REDUCED FORCE CONTROL AND INCREASED CONTRALATERAL TRAPEZIUS CO-ACTIVATION AMONG SUBJECTS WITH WORK RELATED MUSCULOSKALETAL SYMPTOMS

Bente R. Jensen, Theis B. Hansen and Marianne Pilegaard
Institute of Exercise and Sport Sciences, University of Copenhagen, Denmark.
email: brjensen@ifi.ku.dk

INTRODUCTION

Increased values of vibro-tactile sensory threshold indicating entrapment of peripheral nerves have been documented among computer users with severe upper extremity symptoms [1]. However, our knowledge regarding potential functional consequences is limited. The aim was to study fine motor control and upper extremity muscle activation in subjects with and without symptoms.

METHODS

Three groups of female subjects participated. The +sPC group (44 yrs, n=15) had severe upper extremity symptoms and worked at the computer for 75 % of the working day. The -sPC group (43 yrs, n=11) had no symptoms and worked at the computer for 73 % of the working day. The control group (44 yrs, n=9) had no symptoms and worked at the computer for 2 h or less per day. Upper extremity fine motor control was measured in a submaximal handgrip force control task. The task (12 s) was to increase the handgrip force (right hand) as fast as possible to a level above a predetermined upper threshold force level (led feedback) and then decrease the force to below a predetermined lower threshold (led feedback) as fast as possible [2]. The force control task was performed at 3 submaximal absolute force levels, corresponding to 5, 10 and 20 %MVC (maximum voluntary contraction) for a healthy reference group. Each task was repeated 3 times. Task frequency (number of cycles per second), peak force and rate of force increase and decrease for the three groups were calculated. Surface EMG was recorded from mm. trapezius (left and right), right m. extensor carpi radialis, m. extensor digitorum, m. extensor carpi ulnaris and m. flexor carpi radialis during the task and related to maximum values. Average forearm muscle activity expressed as static, mean and peak activity was calculated. Finally, handgrip strength (highest 1-s value out of 3 trials) was measured.

RESULTS AND DISCUSSION

Handgrip strength was 32.0(SE 1.6) kg, 33.1(1.4) kg, and 33.3(1.4) kg for the +sPC, -sPC, and the ctrl group, respectively. Thus, no group differences in muscle strength were found. Task frequency decreased with increasing upper force threshold level for all three groups. However, the frequency of the force control task (across all force levels) was lower for the +sPC group compared to the control group (Figure 1). This could be explained by a slower force increase and a slower force decrease in the +sPC group compared to the control group, whereas no between group differences were found in the peak force during the force control task. Rate of force increase and rate of force decrease was highly correlated ($r = 0.84$, $p < 0.001$).

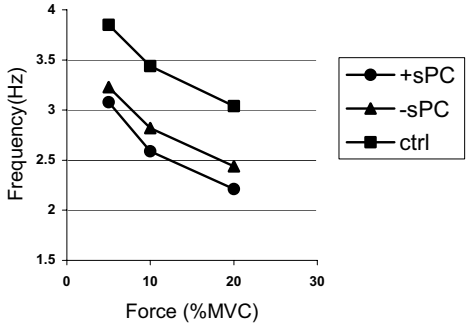

Figure 1: Task frequency during the force control task.

The +sPC group had minor but significantly lower static forearm muscle activity level at all three force levels, a lower mean activity level at the 20 %MVC task and a tendency to a lower mean activity level at the 5 %MVC task than the ctrl group. These differences may be explained by the lower frequency of the force control task in the +sPC group. The increase of the upper force threshold was mainly reflected in the peak activity levels while the static activity remained unchanged. In general, the activity of the mm. trapezius was significantly lower than in the forearm muscles during the force control tasks. The peak activity level of the left m. trapezius was higher in the +sPC and the –sPC groups at the two lowest force levels and higher in the –sPC at the highest force level compared to the ctrl group, while no group differences were found for the right m. trapezius.

CONCLUSION

Impaired fine motor control and increased contralateral shoulder muscle activity were found in the symptomatic group despite of well-maintained muscle strength.

REFERENCES

1. Jensen B.R., Pilegaard M., Momsen A. *Int Arch of Occup and Environ Health* , **75**: 332-340, 2002.
2. Jeng O-J., Radwin R.G., Rodriques A.A. *Ergonomics* **36(7)**: 1055-1069, 1994.