

Ergonomics at sewing workplaces

An increase in sickness rates and in the corresponding absences from work has been observed for years in the German sewing industry. The main group of diseases observed at industrial sewing workplaces are those of the musculoskeletal system, particularly of the spine and the shoulder-arm system.

Under their prevention mandate, the former Lederindustrie-Berufsgenossenschaft and the former Textil- und Bekleidungs-Berufsgenossenschaft (German Statutory Institutions for Accident Insurance and Prevention in the Leather Industry and in the Textile and Clothing Industry) therefore launched a research project with the aim of developing an ergonomic model sewing workplace and a practical guide to setting up ergonomic sewing workplaces. The project was funded by the Deutsche Gesetzliche Unfallversicherung – DGUV (German Social Accident Insurance – DGUV) and conducted by the IFA together with the Munich University of Applied Sciences and the Schwan engineering office in Frankfurt. In the project, measurements of physical load and of body posture during typical sewing tasks were measured in the field in eight selected companies within the sewing industry in the areas of footwear, industrial textiles, clothing and soft-toy manufacture. The load was measured by assessment of physiological parameters such as pulse rate and electrical muscle activity. The body postures and movements were measured by means of the CUELA measurement system (the German acronym stands for computer-assisted recording and long-term analysis of musculoskeletal workloads) developed by the IFA. In this measurement system, sensors attached to the sewing operatives' bodies continually record the movements of the head, the shoulder-arm system, the spine and the lower extremities.

In addition, ambient conditions such as lighting, noise and climatic conditions were measured. The subjective impression of the load for the sewing operatives involved was also recorded. Their task-related complaints and diseases were documented.

The first result was demonstration and quantification for the first time of typical workload situations at sewing workplaces, such as the performance of work in extreme joint angle positions, static postures, repetitions, and the application of high forces. The essential causes of the loads are the high demands placed upon vision by the sewing task, which necessitate close viewing, and poorly designed workplaces which provide people with insufficient individual working space. Based upon these findings, an ergonomically improved model sewing workplace was developed which was then installed in a number of sewing businesses. The new ergonomic sewing workplace is characterized by properties including the following (see figure):

- *Greater foot and legroom:* The foot and legroom was increased by redesign of the foot control and the worktable and by the use of a direct-drive machine. Constrained postures and fatigue of the lower extremities can now be avoided by freely selectable and flexible leg positions.
- *Sewing in changing body postures:* The facility for adjustment of the sewing worktable was designed so as to permit any desired alternation between seated and standing performance of the task. This alternation in the load enables constrained postures to be avoided, and the load on the muscle system and the spine to be relieved.

- *Support of the arm and hand:* Support surfaces on the worktable with facility for personalized adjustment enabled the proportion of static work in the region of the shoulder and neck muscle system to be reduced.
- *Reduction in awkward postures of the upper body:* By changes to the assignment between the foot control and the working level on the sewing table, the strong forward inclination of the upper body during sewing, which in the past had been almost unavoidable, was replaced by a more upright posture. The backrest of the work chair can now be used effectively.



Figure: The newly developed ergonomic sewing workplace; sewing operative fitted with the CUELA measurement system

Following an acclimatization period, the sewing operatives were studied again during a normal working shift. The comparison between the load and stress profiles revealed a substantial improvement in the spinal posture and a reduction in arm and shoulder postures at extreme joint angles for work at the ergonomically optimized workplace. The reduction in physical strain was also measurable. The acceptance of the ergonomically redesigned workplace among sewing operatives is very high; subjective assessment by the test subjects also confirms the reduction in load and strain of the modified work situation.

The newly developed ergonomic sewing workplace is available in commercial form. More than 28 member companies of the Institutions for Statutory Accident Insurance and Prevention have implemented the findings from the research project in their own plants and converting to ergonomic sewing workplaces.

The results of the research project thus enter plant practice directly, and constitute a highly targeted prevention measure against occupational diseases of the musculoskeletal system.

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