

# A new table for work with a microscope, a solution to ergonomic problems

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## Abstract

Microscope workers are exposed to continuous static muscular work and an increased risk of musculoskeletal disorders in the neck, shoulder and upper extremities. In a Finnish research centre, microscope workers reported pain in the shoulder, neck, lower back and upper back. As a consequence, a programme to solve the ergonomic problems of microscope work was initiated and led to the construction of a new table for microscopes. Ten experienced male microscope workers were chosen as subjects to carry out an experimental study in which the new table and an old one, an ordinary non-adjustable laboratory table, were compared in a standardized microscope task. The dependent variable was the electromyographic activity measured from muscles in the neck–shoulder region. The new table allowed the microscope to be used with the head in an upright position, the forearms supported and with less flexion of the upper arm. Surface electromyographic measurements also confirmed that the changes were ergonomic improvements.

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## 1. Introduction

Microscope workers are exposed to continuous static muscular work and an increased risk for musculoskeletal disorders in the neck, shoulder and upper extremities, and ergonomic guidelines and solutions are needed to help prevent such risks among these workers (Haines and McAtamney, 1993; Kalavar and Hunting, 1996; Krueger et al., 1986).

The Geological Survey of Finland is a modern research centre where over 100 persons work with a microscope for 10–50% of their total work time. According to a questionnaire survey, the microscope workers in this centre suffer from pain in the shoulder region (75%), the neck region (57%), the lower back (49%) and the upper back (39%). The most detrimental symptoms were found to be the sensation of neck

stiffness, neck pain and difficulty to turn the head sideways. A programme to solve the ergonomic problems of microscope work was carried out in 1995–96. Different types of work with a microscope were studied, the working postures and movements were analysed, and the workers were asked for suggestions for improving the microscope table.

The programme resulted in the following instructions for the safe use of microscopes:

Characteristics for an ergonomic microscope:

- Adjustable ocular angle.
- Adjustable ocular height.
- Adjustment knobs (focusing, nicols, revolving stage) sufficiently low.
- Possibility to attach a forehead support (a forehead support was tested, and its use decreased muscular activity in the neck).

Characteristics for an ergonomic chair:

- Stable, if on castors, then castors should be lockable.
- Seat height easily adjustable (small women–tall men).

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✉ Deceased.

- Adjustable angle and depth of the seat.
- High back support, adjustable in height and angle (support of low back).
- Neck support, adjustable in height and in frontal plane.
- Optional armrests, adjustable in height, sideways and in frontal plane.

Characteristics for an ergonomic microscope table:

- Stable.
- Adjustable in height (crank, electrical, etc.).
- Sufficient amount of space (manual, counter etc.).
- Sufficient amount of leg room.
- Cut-away section at the front of the table (sitting near the microscope, arm support).
- Tilttable microscope level (ocular angle).
- Support for the forearms and the forehead.
- Adjustable forearm support with soft padding.
- Adjustable forehead support attached to the microscope or the table.

The microscope workers in the Geological Survey of Finland had an ergonomic, fully adjustable chair, they used conventional (non-adjustable ocular height and angle), high standard, expensive microscopes and ordinary laboratory tables. The management found it too expensive to replace the expensive, well-working microscopes with new, ergonomic ones. Therefore to improve the ergonomics of microscope work in the research centre, they chose to have a new microscope table designed.

For good working posture and minimal complaints, a microscope workstation should be adjustable to fit different size operators. Operators should be able to reach all the controls with their elbows resting on the table (Kreczy et al., 1999; Nielsen, 2000; Helander et al., 1991).

Along with these guidelines, we used the knowledge gathered in the ergonomic programme carried out in the Geological Survey of Finland to construct a new table for microscope work (Sillanpää and Viljanen, 1996). The new table had a height adjustable and tilttable middle section, on which the microscope was placed, along with adjustable right and left sections. Finally, a section at the front of the table was cut-away so that the operators could place their forearms on the table. The new table allowed the microscope to be used with the head in an upright position and the forearms supported and with less flexion of the upper arm.

The objective of this study was to compare the effects of working with the new microscope table on muscular load in the neck–shoulder region during a standardized microscope task with the effects of working on an ordinary non-adjustable laboratory table.

## 2. Materials and methods

### 2.1. Subjects

Ten male workers (aged 38–57 years, mean 47 years; body weight 62–103 kg; body height 165–183) were chosen as subjects. The men were experienced microscope users (having worked with microscopes 1.5–30 years, mean 17 years) and were able to practise using the new microscope table before the experiment.

### 2.2. Study design

In the experimental study, the new and old tables (Fig. 1) were compared in a standardized microscope task. The task was to identify the minerals from a rock slice (thin section) placed in position on the revolving stage of the microscope. The subjects repeated the task 5 times on both tables in randomized order.

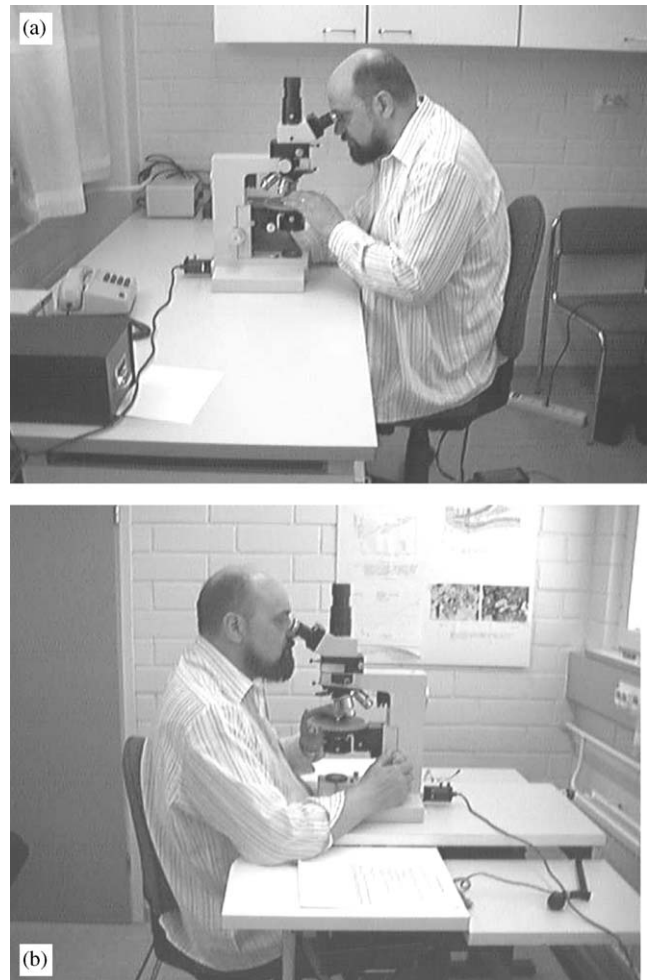


Fig. 1. The old microscope table (a) and the new ergonomic microscope table (b).

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