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Focus on IFA's work

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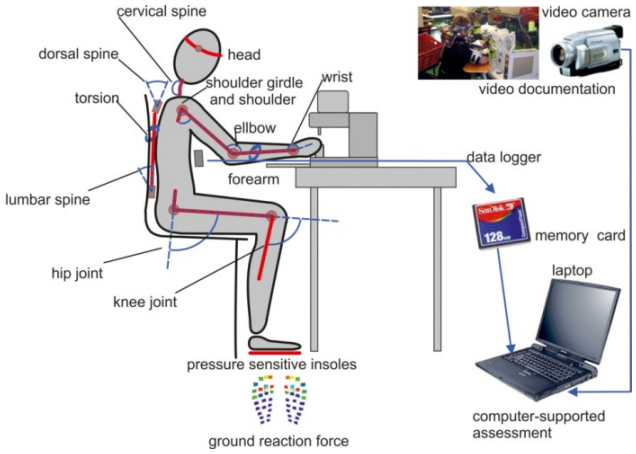
Measuring movement and posture in the shoulder-arm region

Problem

Musculoskeletal disease (MSD) has been a significant cause of sick leave for some years. Besides the spine, around half of such complaints and diseases affect the upper extremities (MSD-UEs). Work-related risk factors for MSD-UEs are repetition (sustained, repeated, homogeneous movements or muscle contractions) and static postures. For both forms of stress, joint positions/ body postures that are unfavourable for the possible range of movement, the force exerted, and exposure to hand-arm vibration are particularly relevant factors, both in isolation and in combination. A range of stress and therefore risk profiles arise for the specific joint regions and the disease patterns.

In order for appropriate prevention measures to be taken at workplaces, these forms of exposure must be reliably identified and recorded. The risk factors which describe task-specific movement patterns as "unfavourable" and which cannot be determined comprehensively and conclusively by observation methods are exceptionally important. A measurement system was therefore required in the first instance which recorded the movement patterns of the arms and hands over longer periods of time during heterogeneous manual occupational tasks.



Schematic design of the system for recording bodily movement. Recorded shoulder-arm movements: shoulder girdle, shoulder joint, elbow joint, forearm, wrist

These measured values were to be used in further processing of the data to derive stress parameters, which were to be evaluated for the hazard they present to health.

Activities

The existing methods of measurement and analysis for recording body postures and movement in the shoulder-arm region were evaluated and examined to determine their suitability for efficient long-term measurement, even for non-stationary workplaces. As none of the measurement systems available so far could meet the requirements, a prototype for a new measuring system was developed and tested.

Results and Application

The existing and proven CUELA system of computer-assisted measurement and long-term analysis of musculoskeletal workloads has been extended. A mechanical system developed at the IFA permits customized positioning and fitting of sensors (potentiometers) to each test subject. The sensors are fitted to the wrist, elbow and shoulder joints such that all axes of joint movement can be detected and measured.

Within the CUELA measurement method, storage of the digitized measured data (at a sampling rate of 50 Hz) on a standard compact flash card and the use of compact lithium-ion batteries already enable movements to be recorded over longer periods irrespective of the test subject's location, as required. The new CUELA version described here now also provides this functionality for the recording of movements of the upper extremities. It has been used for numerous measurements conducted during consultations in companies and research projects. The measured data were processed and interpreted by means of the WIDAAN CUELA software for angle data analysis and then subjected to selected procedures for exposure measurement and assessment. The experience and findings and the prospects for further development activity and research projects are summarized in a report.

Area of Application

Any branch of industry with occupations that entail a wide range of strain and stress from unfavourable shoulder-arm movements.

Additional Information

- Hoehne-Hückstädt, U.; Herda, C.; Ellegast, R.P.; Hermanns, I.; Hamburger, R.; Ditchen, D.: Muskel-Skelett-Erkrankungen der oberen Extremität – Entwicklung eines Systems zur Erfassung und arbeitswissenschaftlichen Bewertung von komplexen Bewegungen der oberen Extremität bei beruflichen Tätigkeiten. BGIA-Report 2/2007. Ed.: Hauptverband der gewerblichen Berufsgenossenschaften (HVBG), Sankt Augustin 2007

Expert Assistance

IFA, Division 4: Ergonomics – Physical environmental factors

Literature Requests

IFA, Zentralbereich

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