

Differences in muscle activation patterns during walking between chronic low back pain patients and controls

BACKGROUND AND OBJECTIVE

Different models exist explaining the development and maintenance of chronic pain. Examples are the pain-spasm-pain (Johansson, 1991), pain-adaption (Lund, 1991), fear-avoidance (Vlaeyen, 1995) and avoidance-endurance model (Hasenbring, 2000). All models have in common that muscle activity is related to pain through different mechanisms, varying between muscular insufficiency or hyperactivity. The aim of this study is to explore differences in surface ElectroMyoGraphy (sEMG) patterns of trunk muscles between patients with chronic low back pain (CLBP) and healthy controls during walking at different velocities. Secondly, differences between patients with high and low fear of movement are explored.

METHODS

In a cross sectional study twenty-two patients with CLBP and eleven healthy controls were studied. Participants walked on a treadmill at different velocities (ranging from 1.4 km/h to 5.4 km/h with increasing steps of 0.8 km/h). Kinematic data of trunk and lower extremities were obtained using a optical three-dimensional gait analysis system (VICON 370). Simultaneously sEMG data of back muscles (erector spinae (ES) L1 and L4 bilaterally) were obtained using a 16 channel surface EMG (Glonner) system. Fear of movement was measured with the Tampascale (TSK). Smoothed rectified EMG (SRE) patterns were calculated per gait cycle and for the single and double support (DS) phases separately.

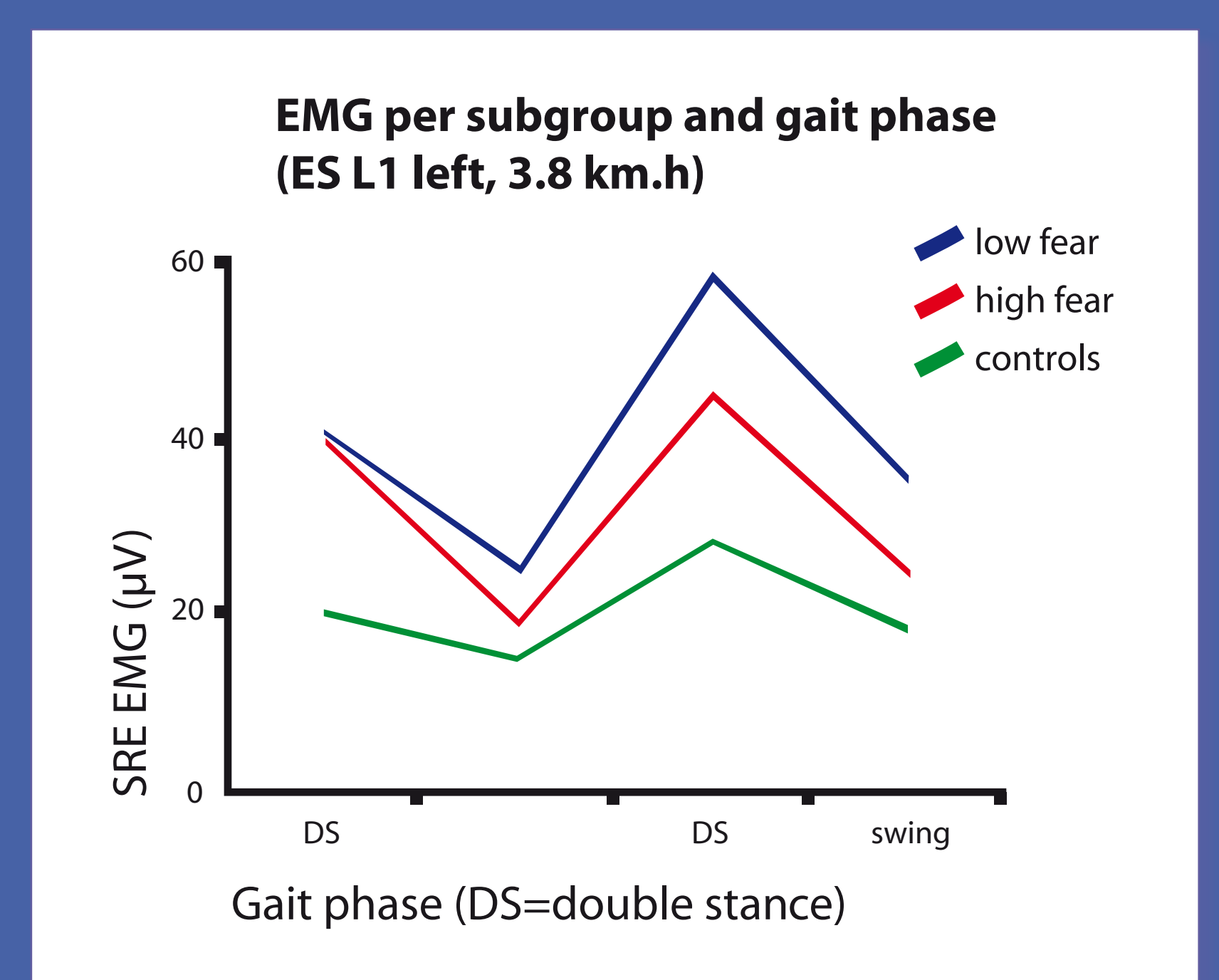
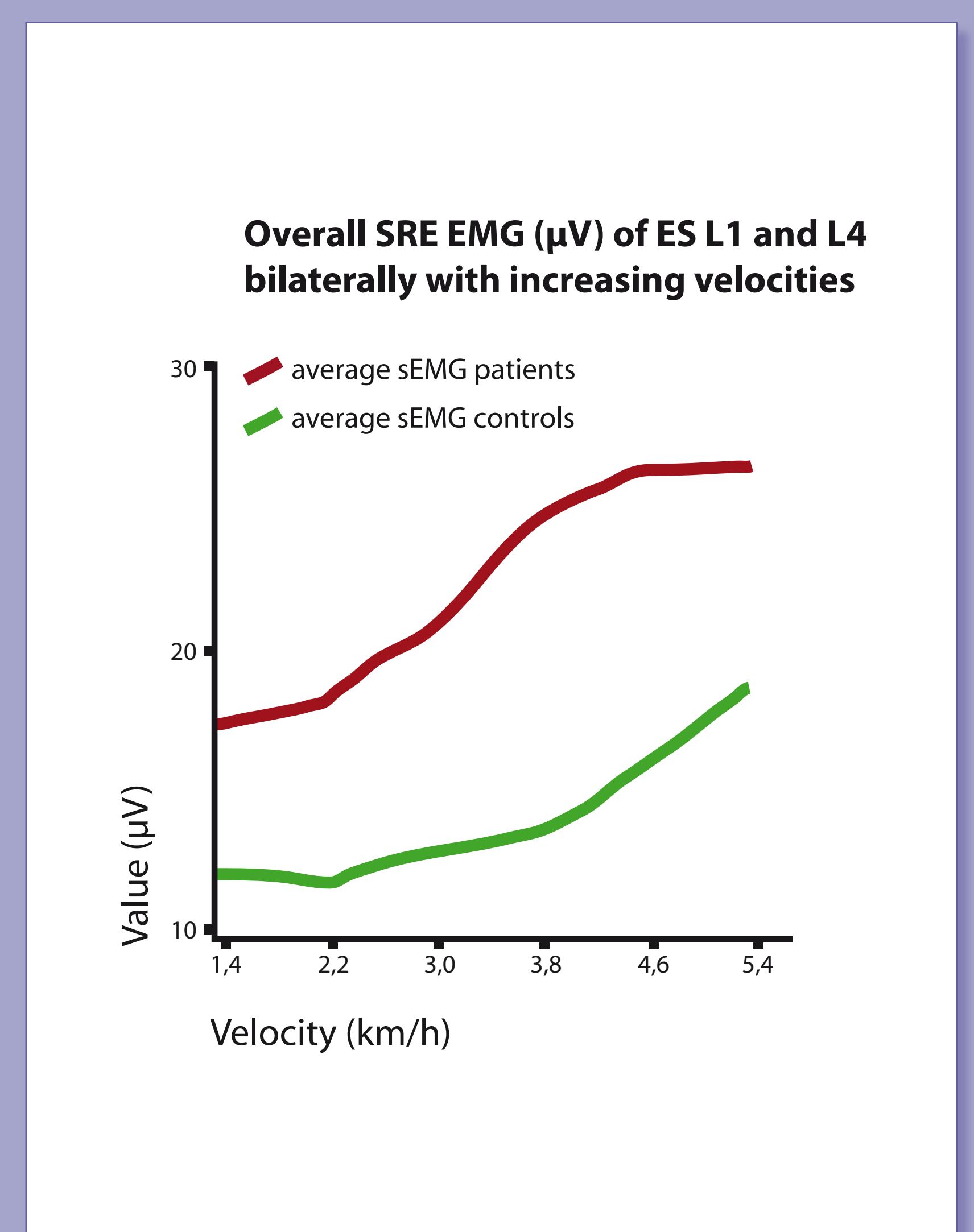
RESULTS

Significant higher SRE values for each muscle were found in patients compared to controls. SRE values increased with walking velocity. In the control group, the relationship between SRE and velocity was characterized by a hyperbolic curve. The lowest SRE values were shown at 2.2 km/h, probably representing the optimal walking speed. Patients showed a less clear hyperbolic curve.

Analysis of the four gait phases showed that the differences between patients and controls were most evident during the double support phase. Subdivision of the patients based on level of fear of movement, showed significantly higher SRE values for all back muscles (except ES L4 right) in patients with low fear of movement.

CONCLUSION

The overall higher levels of sEMG in patients compared to controls are in line with the pain-spasm-pain model. However, the differences in sEMG between patients with differences in fear avoidance levels plead in favour of the model of Hasenbring. It indicates that subgroups of patients have different motor control responses which might play a role in the maintenance of their chronic pain.



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