HAND ARM VIBRATION

International conference
6-9 JUNE 2023
Espace Prouvé,
Nancy, France

The hand-arm vibration syndrome in workers exposed to high frequency vibrations – an intervention study

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Background

- HAVS – Hand-Arm-Vibration Syndrome
- Common symptoms: vibration white fingers (VWF); tingling and numbness
- Reduced grip strength and impaired fine motor skills
- Basic study of a group of wheel loader assembly workers in May 2018
- 30 males, 8 females; Main exposure was to impact wrenches and anvils
- Prevalence of VWF was 30 % for male workers; 50 % for female workers
- Prevalence of neurosensory disturbances; males 70 %; females 88 %
- In 2018, 32 musculoskeletal symptoms were diagnosed in males, e.g. tension neck syndrome, biceps tendinitis, carpal tunnel syndrome and ulnar entrapment. Among females 4 symtoms were diagnosed.



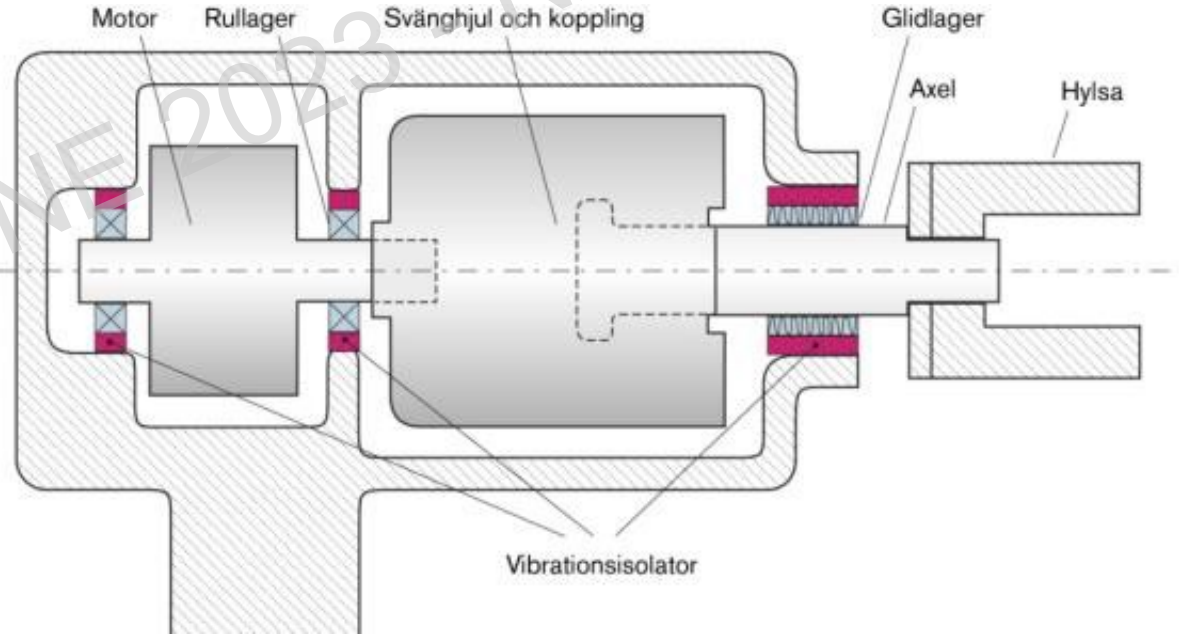

Preventive measures

- Preventive measures were undertaken at the factory, mainly by the workers themselves, who showed a great commitment for the task. The feeling that you can change and improve your own working conditions was a strong driving force.

- The preventive measures enforced at the factory reduced the exposure to transient and high frequency vibrations. The question was whether this could stop or slow down the progress of HAVS and the development of aggravated musculoskeletal symtoms in these workers?

Reconstruction of the tools

- The handle of the impact wrenches got a 3 mm thick vibration isolating layer consisting of a foamed polymer with closed cells. The transient exposure was reduced from 7000 to 800 m/s^2. The ISO-exposure was unchanged (4.5 m/s^2.)



Reconstruction of the tools 2

- The anvil was completely rebuilt. The transient exposure was reduced from 8000 to 150 m/s^2; the ISO-exposure from 13 to 6 m/s^2.

Follow-up study

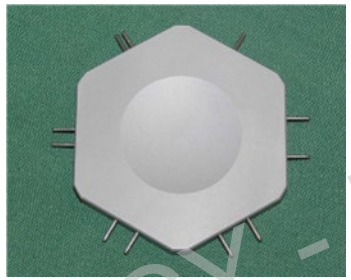
- In June 2022, 35 of the original 38 workers (27 males; 8 females) participated in a follow-up study (four years after the initial study in 2018)
- The mean-age of the male workers was 43.3±10.3 yrs; mean exposure time was 17.9 ± 7.3 yrs.
- The corresponding figures for the female workers were 40.8±8.8 yrs and 14.6±6.3 yrs, respectively.

Medical examination
The same investigation in 2018 and 2022

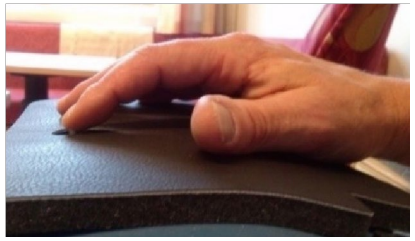
- Questionnaire (e.g. medical and work history; mapping of vibration exposure)
- VPT – vibration perception thresholds
- Temperature perception – Temp Roller II
- 2-PD
- Semmes-Weinsteins monofilament test
- Needle test (sharp/blunt)
- Hand grip strength (Jamar)
- Classification of symptoms and signs according to the Stockholm Workshop Scale (Vascular – stage 0 – 4; Neurosensory – stage 0 – 3)
- Musculoskeletal examination of neck, shoulders, arms and hands




Temperature perception



2-PD



Vibration perception thresholds

Monofilament

Jamar

Measurements of vibration exposure

- Data from questionnaires (time of exposure; months/years; daily exposure time in minutes; work tasks, type of vibrating tools, percentage use of right hand, left hand or both)
- Information from the company's line power tool inventory list (vibration levels of the tools)
- On-site vibration level measurements

RESULTS

- In the total material a significant deterioration from 2018 to 2022 was observed for 2-PD, temperature perception, vibration perception thresholds and the needle test.
- No significant differences were noted for the monofilament tests and handgrip strength.
- Male workers showed the same pattern as they constituted almost 80 % of the total material.
- Female workers showed a deterioration of VPTs in dig 2 and 5, right hand but no significant differences were noted for all other variables
- The interesting part is the comparison of the overall grading of VWF and neurosensory disturbances in 2018 vs 2022 according to the Stockholm Workshop Scale.




RESULTS 2

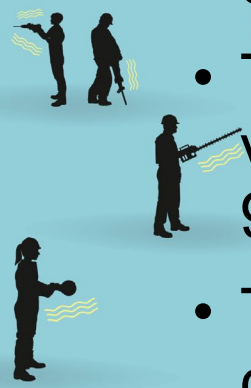
- The SWS grading for vascular changes did not differ significantly in the right and left hand, respectively, between 2018 and 2022.
- In 2018 the total prevalence of neurosensory disturbances was 77 % in the right hand and 71 % in the left hand (2022 – 66 % right hand; 62 % left hand). The SWS grading for neurosensory disturbances had deteriorated in the right hand during follow-up, but was unchanged in the left hand
- In our study, we also measured work-ability by using the first item from the Work Ability Index questionnaire
- It is a self-assessment of current work ability level compared to life-time best and has shown an equally good predicted value as the whole WAI-instrument with regard to sick leave, health and reported pain.

Results 3

- The WAS score (0 – 10) had a mean of 7.8±1.9 in 2018 compared to 8.3±1.5 in 2022, showing an improvement during the follow-up, although not significant.
- A multiple regression model identified two variables that were included in the WAS model. Feeling of reduced grip strength made the strongest contribution to the model followed by age.

DISCUSSION

- Several studies have shown an increased prevalence of VWF and neurosensory disturbances in workers that are exposed to transient and high frequency vibrations
- In this study rather inexpensive preventive measures had a huge impact on the development of vibration related symptoms and signs.
- These preventive measures reduced the transient and high-frequency vibration exposure from impact wrenches and anvils with approximately 90 %.
- The whole factory was participating in the preventive program with great commitment. These preventive measures was also spread to other factories within the company.



Discussion 2

- The SWS overall grading of VWF in the right and left hand and the neurosensory disturbances in the left hand were largely unchanged from 2018 to 2022. Without these preventive measures there would most likely have been an increase of the vibration-related symptoms at the factory.
- The work ability score (WAS) showed an improvement during follow-up.
- The number of musculoskeletal diagnosis decreased during follow-up .
- Another positive sign, is, that according to information from the factory, the number of new cases of vibration related injuries has decreased during the last years.