NEUROPHYSIOLOGIC SYMPTOMS AND VIBRATION PERCEPTION THRESHOLDS IN YOUNG VIBRATION-EXPOSED WORKERS – A FOLLOW-UP STUDY

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1. INTRODUCTION

Vibration exposure may cause the hand-arm vibration syndrome (HAVS), including digital vasospasms (vibration white fingers; VWF), sensorineural symptoms and/or muscular weakness and fatigue (Gemne, 1997). Neurophysiologic symptoms include numbness and/or tingling, impaired touch sensitivity, impaired manual dexterity and reduced grip strength in the hands. The Stockholm Workshop Scale is commonly used for sensorineural (SN) staging (0SN – 3 SN). Sensorineural symptoms of this in combination with difficulties in handling small objects may interfere both with the workers social- and work-related activities (Sakakibara et al., 2005).

2. OBJECTIVE

The objective of this work was to study the development of neurophysiologic symptoms and vibration perception thresholds in a cohort of young vibration-exposed workers.

3. METHODS

The follow-up study in 2006/2007 comprised 108 young male vibration-exposed workers (mean-age was 22.6 ± 1.0 y) from the machine shop and construction industries, who had been followed since they finished school. They were compared with 21 male non-exposed referents (mean-age 22.4 ± 0.9 y). All participants completed several questionnaires related to working and medical history, smoking, alcohol consumption, previous and on-going vibration exposure and symptoms of sensorineural disturbances. The neurophysiologic function was checked by the determination of vibration perception thresholds (VPTs) at 31.5 and 125 Hz and by Semmes Weinstein's Monofilament tests. Measurements of vibrotactile thresholds were performed by delivering sinusoidal vibrations to the pulp of digits II and V, bilaterally (the up-and-down method of limits; von Békésy method), and registering the subjects response, using the HVLab Tactile Vibrometer system (HVLab, United Kingdom).

The results were compared with the findings from the baseline study in 2004/2005. Parametric statistics were used for comparison of elements that showed a normal distribution (checked by Normal Probability Plots, Levene's test). For elements with a skewed distribution, nonparametric statistical processing was applied (Mann-Whitney's U-test; r_s = Spearman's rho). P-values < 0.0: were regarded as statistically significant (2-tailed tests).

Multiple regression analysis was performed with VPT as th dependent variable, and with age, height, examiner an different vibration dose calculations as predictor variable (total hours of vibration exposure (h), a*t weighted tota dose, a^2*t weighted total dose, current weighted vibratio exposure A(8) and total a^2*t weighted total dose for wor and leisure time). Model fits were checked by means o residual analysis (Altman, 1991)

4. RESULTS

Among the exposed workers, 18 subjects (17 % reported tingling sensations, 9 reported numbness (8 %) an 5 reported both tingling and numbness in their fingers. Thi is a doubling of reported tingling sensations compared to th baseline study (8 %), while reported numbness was more o less unchanged (10 % at baseline study).

The exposed workers showed significantly raised VPTs fo 32 Hz in digit II (p=0.036) and for 125 Hz in digit V, le hand (p=0.045). The other VPTs didn't differ significantl between workers and referents. The exposed worker showed approximately the same median values of vibratio perception thresholds (m/s^2) in the follow-up study (31. Hz, digit II, left hand 0.11, digit II, right hand 0.13; 125 Hz digit II, left hand 0.16, right hand 0.17) as in the baselin study (31.5 Hz, digit II, left hand 0.13, digit II, right han 0.15; 125 Hz, digit II, left hand 0.17, right hand 0.24).

A multiple regression analysis (VPTs as dependen variables; age, height, examiner and vibration doses a predictor variables) showed the strongest associations fo the models including two of five calculated doses (curren weighted A(8), r^2=0.38; work+leisure a^2*t weighted tota dose, r^2=0.29) in the highest exposed quartile (Table 1).

DISCUSSION

This is a fairly young cohort of machine shop an construction workers who have been followed since th participants finished school. The follow-up study showed a increase of reported neurophysiologic symptoms (tingling in vibration exposed workers as compared to the result from the baseline study. The vibration perceptio thresholds, however, were approximately at the same leve at baseline and follow-up and no apparent deterioration was observed during the study period. A multiple regression analysis with VPTs as the dependent variable showed the strongest associations with two of five calculated vibration doses, A(8) and work leisure a^2*t weighted total dose, respectively.

In conclusion, neurophysiologic symptoms and vibration perception thresholds seem to appear after short-term exposure in this cohort of young vibration exposed workers, who will be followed up prospectively.

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Table 1. Multiple regression analysis, digit II, left hand, 32 Hz, highest exposed quartile. Parameter estimates and p-values. NS = non significant.

Vibration dose definition	Intercept	Age	Height	Examiner	Vibration dose	R-squared significance of model
Total hours exposure (h)	0.78 (NS)	-0.026 (NS)	-2.9×10^{-5} (NS)	-0.05 (NS)	-1.1×10^{-6} (NS)	$R^2 = 0.07$ NS
A*t weighted total dose	0.84 (0.039)	-0.026 (0.036)	- 0.001 (NS)	-0.05 (NS)	5.8×10^{-7} (NS)	$R^2 = 0.22$ NS
a^2*t weighted total dose	0.75 (NS)	-0.023 (0.04)	-0.001 (NS)	- 0.022 (NS)	9.9×10^{-9} (NS)	$R^2 = 0.17$ NS
Current weighted A(8)	0.98 (0.025)	-0.036 (0.006)	0.00 (NS)	-0.08 (0.045)	0.02 (NS)	$R^2 = 0.38$ p = 0.042
Work+leisure a^2*t weighted total dose	1.30 (0.008)	-0.03 (0.035)	-0.003 (NS)	-0.062 (NS)	7.5×10^{-7} (NS)	$R^2 =0.29$ (NS)

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