

# Musculoskeletal, visual and psychosocial stress in VDU operators before and after multidisciplinary ergonomic interventions. A 6 years prospective study—Part II

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## Abstract

A prospective epidemiological field study covering a 2 years period has earlier been published (Appl. Ergon. (1998) 29(5) 335). The study has a parallel group design with two intervention groups (T and S) and one control group (C) of Visual Display Unit (VDU) operators. The present paper covers the period from 2 to 6 years of the study. After 3.5 years, the C group got the same intervention in terms of new lighting system, new workplaces and at last an optometric examination and corrections if needed. The C group reported a significant reduction in visual discomfort after interventions while the two groups (T and S) continued to report significant reduction of visual discomfort after 6 years. By supporting the forearm on the table top, the C group reported significant reduction of shoulder and neck pain while the T group reported significant reduction in shoulder and back pain after 6 years. Organizational and psychosocial factors at work and outside work did not show any significant changes during the study period. © 2001 Elsevier Science Ltd. All rights reserved.

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## 1. Introduction

Eye discomfort and musculoskeletal illness are the main problems reported by visual display unit (VDU) operators. Eye discomfort is shown to be connected to VDU work (Bergqvist et al., 1992; Aarås et al., 1998). Further, the prevalence of musculoskeletal illness is found to be higher in VDU work compared with non-VDU work (Punnett and Bergqvist, 1997). Important factors for designing the lighting systems and the workplace, as well as procedure for optometric corrections of VDU workers are given by Aarås et al. (2000). In addition, the paper gives a review of the international literature regarding health consequences for VDU workers. This review covers lighting, optometry, and factors related to musculoskeletal illness for VDU

workers. Punnett and Bergqvist (1997), in their review of epidemiological studies of VDU work, found that VDU work indicated higher risk of neck, shoulder, arm, wrist and hand musculoskeletal illness compared with non-VDU work. In their extensive review only nine intervention studies are reported until 1997. Eight of these studies suggested that a decrease in musculoskeletal illness could be achieved by ergonomic intervention programmes. The follow up time varies for most of the studies between 6 and 18 months. Ong (1984) reported that the prevalence of symptoms in neck, arms and hands decreased by about 67% after giving data entry VDU workers, ergonomic workstation adjustments, longer lunch break, improvements in noise and illumination, as well as improved thermal environment. Kukkonen et al. (1983) combined workstation improvements, training and relaxation exercises for 60 data entry operators. Six months follow up showed that the intervention group had fewer symptoms and physical

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findings than a reference data entry group. At commencement the intervention group had more upper extremity disorders than the reference group. These results were supported by a larger study by Oxenburgh (1985). Shute and Starr (1984) introduced adjustable workstation and chairs to 66 data entry workers. After 5–8 weeks, the operators reported significant decrease in the incidence of neck, shoulder and wrist/hand symptoms. Training the VDU workers to modify the workstation layout as well as taking other measures to improve their working conditions are factors reported to give less pain in two intervention groups compared to the control group both after 4 weeks and after 6 months (Kamwendo and Linton, 1991). There is still need for prospective multidisciplinary intervention studies with long follow up time in order to evaluate the health consequences of VDU work.

The background for this study was that the VDU workers reported both visual problems and musculoskeletal discomfort. The interventions were based on the following studies:

1. Laboratory studies had been carried out in order to find criteria for luminaires and their optimal position relative to the screen (Bjørset, 1986). Luminaires giving both direct and indirect lighting, with one luminaire on each side of the screen, were found to give the best solution regarding visual condition.
2. Different types of lenses were studied in the laboratory regarding postural load by Horgen et al. (1989, 1995). Single vision lenses were found to create less muscle load compared with progressive lenses.
3. A laboratory study of muscle load in different work positions showed that supporting the forearm on the table top reduced the muscle load of trapezius and erector spina lumbalis (L3 level) for sitting VDU work (Aarås et al., 1997).

Following these laboratory results a multidisciplinary team was established for the intervention study. Three serial interventions were carried out in two intervention groups (T and S) while one group acted as a control group (C), (Aarås et al., 1998). The interventions consisted of the following: first a new lighting system, then new workplaces and last an optometric intervention. The new lighting system for localized lighting increased maintained illuminance levels from about 300 lux to above 600 lux, increased luminances of the room surfaces from about 30 cd/m<sup>2</sup> to about 80 cd/m<sup>2</sup>, and reduced glare problems. The first part of the study covered a follow up period of 2 years. The two intervention groups (T and S) reported significant improvement of the lighting conditions, as well as of the visual conditions, and significantly reduced visual discomfort and glare. No significant change was reported in the C group. The optometric intervention

with single vision lenses which were given according to actual visual distances for VDU work, further reduced the visual discomfort while no change was observed in the C group. By redesigning the workplaces, and allowing the operators to support their forearms on the table top for the T and S groups, a significant reduction of shoulder pain was reported in the S group and a clear tendency was observed in the T group, while no such change was reported in the C group. After two years, significant differences in shoulder pain were found between the two former intervention groups T and S and the C group.

The second part of this study describes the results reported by the C group when this group got the same interventions as the T and S groups.

## 2. The aims of the study

Will interventions in the C group, consisting of improved lighting, improved workplaces and optometric corrections, influence the visual discomfort, headache and musculoskeletal pain? In particular,

- will changing the lighting condition and giving optometric corrections reduce visual discomfort and headache for the VDU operators?
- will an opportunity to support the forearms on the table top in front of the operator lead to reduced pain in the musculoskeletal system?
- will the effect reported by the former intervention groups (T and S) after 2 years, still be present after 6 years?

## 3. Design of the study

The study was performed as a prospective, parallel group design. Approximately 50 male subjects participated in each of the three groups (Aarås et al., 1998). The main task in each group was software engineering. Two groups (T and S) were given interventions in terms of new lighting, new workplaces, and optometric corrections, when required. The C group acted as a control group for 3.5 years. That means that the C group continued with the initial lighting system, initial workplaces, and were not given optometric intervention. Points of time for start of the three interventions in the T and S groups are given by Aarås et al. (1998, Table 2). The three interventions were, for each participant in the T and S groups, at least 6 months apart. This allowed recording of visual discomfort and pain levels also for an observation period of 6 months. The C group got the same lighting and work place interventions as the T and S groups approximately 3 months before the 4th measurement (3.5 years after the start of the

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