Gluteus Maximus Activity during Bilateral Countermovement Jump in D1 Female Athletes

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Gluteus Maximus Activity during Bilateral Countermovement Jump in D1 Female Athletes

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Valparaiso University Department of Kinesiology

Abstract

The objective of this study was to compare left and right Gluteus Maximus muscle activation in division one (D1) female basketball players, while performing a countermovement jump (CMJ). The study asked, “What impact does the bilateral CMJ have on gluteal activation in D1 female athletes?” The null hypothesis stated no significant differences would be found in gluteal activation between the right and left Gluteus Maximus muscles. Nine female participants volunteered for the study. Pre-screening of participants involved assessment of the Functional Movement Screen™ squat pattern and muscular voluntary isometric contractions (MVIC) of the right and left Gluteus Maximus. Surface electrodes were placed on the belly of each gluteus maximus to record muscle activation while performing three trials of the CMJ. Data was analyzed using the Delsys EMGWorks® software. Root mean square (RMS) values were normalized to the MVIC for each muscle. Nine female Division I basketball players volunteered for the study. Pre-screening of participants involved assessment of the Functional Movement Screen™ squat pattern and muscular voluntary isometric contractions (MVIC) of the right and left Gluteus Maximus. Surface electrodes were placed on the belly of each gluteus maximus to record muscle activation while performing three trials of the CMJ. Data was analyzed using the Delsys EMGWorks® software. Root mean square (RMS) values were normalized to the MVIC for each muscle.

Introduction

A bilateral countermovement jump is used to evaluate muscle activation of the lower extremities. A countermovement jump activates the gluteal muscles and provides a relationship between muscle activation and vertical jump height. Vertical jump height during the countermovement is affected by depth squat and gluteal activation. Gluteus Maximus provides stability, explosiveness, strength, aids in daily life tasks, and controls gait. The Gluteus Maximus is the prime mover during hip extension and lateral rotation. Gluteal weakness will alter the function of the gluteus maximus and may cause disruption of the kinetic chain. Kinetic chain disruption alters how the human body functions and may be a result of inflammation, hip flexor tightness, pelvic alignment, and core weakness. Evaluation of gluteal activation provides useful information in sports-related, therapy, and training settings.

Methods

Setting

• Small DI Midwestern University laboratory
• Fall 2019

Participants

• 9 female Division I basketball players

Procedures

• Five-minute dynamic warm-up on exercise bike.
• FMS™ squat assessment was performed and video was recorded.
• Skin surface above R & L Gluteus Maximus prepared and secured with electrode sensors.
• MVIC collected for each muscle.
• 3 CMJs performed while video-recorded.
• Jump heights were recorded for each CMJ.
• Electrodes detecting muscle activity sent data via Bluetooth to computer program.
• Matched-paired t-test with replication used to analyze the data.

Results

Table 1

Mean Countermovement Jump Height (in)

<table>
<thead>
<tr>
<th>Participant</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGM</td>
<td>20.6</td>
<td>16.1</td>
<td>20.6</td>
<td>16.7</td>
<td>15.7</td>
<td>16.6</td>
<td>17.1</td>
<td>19.1</td>
<td>18.4</td>
<td>17.9</td>
</tr>
<tr>
<td>LGM</td>
<td>26.1</td>
<td>24.0</td>
<td>24.0</td>
<td>77.6</td>
<td>36.8</td>
<td>16.1</td>
<td>n/a</td>
<td>59.6</td>
<td>74.8</td>
<td>40.5</td>
</tr>
</tbody>
</table>

Gluteus Maximus muscle activation during bilateral CMJ.

Table 2

Comparison of mean percent MVIC muscle activation: CMJ

<table>
<thead>
<tr>
<th>Participant</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>K</th>
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</thead>
<tbody>
<tr>
<td>RGM</td>
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<td>35.8</td>
<td>197.3</td>
<td>179.7</td>
<td>152.0</td>
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<td>86.3</td>
<td>139.7</td>
<td>102.8</td>
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<tr>
<td>LGM</td>
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<td>42.5</td>
<td>83.5</td>
<td>112.3</td>
<td>122.8</td>
<td>16.1</td>
<td>92.6</td>
<td>33.4</td>
<td>313.1</td>
<td>74.17</td>
</tr>
</tbody>
</table>

Table 3

Comparison of mean percent MVIC muscle activation: Landing

<table>
<thead>
<tr>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGM</td>
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<td>25.7</td>
<td>153.5</td>
<td>226.7</td>
<td>48.4</td>
<td>24.1</td>
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<tr>
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<td>77.6</td>
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<td>16.1</td>
<td>n/a</td>
<td>59.6</td>
<td>74.8</td>
<td>40.5</td>
</tr>
</tbody>
</table>

Acknowledgements

I would like to express my deepest gratitude to Dr. Kelly Helm for her assistance, encouragement, and guidance she provided during this research project. I would also like to thank Professor Guelcher and Alice Lampmann from College of Engineering for their help during data collection. I would also like to thank Tamara Wade, from the statistics department, for assisting in the statistical analysis in this research project. A special thanks to the Valparaiso University women’s basketball team for their willingness to participate in the research and the coaches for their approval.

Conclusion

Statistical analyses indicated no significant difference between left and right Gluteus Maximus muscle activation. However, differences in muscle activation between the right and left Gluteus Maximus muscles were found when comparing countermovement and landing portions of the jump. Continuous, unequal gluteal activation and favoring one side to another may result in an overuse injury and cause a gradual increase in muscle imbalances. Researcher concluded that EMG of the CMJ did not indicate a high degree of variance in muscle activity between right and left Gluteus Maximus. Future research should include a larger sample size, a more demanding and force generating bilateral movement, and increased amount of MVIC trials for normalizing data.

References


