The Role of Extensor Digitorum Longus and Peroneus Muscles in Ankle Instability Individuals during Single-leg Inverted Landing

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Summary

This study investigated the muscle contribution of extensor digitorum longus (EDL), peroneus longus (PL), and peroneus brevis (PB) muscles in individuals with chronic ankle instability (CAI) during single-leg landings. Twenty CAI and twenty healthy individuals performed single-leg landings on flat and inverted platforms. Results showed delayed PL activation and lower post-landing PL activity in the CAI group, leading to greater peak ankle inversion. Additionally, CAI individuals exhibited significantly lower EDL activation at peak ankle inversion, highlighting its role as a secondary stabilizer. These findings suggest that impaired neuromuscular control of both PL and EDL muscles contributes to excessive ankle inversion in CAI, emphasizing the importance of EDL activation in maintaining lateral ankle stability.

Introduction

A high prevalence of sustaining an initial lateral ankle sprain (LAS) can lead to CAI[1]. LAS commonly occurs during landing with ankle inversion [2], highlighting the crucial role of evertor muscles, particularly the peroneus muscles [3]. The individuals with CAI had a delay in the peroneus muscle activation and decreased peroneus muscle firing [4, 5]. The EDL is a synergist of peroneus muscles by everting the foot [3]. The CAI patients had ankle weakness when the function of the EDL was limited [6] and the CAI can negatively impact ankle function and long-term well-being [7, 8]. Little is known about the neuromuscular control of the EDL muscle during a single-leg landing, particularly in a simulated inversion condition. This study investigated the muscle activation and latency of the EDL, PL, and PB muscles in individuals with CAI during single-leg drop landing tasks on an inverted and non-inverted platform.

Methods

Twenty CAI individuals (CAIT <24) and twenty healthy individuals (CAIT=30) were recruited in this study. The participants were required to perform single-leg drop landings from a 30 cm height onto a flat platform and a 20-degree inverted tilted platform. Each participant completed a total of eight trials with unexpected pseudo-randomization. The wireless surface electromyography (EMG) system (Delsys Incorporated, USA) was used to collect EMG signals of PL, PB, and EDL. The root mean square (RMS) EMG signals were analyzed. Additionally, the ankle inversion angle was measured during each landing with a motion capture system (Motion Analysis Corporation, USA).

Results and Discussion

The two-way repeated measure analysis of variance (ANOVA) revealed a significantly longer PL muscle latency ($F = 15.68$, $p < 0.001$) and lower PL muscle activation in the post-landing phase ($F = 8.47$, $p = 0.004$) in the CAI group than in the control group, resulting the CAI group showing greater peak ankle inversion than the control group ($F = 176.18$, $p < 0.001$) as the risk of excessive ankle inversion. A significant group-by-task interaction effect of EDL activation was observed at the peak ankle inversion. The pair-wise post hoc comparison revealed the CAI group during the inversion landing ($p = 0.011$) and normal landing ($p < 0.001$) task showed a significantly lower EDL muscle activation than the control group during the inversion landing task **(Figure 1)**, suggesting EDL muscle is important for stabilizing the lateral ankle to prevent excessive ankle inversion.

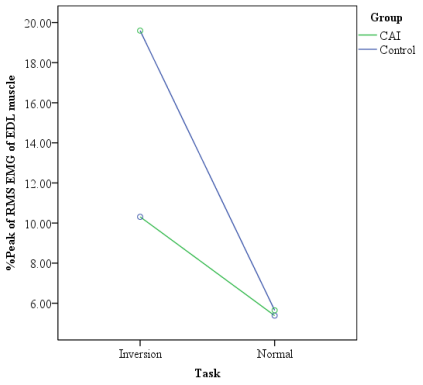

Figure 1 The interaction effect between group-by-task RMS EMG of EDL muscle

Conclusions

The PL muscle is crucial in stabilizing the ankle and preventing excessive inversion. Additionally, the EDL is a secondary stabilizer contributing to ankle stability in both frontal and sagittal planes, specifically during inversion landings.

References

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