HAND ARM VIBRATION

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

Using an Impact Wrench in Different Postures—An Analysis of Awkward Hand–Arm Posture and Vibration

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Background

Occupational disease by hand-Arm vibration

BK 2103
2113

© WavebreakmediaMicro

Bone and joint disease

BK 2104

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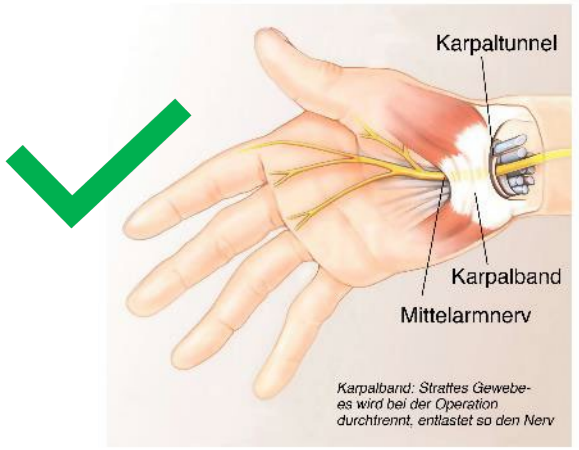
Circulatory and nerve dysfunction

BK



Pressure damage to the median nerve in the carpal tunnel

Influence of posture???

ISO TR 10687 WBV and posture

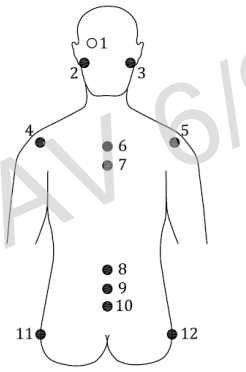
TECHNICAL REPORT

ISO/TR 10687

Second edition
2022-02

Mechanical vibration — Description and determination of seated postures with reference to whole-body vibration

Vibrations mécaniques — Description et détermination des postures assises en référence à des vibrations transmises à l'ensemble du corps



Key

1	left lateral canthus	7	T_3 (spinous process)
2	left tragus	8	L_1 (spinous process)
3	right tragus	9	L_3 (spinous process)
4	left acromion	10	L_5 (spinous process)
5	right acromion	11	left greater trochanter
6	C_7 (spinous process)	12	right greater trochanter

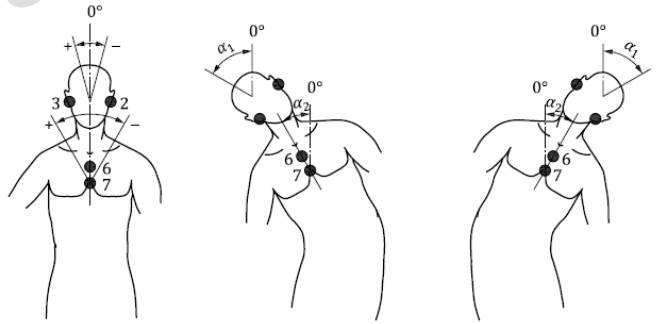


Figure 13 — Lateral flexion of the neck

ISO PWI 3153

Mechanical vibration — Posture in whole-body vibration environments

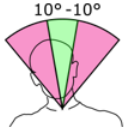
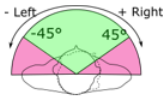
Category	Head inclinatio sagittal	Head inclination lateral	Neck torsion
			
Neutral	0° to 25° <0° Full head suppo	-10° to 10°	-45° to 45°
Moderate	25° - 85°		
Awkward	< 0° no head support or > 85°	< -10° or > 10°	<-45° or >45°

Figure B.1 Assessment categories for the head and neck

Setup

working in three directions

- identical conditions for the subjects
- height adjustable setup
- defined posture of arm (90° angle)
- 12 Screwing operations in oak wood (pre-drilled)
- scheduled breaks between directions
- Impact wrench 1.2 kg, 18 V and torque 200 Nm

Population

11 subjects (4 female, 7 male)

Age [years]	Size [cm]	Weight [kg]
36 ± 11	178 ± 8	76 ±15

upwards

forwards

downwards

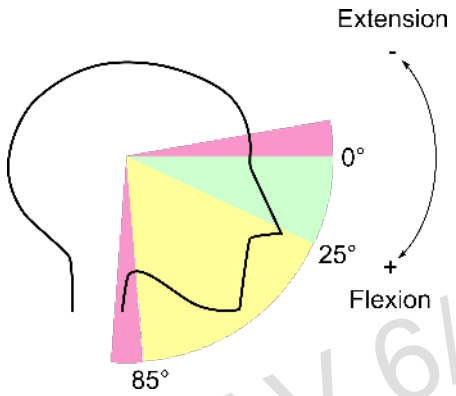
Measurement posture

inertial sensors:

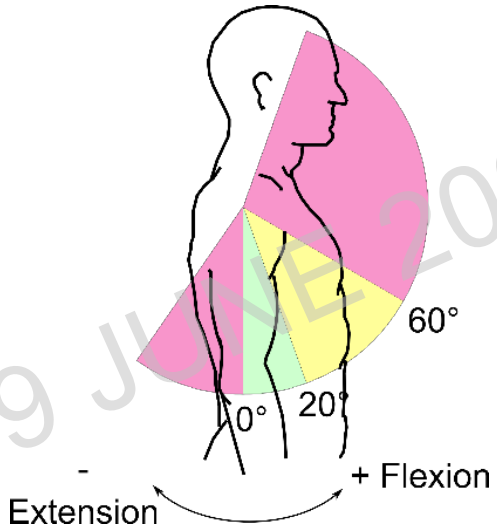
- Head
- Shoulders
- Upper arm
- Lower arm
- Hands
- Pelvis
- Sternum

Assessment of body angles

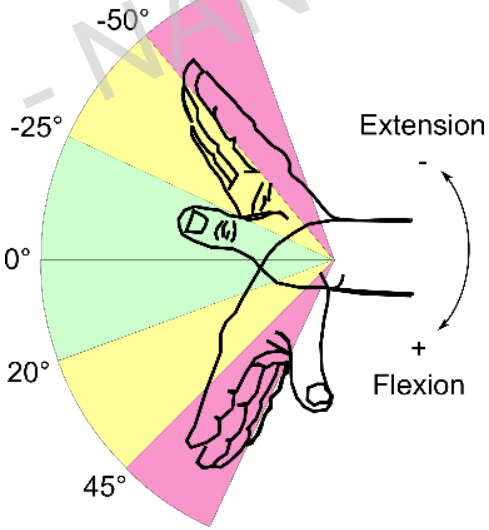
Head Inclination (sagittal)



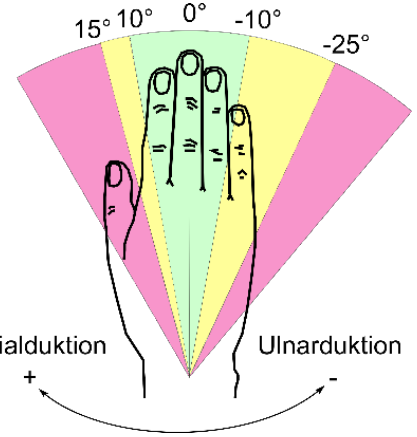
Upper Inclination (sagittal)



Wrist Flexion



Wrist Adduktion/ Abduktion



Measurement vibration

- Hand-arm vibration
  (ISO 28927-5:2009)

- a_{hv} Vibration total value

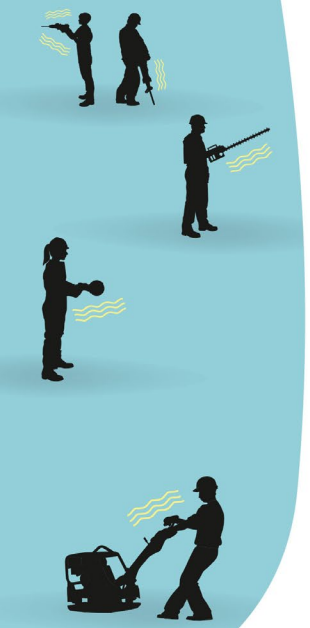
$$a_{hv} = \sqrt{a^2_{hwx} + a^2_{hwy} + a^2_{hwz}}$$

Measurement muscle activity

- Elektromyography
  - Muscle activity
    - Trapezius
    - Biceps brachii
    - Extensor digitorum
    - Flexor capri ulnaris
  - Maximal Valontary Contraction (MVC)

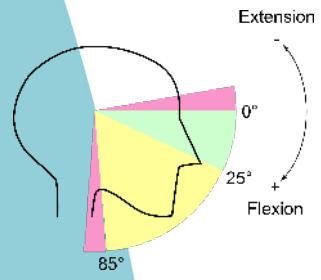
Subjective perception

- Subjective perception
  - Borg scale

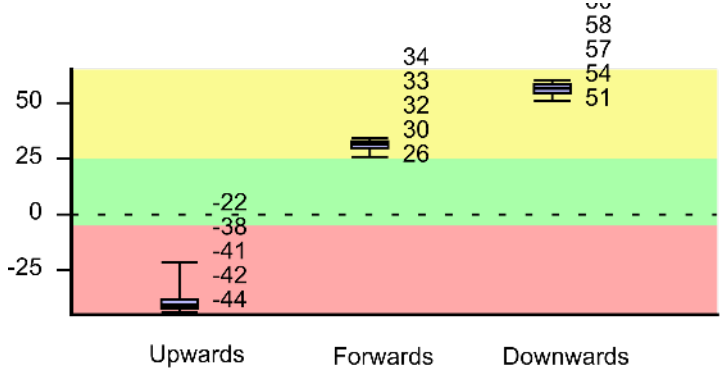


Bewertung	
0	Absolut Nichts
0,3	
0,5	Extrem Schwach
0,7	
1	Sehr Schwach
1,5	
2	Schwach
2,5	
3	Mittelmäßig
4	
5	Stark
6	
7	Sehr Stark
8	
9	
10	Extrem Stark

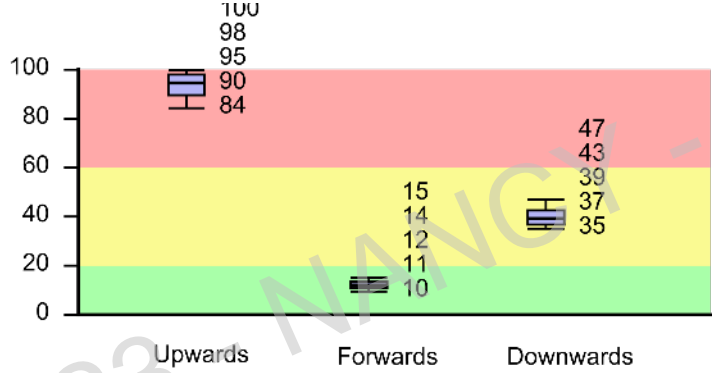
Results . Exposures

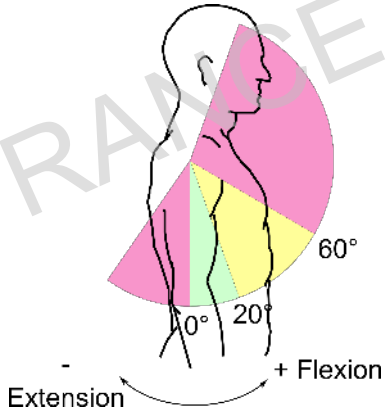


Head inclination (sagittal) in °

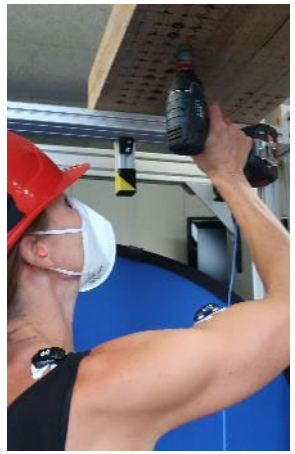


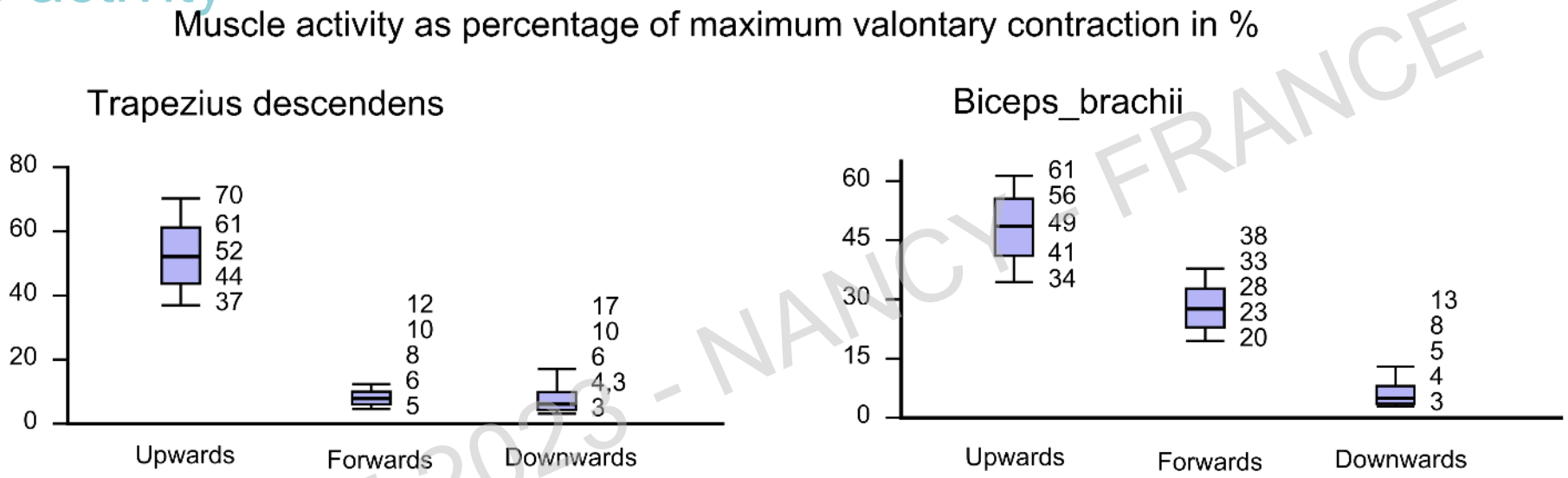
Upper-arm inclination (sagittal) in °



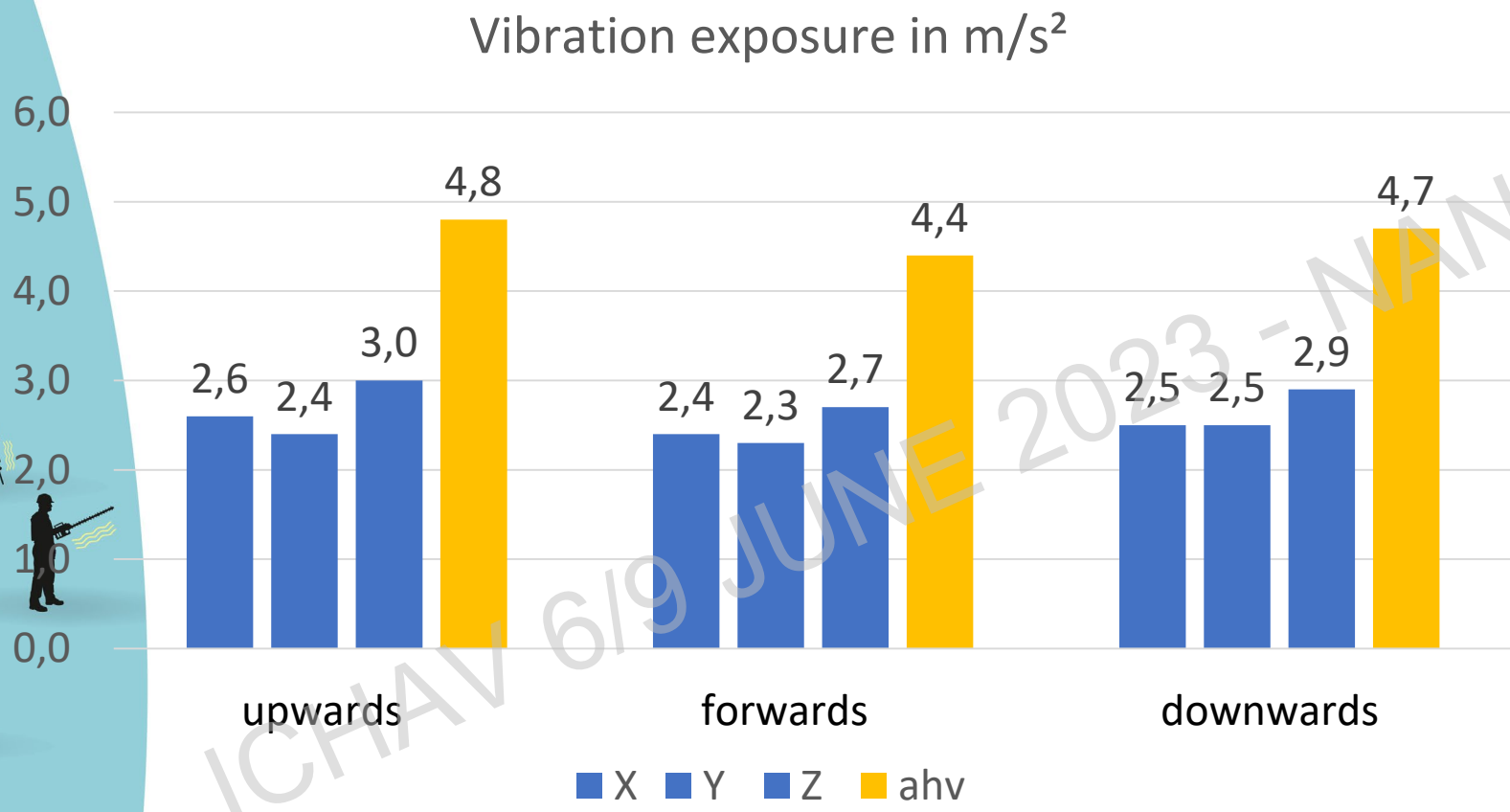


Results: Muscle activity

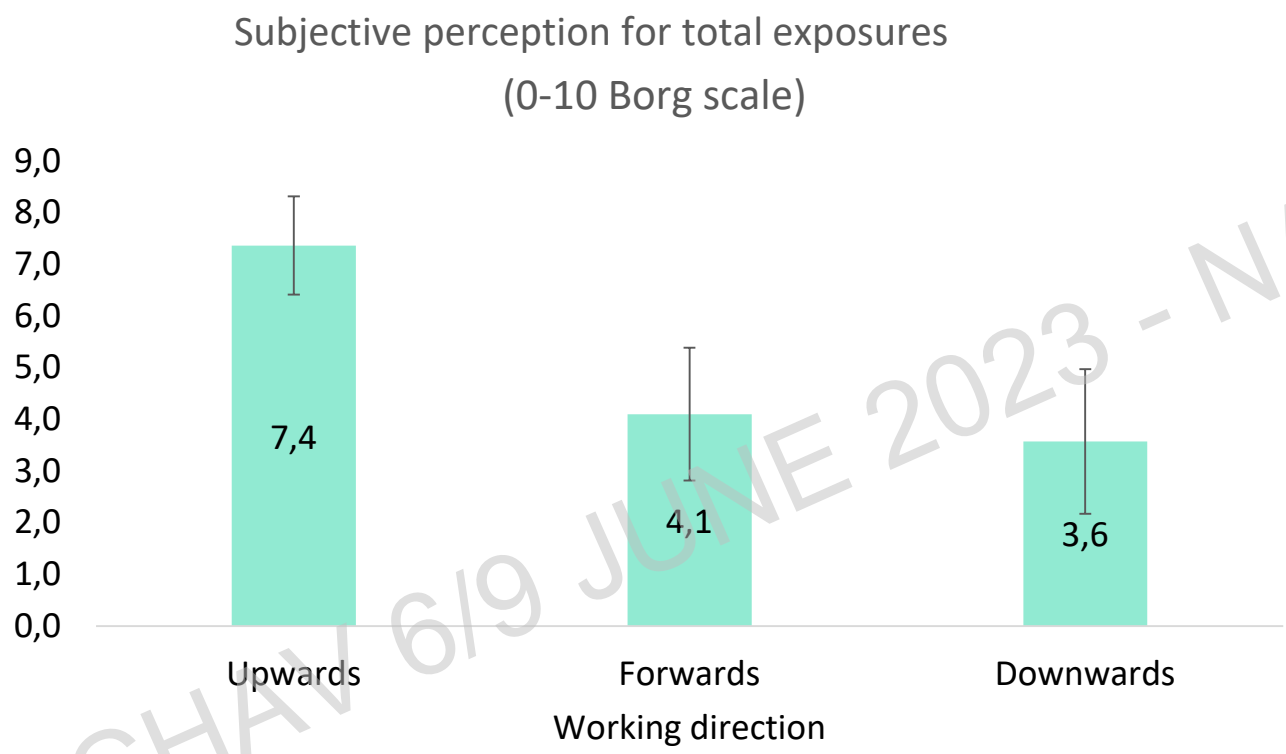




Results: Hand-arm vibration



Results: Subjective perception



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Summary

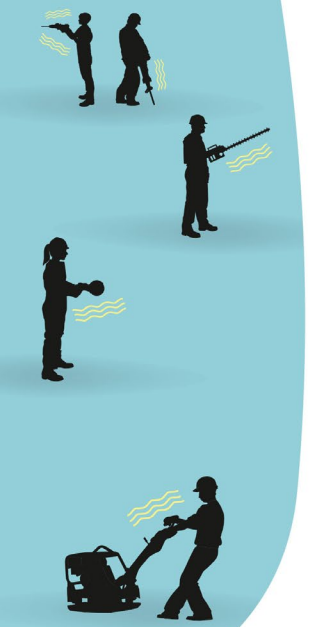
Different postures:

Vibration – **no differences following ISO-Standards**

Posture – overhead and also downwards working notably **higher exposures**

EMG - overhead and also downwards working notably **higher muscle activity**

Subjective perception– **highly unpleasant** during overhead working



Vibration x Posture x Forces

Misinterpretation of vibration exposure!

- Thank you for your attention!