Trapezius Muscle Activity Variation during computer work performed by individuals with and without chronic neck shoulder pain

Denean Kelson[1], Divya Srinivasan[1], Svend Erik Mathiassen[2]
[1] Department of Industrial and Systems Engineering, Virginia Tech, Blacksburg VA, USA
[2] Centre for Musculoskeletal Research, Department of Occupational and Public Health Sciences, University of Gavle, Sweden

Introduction: Although studies have postulated that individuals with chronic neck-shoulder pain will show less variation in muscle activity compared to healthy individuals when engaged in repetitive/monotonous work, this has seldom been verified in empirical studies of actual computer work. Studies have rarely addressed temporal patterns in muscle activation, even though there is a consensus that temporal activation patterns are important for understanding fatigue and maybe even MSD risks. This study applied exposure variation analysis (EVA) to study differences in temporal patterns of trapezius muscle activity as individuals with and without pain performed computer work. The aims of this study were to: Assess the reliability of EVA as a tool to measure variation in trapezius muscle activity in healthy individuals during the performance of computer work; Determine the extent to which healthy subjects differ from those with chronic pain in trapezius muscle activity patterns during computer work, measured using EVA.

Methods: Participants completed pre-selected computer tasks for 30 minutes at a comfortable but fast pace. Upper trapezius (UT) muscle activity was recorded using surface electromyography (EMG) during 2 repeated sessions for 8 healthy (H) and 1 session for 5 individuals with chronic neck/shoulder pain (CP). EVA with five intensity classes (0-6.67,6.67-20,20-46.67,46.67-100,>100% RVC) and five duration classes (0-1,1-3,3-7,7-15,>15 sec) was performed on the UT EMG data. EVA marginal distributions (along both amplitude and duration classes) for each EVA class, as well as summary measures (mean and SD) of the marginal sums along each axis were computed. Finally, "resultant" mean and SD across all EVA cells were computed. The reliability in EVA indices was estimated using intra-class correlation coefficients (ICC) computed from repeated measurements of healthy individuals (aim 1), and EVA indices were compared between groups (aim 2).

Results: ICCs from healthy individuals ranged from 0.60-0.89. There were no statistically significant differences in EVA amplitude marginal sums between groups. However, CP exhibited lower times of activation than H in the duration classes of 0-1 and 1-3 seconds (p=0.03 & 0.04 respectively), and higher time of activation in the final duration class of >15 seconds (p=0.03). CP also exhibited greater EVA duration mean and SD (p=0.03 & 0.02) and greater EVA resultant indices (p=0.003 and 0.02 for mean and SD respectively).

Conclusion: To our knowledge, this is the first study to report on the reliability of EVA applied specifically to computer work. Furthermore, EVA was used to assess differences in muscle activation patterns as individuals with and without pain engaged in computer work. Individuals with pain seemed to exhibit prolonged sustained activation of the trapezius muscle to a greater extent. Any amplitude differences between groups may have been too subtle for the current setup of the EVA amplitude classes to identify.