

# Ergonomic chair design for ENT, Eye, Neurosurgery and Plastic surgeons

Shahrzad Riaei<sup>1</sup>, Hadi Daneshmandi<sup>1</sup>, Mohsen Razeghi<sup>1</sup>, Bahram Kouhnavard<sup>2</sup> & Zahra Zamanian<sup>1</sup>

<sup>1</sup>Shiraz University of Medical Sciences, Shiraz, Iran, <sup>2</sup>Tehran University of Medical Sciences, Tehran, Iran

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## SUMMARY

Surgeons usually work with sharp tools and sophisticated equipment that create many opportunities for neck, finger, hand, arm or wrist injuries. Despite their limited knowledge of ergonomics, they try to reduce pain during surgery. The most commonly used approach is position change. Today, surgeons use minimally invasive methods. These procedures often impose more physical needs on the surgeon than open surgery. Ergonomic chairs designed for surgeons do not provide the ergonomic position required for microscopic surgery but they can prevent back pain during open surgery. Over the past two decades, new innovations have led to a significant increase in the prevalence of microscopic surgeries, so this study aimed to investigate the characteristics of an ergonomic surgeon chair and its design for use in microscopic surgeries.

## KEYWORDS

Design, Ergonomic Chair, Surgeons, Microscopic Surgery

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## Introduction

Work-related musculoskeletal disorders (WMSDs) are one of the most common causes of chronic pain and disability in health care personnel including surgeons due to the nature of their daily work (Khan, 2016). Studies have shown that physical, psychosocial / organizational, individual and occupational factors cause these disorders. Studies have shown that the prevalence of musculoskeletal symptoms in surgeons (who perform minimally invasive surgery) and endoscopy is significantly higher than other medical and surgical specialists (Memon 2016, Hallbeck 2017).

## Method

This was a cross-sectional study. The sample size was determined based on the census data of 27 surgeons from 4 surgical specialties including ear, nose and throat surgery, eye surgery, neurosurgery and plastic surgery who performed microscopic surgeries. Inclusion criteria were musculoskeletal health of surgeons. The study population consisted of all microbial surgeons of teaching hospitals of Shiraz University of Medical Sciences in Iran. The study was conducted in 4 stages: the first step was to review the texts related to the purpose of the study, the second step included interviewing microscopic surgeons, viewing and taking photos and videos, the third step was ergonomic assessment of the risk of musculoskeletal disorders during surgery by Rula method and the fourth step was three-dimensional modelling.

## Results

The mean age of the participants at this stage was  $37.37 \pm 6.11$  years. The mean height and weight for the male participants were  $174.39 \pm 4.94$  cm and  $73.3 \pm 4.68$  kg, respectively. The mean time of

each microscopic surgery was 1.71 hours and the average number of daily working hours (microscopic surgery) was 3.42 and 4 hours in sitting and standing positions, respectively. The average daily working hours of the micro-surgeons were 4.71, 1.28 and 1.42 hours for forward bending, upright seated and lean-back positions respectively. Therefore, it can be said that these surgeons spent most of their working hours bending forward. VAS pain scores after using standard chairs for microscopic surgery were 5.32 (back pain), 4.42 (shoulder / right arm pain) and 4.15 (shoulder / left arm pain), which were their highest pain scores.

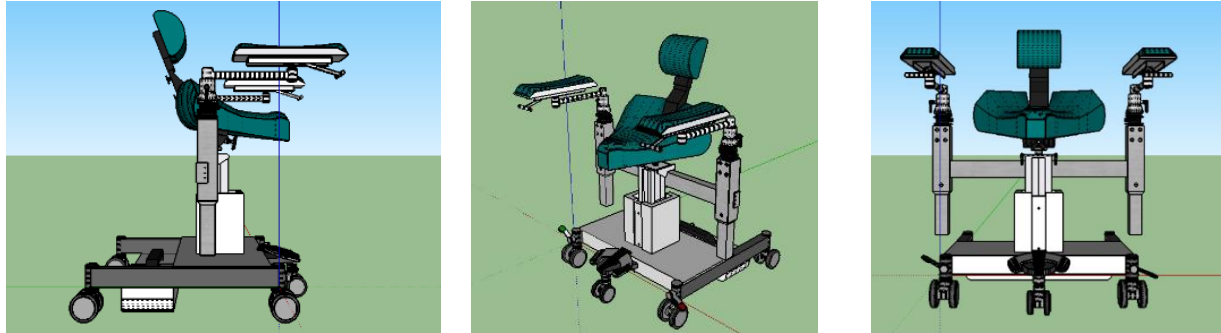


Figure 1: Final 3D design

According to research findings, surgeons spend most of their working hours bending forward. The results of objective evaluations also showed that microbial surgeons are at high risk for musculoskeletal disorders of the arm, forearm, wrist, neck and trunk. According to the surgeons' own report on the comfort of ordinary chairs, these chairs had a low score in the ease of adjusting the height of the chair during an activity. Hence, the use of foot pedals in the new design can increase the ease of adjusting the height of the seat. Also, according to the rules and regulations of the Iranian Institute of Standards and Industrial Research (ISIRI), surgeons can use electric chairs.

Due to the nature of their work (ocular and precise) surgeons are at risk for musculoskeletal disorders, especially in the lumbar and shoulder / arm area, for microscopic surgery, it was decided to make a chair so that the surgeon can be in position. Sit down and keep your feet flat on the floor to limit forward bending during surgery. In the new design, the chair has an almost lower slope, so that the surgeon can overlook the operating room and the patient's bed. The foot pedals are designed to increase the ease of adjusting the height of the seat. In addition, height-adjustable supports in all directions and a short height-adjustable support with a lumbar support were considered. The back height supports from the top of the pelvis to the shoulder blades and also allows maximum freedom of shoulder and hand movements. Also, castor wheels designed (for ease of use) can be locked with a special mechanism.

## References

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