

Investigating the distribution of back muscle activity during a fatiguing task in people with low back pain

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Introduction

- Low back pain (LBP) is globally recognised as a major cause of disability. Approximately 70-84% of people will experience symptoms, with 540 million people experiencing 'activity-limiting' LBP at any one time (1, 2).
- High density electromyography (HDEMG) is a means of measuring the electrical activity within a muscle during a contraction. This information can be used to provide insights into changes in the activity of the muscle while completing a task (3).
- Previous HDEMG studies identified differences between the muscle activity of LBP and asymptomatic control participants as they completed functional tasks (3, 4).
- No previous study investigated endurance in the lumbar erector spinae muscle (ES) during a body-weight holding task (5).

Aim

- To investigate changes in muscle activity between a LBP and a control group while completing a lumbar endurance test (Ito test).

Methods

- 13 control (CON) (Age 26.46 ± 5.0) and 13 low back pain (LBP) (Age 27.39 ± 9.7) participants were recruited from the University of Birmingham.
- A HDEMG grid of electrodes (13x5, OT Bioelectronica) was placed over the lumbar ES, on the right hand side for CON and the most painful side for LBP participants (Figure 1).
- To complete the Ito test, participants were instructed to raise their chest from the bed while maintaining a neutral position of their neck (Figure 1) (6).
- Endurance time and muscle activity were recorded simultaneously to a maximum of 300 s and task failure was defined by a deviation in trunk height of more than 10° , measured by a digital goniometer.
- Results were analysed using two-way repeated measures ANOVA and a paired student t-test.

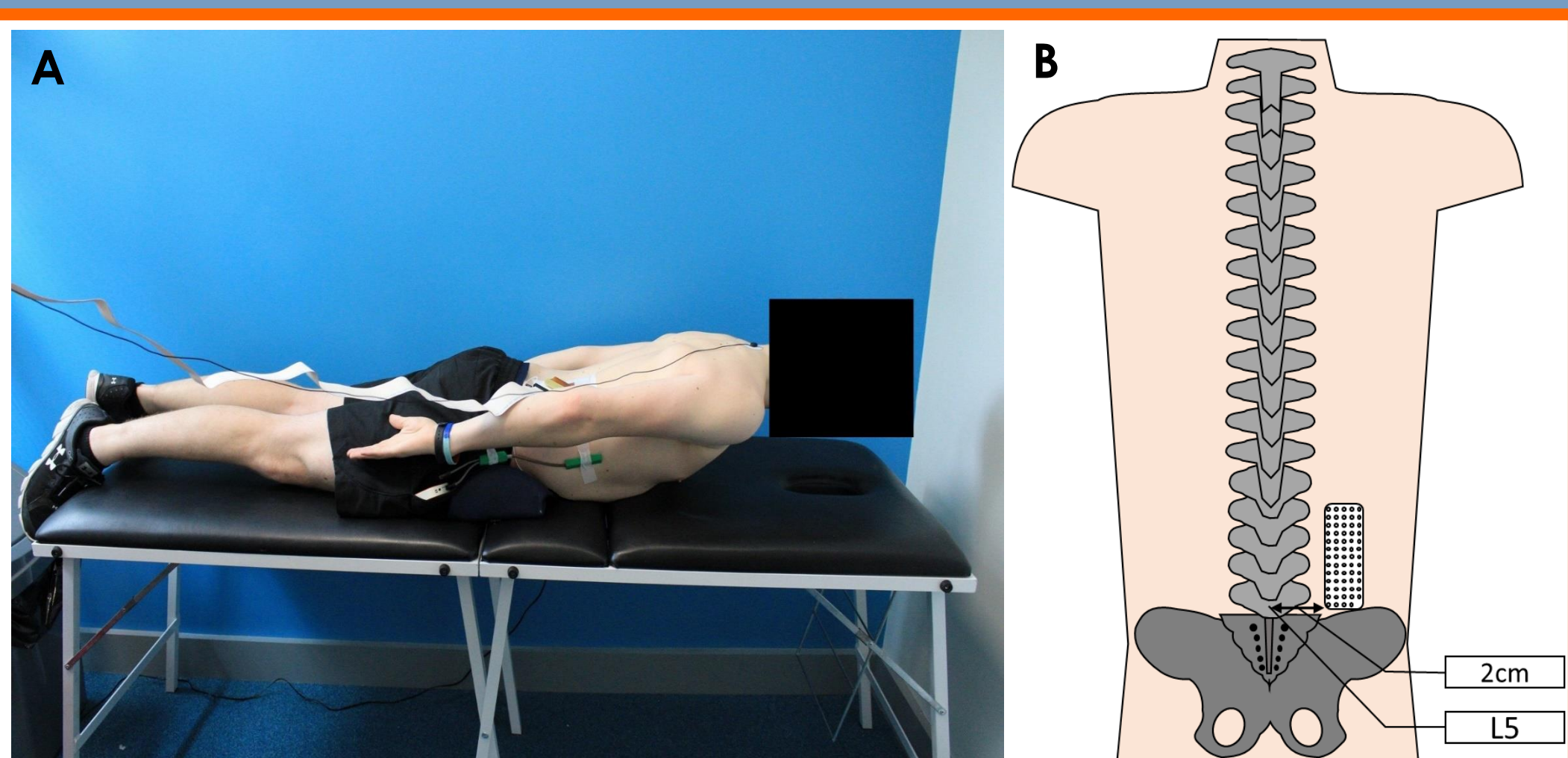


Figure 1. Example of the Ito Test protocol (A) and schematic of HDEMG Placement (B)

Results

- The mean endurance time for CON was 283.0s (SD ± 33.0 s) and LBP was 186.2s (SD ± 72.33 s), a difference of 96.7s ($p < 0.01$) (Figure 2).

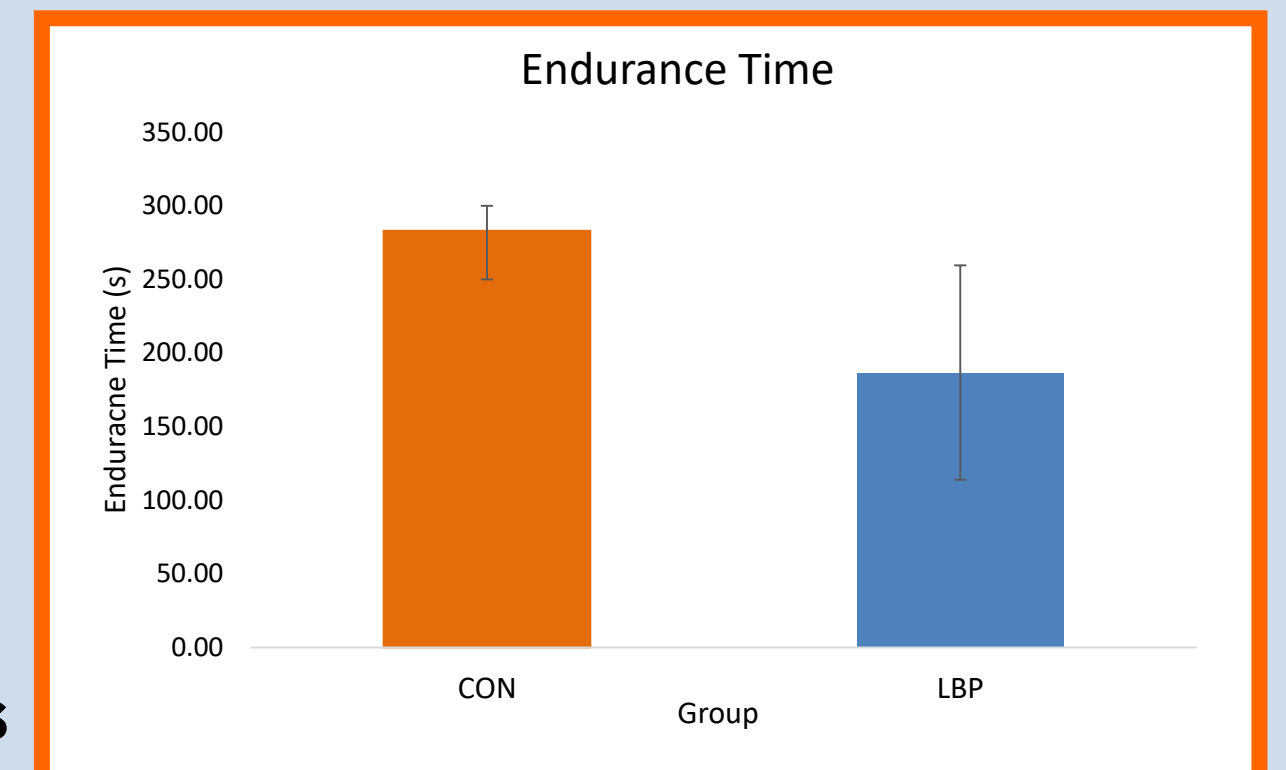


Figure 2. Mean endurance time for Low back pain (LBP) and Control (CON) groups

- A lower overall activation of the ES was seen in LBP participants; the centre of contraction was higher in the muscle and moved less throughout the task than in the CON participants ($P < 0.05$).
- Regression analysis showed that participants with a larger movement of the centre of activity were able to sustain the contraction for longer ($P < 0.01$).

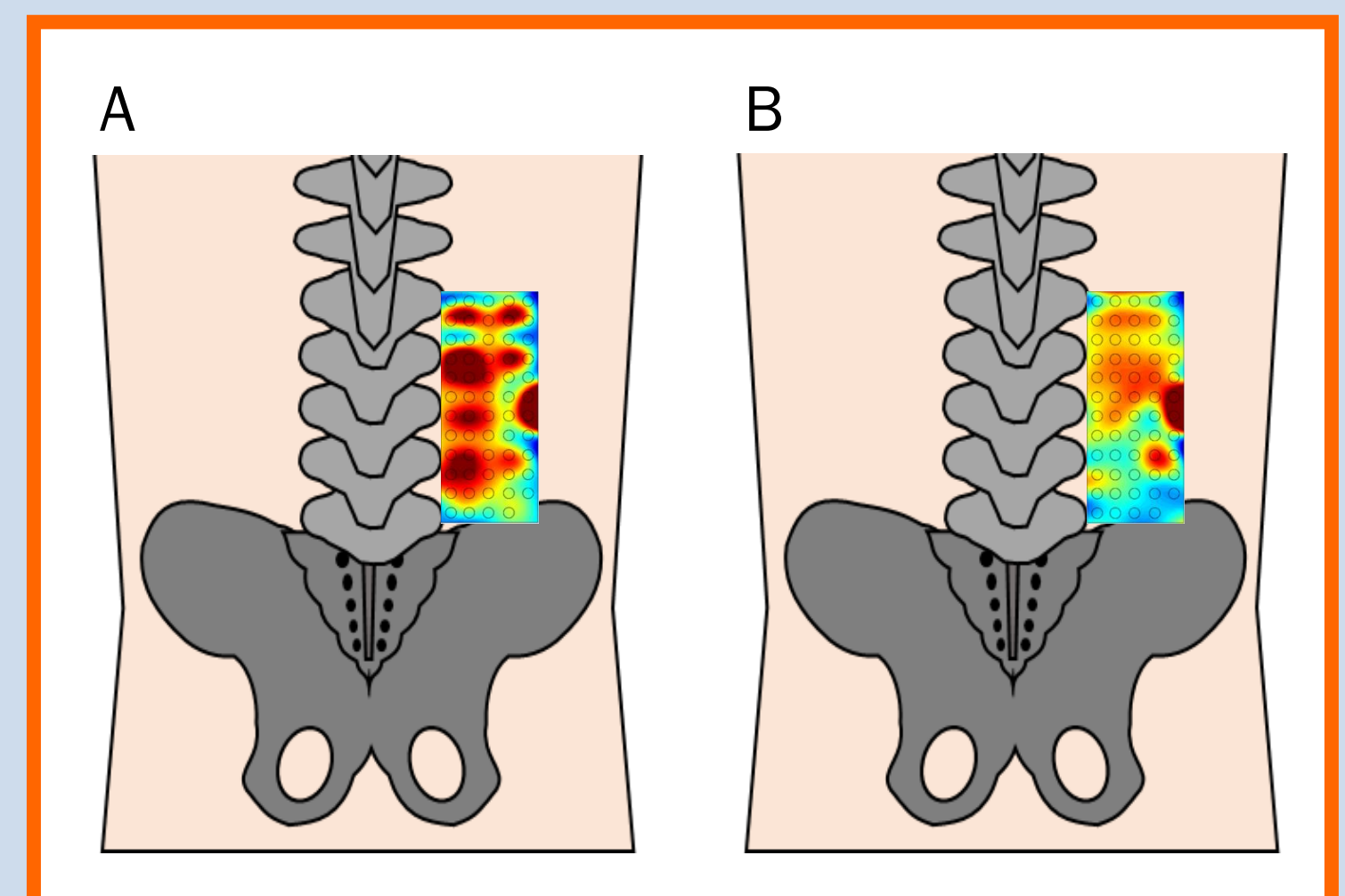


Figure 3. Demonstrating the activation pattern of a CON (A) and LBP (B) participant, where higher activation is indicated by red.

Discussion

- Participants with LBP showed poorer performance on the task, characterised here by the shorter endurance time.
- The activation pattern demonstrated by the LBP group indicated that a different muscle strategy was used to perform the endurance task; possibly relying on weaker or less biomechanically favourable muscles.
- It is thought that the lower overall redistribution of the activity in the LBP group could cause localised fatigue within the muscle, leading to the shorter endurance time.

Conclusion

- Participants with LBP showed decreased endurance and altered contraction characteristics.
- By adding to the understanding of the muscle activation strategy in LBP participants, these results have relevance for ongoing pain, particularly in the context of personalised rehabilitation.

References

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