IS MUSCLE CO-ACTIVATION A PREDISPOSING FACTOR FOR LOW BACK PAIN DEVELOPMENT DURING STANDING?

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INTRODUCTION

Occupations involving static postures such as prolonged standing have been associated with low back pain (LBP) development [1]. While trunk muscle co-activation has been found in people with LBP compared with healthy controls [2], it is unknown whether these differences preceded the development of the LBP problem. Therefore, it cannot be determined whether the muscle co-activation is an adaptation to LBP or a predisposing factor.

Previous work [3] has found muscle co-activation to be associated with LBP development in previously asymptomatic individuals. The purpose of this study was to investigate whether muscle co-activation is a predisposing versus adaptive factor in standing-induced LBP. A multifactorial approach including clinical assessment tools and psycho-social questionnaires was used to enhance the clinical relevance of the work.

METHODS

43 volunteers, 22 male and 21 female, with no history of LBP were enrolled. Following a clinical examination by a physical therapist, 16 channels of continuous electromyography (EMG) from the trunk and hip were collected during 2-hrs of standing. Participants were instructed to ‘stand in their usual style’ as they completed light occupational tasks. Participants rated LBP on a 100 mm visual analog scale (VAS) every 15 min. Participants who exhibited increases of LBP > 10 mm were considered to be pain developers (PD).

Muscle co-activation was quantified with co-contraction index [4] (CCI). Three-way general linear models (group, gender and time) were used for statistical analyses with $p<0.05$ for significance.

RESULTS

Participants clearly separated into two groups with 40% of participants being classified as PD (Figure 1). There were no gender differences in pain development, gluteus medius or trunk flexor/extensor co-activation as quantified by CCI.

Figure 1: PD and NPD were clearly separated based upon VAS scores during the 2-hours of standing.

Figure 2: PD demonstrated higher gluteus medius muscle CCI than NPD, especially during early and late stages of standing (*$p < 0.05$).
The only clinical assessment tool that predicted PD was a novel Active Hip Abduction (AHAbd) test (\(p < 0.05\)) [5]. Bilateral gluteus medius and trunk flexor/extensor CCI values were higher in PD versus NPD during the initial and final stages of standing (Figure 2).

PD and NPD groups demonstrated different modulation of co-contraction throughout the standing period. PD had a decrease in both trunk and gluteus medius co-contraction during the middle portion of standing, corresponding to the period of acute pain development (Figure 3), while the NPD group had an overall increase in their co-contraction levels during the same time period (Figure 4).

**DISCUSSION**

Low back pain developers had increased co-contraction prior to any subjective reports of pain, leading us to conclude muscle co-activation is a predisposing rather than adaptive factor for LBP development during this task. PD also demonstrated decreased frontal plane control and reported more difficulty in performance during the AHAbd clinical test. Muscle co-activation during standing in this group may be present as a compensatory motor control pattern for an underlying deficiency in trunk control that has not yet manifested with clinical LBP symptoms. A combination of the above findings could be useful in early identification of individuals who are at-risk for LBP, especially those exposed to occupational tasks involving prolonged standing.

**CONCLUSIONS**

Individuals who develop LBP during standing demonstrate different muscle activation patterns than individuals who do not develop LBP. Differences exist prior to pain development, and therefore may be a predisposing factor for LBP during standing. Some increase in muscle co-activation during a relatively static, prolonged task, may provide some protection against LBP development.

**REFERENCES**


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