INTRODUCTION

To aide understanding altered neuromuscular recruitment patterns in a low back pain population, improved metrics based on objective data are required. The purpose of this study was to compare trunk muscle activation patterns in a low back injured group (LBI) with an asymptomatic group (ASYM) during two controlled pelvic stabilization exercises, using principal component (PC) analysis.

METHODS

Thirty LBI and 51 ASYM participants of both sexes volunteered for the study. The LBI group reported a significant bout of low back pain within the previous 12 weeks, which they self-reported had resolved. The ASYM group had no recent history (>1yr) of low back pain.

Following a series of maximum isometric voluntary contractions (MVCs), participants performed a supine trunk stability test [1], with two levels of difficulty: Level 1 with the leg supported, Level 2 with no support.

Electromyographic (EMG) data collected from 24 trunk muscle sites (abdominal and back extensors) were full wave rectified and low pass filtered (6 Hz). Data for the entire exercise were time normalized to 100%, then amplitude normalized to the appropriate MVC. EMG ensemble average waveforms for three trials per condition were entered into a PC analysis model, using a covariance matrix. Mixed model ANOVAs were performed on PC scores explaining more than 89% of the variance.

RESULTS

Four PCs explained 89% and 96% of the variance for the abdominal and back muscles, respectively, with both groups having similar shapes in the first 3 PC patterns. Significant main effects and interactions for each PC score are shown in Table 1. Three abdominal PCs had group*level interactions, whereas only PC1 did for the back muscles.

DISCUSSION AND CONCLUSIONS

PC1 captured the overall mean pattern, with an increase in amplitude as the left leg was lifted and lowered (Figure 1). The group*level interaction plot for the abdominals showed that the LBI group PC1 score was significantly higher than the ASYM, as was Level 2 compared to 1. PC2 captured the increased muscle activity mid-phase, as well as a decrease in activations at the beginning and end of the pattern. The group by muscle interaction for the abdominals was primarily associated with an increase in activation with the Level 2, whereas there was a strong L>R tendency in the back muscles. PC3 captured a large increase in activity in the initial 10% of the pattern and in the last 15%, more so in the abdomen than the back. This is largely attributed to the initial stabilizing activity of the internal obliques. However, early and late muscle activation levels in the back were significantly higher in the LBI group. Finally, PC4 captured the tendency for some muscles to increase their activity during the initial left leg lift (15% timeline), but drop off substantially in the final 20%. For the abdominals, there was a consistent L>R trend.

This study demonstrates that, despite the perception of readiness to resume normal activities, participants in the LBI group still had altered amplitude and temporal muscle activation levels compared to the ASYM group. There was also an overall trend of increased co-contraction in the LBI group: less ability to fine tune muscles according to the applied moment.

REFERENCES