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# Ergonomics in surgical environments

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## ABSTRACT

The majority of work-related musculoskeletal disorders (WRMDs) in surgery are mostly related to sustained position and awkward postures, forcing non-natural gestures in surgeon's body. This article points to describe the different ailments studied during surgical tasks over the years: causes which increase the discomfort and fatigue, and effects related with them, in order highlight the current working conditions and how might be improved. To do that, a research is done to understand the main issues related on full body ailments and how is have been evaluated in different types of surgery, for which, the lead postural analysis technologies are presented, understanding Rapid Upper Limb Assessment system (RULA) the most suitable method to establish priorities for preventive/corrective actions. Knowing the ailment's causes it have been necessary to define the critical points related with the causes, as instrumentation design, regulations in operating tables and chairs, pedal drives, and other surgical elements that require an ergonomic improvements, so that, the main design guidelines have been collected in this document and have been compared with a sample of current products available in the market, with the purpose of knowing the degree of implication between the requirements requested by the surgical teams and the companies dedicated to their designs.

## CCS CONCEPTS

• **Hardware** → Emerging technologies; Analysis and design of emerging devices and systems; Emerging technologies; Emerging interfaces.

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## KEYWORDS

laparoscopy, ergonomics, common injuries, physical ailments, discomfort

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## 1 INTRODUCTION

Ergonomics at the workplace is growing in importance in our daily lives. The advantages in following ergonomic criteria have been proven when performing consistent and repetitive tasks. These global guidelines serve as a preventive element against possible illness or sick leave, so their use, in addition to being beneficial for workers, is also useful to the companies and organizations that employ them. However, in the field of medicine, specifically in the field of surgery, these criteria are limited by the particularities that each operation presents. Nowadays, performing long and complex surgeries is common, although it is true that preparation for an operation [1] and the positioning of the patient according to the type of intervention have been studied in depth; being a key factor for obtaining satisfactory results of surgery [2]. The field of ergonomics when applied to a medical team that performs an operation is still an area that presents many issues which are open to debate. Generally speaking, accessibility to the patient's condition, instruments used, postures maintained and fatigue caused by the required interaction between external devices and the patient are the origin of common complaints among surgeons and assistants when performing operations [3]. The objective of this work is focused on the postural ergonomics of surgeons, ascertaining their causes and the main ailments diagnosed. In addition to this, ergonomic calculation methods are shown, in order to be able to identify such problems through postural analysis, showing the latest trends and design guides that are currently under development.

Additionally, a brief summary is made of the state of equipment that exists on the market today, which is designed to attempt to



**Figure 3: Adaptación de fig.1 Left: surgeon's posture while performing microsurgery and Stryker Surgitool (41). Right: Surgical chair Frastema 88FX**

## 5 CONCLUSIONS

Ergonomics in surgery is a key factor in its own performance. The data provided only highlights the broad margin for improvement in this area. It is known that medical personnel suffer ailments in different areas of the body during/after the surgery, although the areas most affected are those in the upper body, such as the back, due to static positioning, the neck, due to the posture adopted when operating, and the wrist, due to instruments' use. The instruments used have a broad scope of study, with grip geometry and ergonomics being one of the main points in which efforts should be focused, as well as the operating table itself, which should improve in its positioning and technical usefulness to facilitate the work of the medical team. Surgical equipment in the operating theatre is another area for improvement: the arrangement of electronics required around medical staff, their angle and positioning, and their interaction with them, the free passage area, the arrangement of assistance around the surgeon and the distribution of surgical furniture is an aspect which the study shows as having shortcomings. The concept of ergonomics does not only affect the posture of medical personnel, which is influenced by multiple factors, it is an issue involving the user and his/her interaction with their surroundings. Thus, ergonomics in this field cannot be treated separately, but as a compendium of elements working as a whole. This view, having already been presented in various studies, would bring a significant improvement in the working conditions of medical staff. Future guidelines should aim on one hand towards prevention, correcting posture errors made by the medical team. On the other hand, corrective measures should be taken in the design of medical equipment, so as to provide surgical furniture with ergonomic value, preventing ailments and injuries among surgeons and assistants as much as possible.

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