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## Ergonomic analysis and simulation in department of ophthalmology

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### Abstract

Although the fundamental task of ergonomics is to generate normal and healthy working conditions the great number of work-related musculoskeletal disorders is present in most industries and occupations and it is even increasing. Therefore scientifically designed workplace based on methodical approach is very important to minimize risk at work. The paper presents a systematic approach to the workplace design in department of ophthalmology regarding strain and stress. Strains and stresses belong to an important group of factors that reduce human efficiency at work, resulting in fatigue. Beside that workplace should be designed considering human dimensions using anthropometric measures. Investment in new technologies, practices and methods sometimes beside benefits brings also new challenges that must be addressed. Results of performed OWAS analysis show that present way of working could be damaging for nurses and doctors therefore workplace adjustment should be made.

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### 1. Introduction

While working, the workers are exposed to various strains and stressors that contribute to stress. Strains and stresses belong to an important group of factors that reduce the effects of this phenomenon, working hours should be interrupted by several rest periods and breaks. Beside that workplace should be designed considering human dimensions using anthropometric measures [1]. For effective ergonomic analysis the most important factors that influence stress at work are:

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1. working environment with working conditions such as noise, heat, humidity, illumination, air velocity and
2. body postures; especially awkward postures that can cause health problems.

There are of course another influence factors present for human at work such as psychophysical, dependent from human characteristics and personality, but these factors were not subject of our research.

In the paper two workplaces from Department of Ophthalmology will be presented where similar problems occur: back and neck pains, fatigue and eye difficulties. On the first workplace the Intravenous Fluorescein angiography is made which is a technique for examining the circulation of the retina and choroids using a fluorescent dye and specialized camera. The working procedure is complex and nurses must assist in several forced positions for longer time. Also the sitting position is not harmful for the doctor the long lasting observation through the microscope is tiresome. On the second workplace for visibility problems and squint patients are mostly children and nurses assist in bent positions again. Another problem is bad illumination which is needed because of the nature of medical examination.

Doctors and nurses has been the subject of many studies to examine how physical stress and other work related factors may affect their health and well-being. Ophthalmologists are at particular risk of developing musculoskeletal disorders – back pain, neck pain, numbness in the arms, carpal tunnel syndrome etc. Several studies have confirmed this:

- A 1994 survey of 325 ophthalmologist in the United Kindom found that 54 percent of respondents had significant attacks of back pain, with those longest in the field having more frequent back pain [2].
- In a 2005 survey of American ophthalmologists, 52 percent of the 697 respondents reported neck, upper body or lower back symptoms in the prior month, with 15 percent limiting their work as a result[3].

From the ergonomics point of view the occupational risk factors are [4]:

- repetitive tasks usually under stressful circumstances,
- tasks that require fine motor control and visual focus. These raise muscle tension in the head, neck and upper extremities,
- prolonged maintenance of awkward.

Many of studies regarding to nurses focused on disorders of back, trunk, upper extremities, neck and lower extremities which are generally known as leading work –related illnesses and injuries [1-4]. Also most research has been carried out in general hospitals; there is no available data about physical work load of ophthalmic nurse in functional diagnostic. Ophthalmic nurse must assist in several forced positions for longer time therefore ergonomic analysis were made aimed to determine possible health problems and to prevent them where possible [5].

## 2. Methodology

For the presented problem consideration the following steps were taken:

- workplace analysis and evaluation; analysis of the existent workstation dimensions with respect to working postures and workers' perceptions; For our research we followed up workday activities in clinic for orthoptic. The observation was conducted all day for doctors workstation and nurses workstation,
- workplace analysis considering working environment; accurate measures of noise, illumination, heat, humidity and air velocity were taken,
- the extended OWAS method was used to evaluate the strain caused by different operators' postures at the following workstations: orthoptic clinic, workplace for intravenous fluorescein angiography and laser.
- selected workplaces were designed and analysed using Jack software package made by Technomatics.

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