMed and TFL.

METHODS
Eleven healthy males (23.8 ± 3.4 years, 177.7 ± 6.2 cm, 74.5 ± 6.2 kg) participated in this study. Each participant performed two NWB gluteus medius rehabilitation exercises – the side-lying version of the clamshell and hip abduction exercises – in three conditions, while electromyography (EMG) signals of the right GMed and TFL were recorded. The hip flexion angle was varied from 30, 45, and 60 degrees for the side-lying clamshell exercise and from internal, external, and neutral hip rotation orientation for the side-lying hip abduction exercise. The ratio of GMed-to-TFL peak EMG signal amplitude was compared across conditions for each exercise. Separate one-way repeated measures analyses of variance (ANOVA), followed by post hoc analyses, were performed for each exercise to examine the differences in the relative muscle activity of GMed and TFL across conditions.

RESULTS
No significant difference was found between the three conditions of the side-lying clamshell. Regardless of the hip flexion angle when performing this exercise, the relative muscle activity of GMed and TFL did not vary a significant amount and the GMed-to-TFL peak EMG signal amplitude ratio remained well above 1.0 (Table 1). Across all conditions, the average peak EMG signal amplitude for GMed and TFL during the side-lying hip abduction exercise was 40.97 ± 18.77% MVC and 38.13 ± 22.46% MVC, respectively.

Table 1: GMed-to-TFL peak EMG signal amplitude ratios for all three conditions of the side-lying clamshell and hip abduction exercises.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Condition</th>
<th>Mean GMed-to-TFL peak EMG signal amplitude ratio (± 1 SD)*</th>
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</thead>
<tbody>
<tr>
<td>Side-lying clamshell</td>
<td>30° of hip flexion</td>
<td>5.44 (5.36)</td>
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<tr>
<td></td>
<td>45° of hip flexion</td>
<td>5.08 (4.06)</td>
</tr>
<tr>
<td></td>
<td>60° of hip flexion</td>
<td>6.70 (6.60)</td>
</tr>
<tr>
<td>Side-lying hip abduction</td>
<td>Internal rotation</td>
<td>1.23 (0.38)</td>
</tr>
<tr>
<td></td>
<td>Neutral rotation</td>
<td>1.21 (0.33)</td>
</tr>
<tr>
<td></td>
<td>External rotation</td>
<td>1.37 (1.03)</td>
</tr>
</tbody>
</table>

*Any number above 1.0 indicates a GMed-dominant condition.

DISCUSSION & CONCLUSIONS
The side-lying clamshell and hip abduction exercises are GMed-dominant (relative to TFL), regardless of the hip flexion angle and rotation orientation, respectively. Therefore, these exercises are appropriate choices in hip rehabilitation exercise programs to promote GMed activation; however, it appears that hip flexion angle and rotation orientation are not important considerations for increasing GMed muscle activation when prescribing and performing the side-lying clamshell and hip abduction exercises, respectively. Proper technique (e.g., no spine ‘twisting’ or rotation at the pelvis to initiate the movement) is likely a more substantial consideration when prescribing and performing these exercises. These findings provide information to clinicians that can enhance effective prescription of these common NWB hip rehabilitation exercises.

REFERENCES

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