SINGLE MOTOR UNIT ACTIVITY IN THE TRAPEZIUS MUSCLES OF ELDERLY FEMALE COMPUTER USERS WITH AND WITHOUT NECK-SHOULDER PAIN DURING COMPUTER WORK

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INTRODUCTION

Musculoskeletal disorders in the neck and shoulder regions of female computer users are a major occupational concern in the European countries and the incidence of disorders increases with age and hours of work per week. It has been reported that neck shoulder cases (NS-cases) compared to neck shoulder controls (NS-controls) have a significantly lower muscle strength and a lower muscle activation measured as a lower EMGrms value at the same relative force demand [1]. This finding supports the pain adaptation model supposed to protect the painful muscle from further activity by an inhibitory effect of pain. In contrast, another study has reported an increased trapezius activity during computer tasks in the NS-cases compared to controls evaluated from the total number of motor unit action potentials (MUAP) per second [2]. Such an activity pattern would be in agreement with the vicious circle theory suggesting a pain induced increase in activity in the painful muscle. The aim of the present study was to investigate if the results of a decreased muscle strength and lower activation in a large field study of subjects with and without neck-shoulder pain can be supported by an analysis on single motor unit (MU) level during a typing and editing task in a sub sample of the study population.

METHODS

Two groups of computer users were recruited: 88 NS-cases, who reported trouble in the neck and/or shoulder region for more than 30 days during the last year, and 164 NS-controls who reported trouble in the neck and/or shoulder region for no more than 7 days during the last year. Their mean (SD) values were: age 53 (5) years, height 1.66 (0.06) m, weight 70 (14) kg with no significant difference between NS-cases and NS-controls. An adhesive electrode array composed of eight linearly arranged bar electrodes (size 1x5 mm, 5mm inter electrode distance) was placed on right upper trapezius muscle attempting a position distal to the endplate zone without covering the tendon. Measurements started with a bilateral MVC of the trapezius muscle during shoulder elevation and a 30% MVC test. Further, the subjects performed a 10 min typing and editing task. EMGrms was calculated using an inter electrode distance of 20 mm. On a sub sample of 11 cases and 19 controls MUAP were detected in the typing and editing composite EMG signals with a wavelet based method, separating action potentials from the background noise. MUAP rate is defined as the total number of action potentials divided by the total activity time. A MU was defined when at least 20 action potentials could be allocated to the same MU. Of the total number of action potentials a fraction of 20.8 (19.2) % for cases and 30.8 (18.1) % for controls, could be clustered into single MU.

RESULTS AND DISCUSSION

In the large group of NS-cases and NS-controls a significantly lower MVC was found for the NS-cases (mean 310 (122) N) compared to the NS-control (mean 364 (122) N). In the sub sample the corresponding values were 400 (88) N and 395 (136) N with no significant difference. During the 30% MVC test a significantly lower EMGrms was found both in the large group (NS-cases =194 (105)µV vs. NS-controls 256 (169)µV) and in the sub sample group (NS-cases= 195 (77) µV vs. NS-controls= 248 (93)µV). However, in the more functional typing and editing task similar levels of EMGrms were found in NS-cases and NS-controls. This was supported by the more detailed muscle activity analysis in the sub sample. From the right trapezius muscle a total of 4938 (2836) and 4852 (3480) MUAP per subject was detected in NS-cases and NS-controls, respectively. MUAP rate, the combined measure of MU number and firing rate, was similar, being 10.8 (6.1) MUAP per sec in NS-cases and 11.7 (5.3) MUAP per sec in NS-controls. A total of 22 MU were defined for NS-cases and 44 MU for NS-controls giving a mean of 2 MU per subject in both groups. For each subject mean values of the properties of the detected MU were calculated. Table 1. presents the results as group mean (SD). Only MUAP area was significantly different between the groups.

Table 1.

	NS-Cases	NS-Controls
No. of MUAP per MU	612 (560)	915 (820)
MU Activity duration (s)	312 (173)	258 (163)
MUAP Area (mV*s)	0.774 (0.382)*	1.136 (0.762)
MUAP MPF (Hz)	112 (13)	107 (15)

* indicates significant difference between cases and controls ($p < 0.05$)

CONCLUSIONS.

In the present study lower muscle activation, measured as EMGrms, in NS-cases compared to NS-controls was found both in the large study group and in a sub sample during a 30%MVC. In contrast, for the more functional typing and editing task, neither EMGrms nor MUAP rate, could confirm a lower level of activation in NS-cases. The significantly smaller MUAP area for NS-cases may indicate a selective recruitment of smaller MU or a pain related change in properties such as fibre diameter of the low threshold MU for the NS-cases.

REFERENCES

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