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Ensuring employee well-being: a deep dive into ergonomic product testing

Ján Zuzik, Ing.*
Department of Industrial Engineering, Faculty of Mechanical Engineering,
University of Žilina,
Univerzitná 1, 010 26 Žilina.
E-mail: jan.zuzik@fstroj.uniza.sk, Tel.: + 421 41 513 2748

Ľuboslav Dulina, prof. Ing., PhD.
Department of Industrial Engineering, Faculty of Mechanical Engineering,
University of Žilina,
Univerzitná 1, 010 26 Žilina.
E-mail: luboslav.dulina@fstroj.uniza.sk, Tel.: + 421 41 513 2709

Vladimíra Biňasová, Ing., PhD., DiS.
Department of Industrial Engineering, Faculty of Mechanical Engineering,
University of Žilina,
Univerzitná 1, 010 26 Žilina.
E-mail: vladimira.binasova@fstroj.uniza.sk, Tel.: + 421 41 513 2727

Beáta Furmannová, Ing., PhD.
Department of industrial engineering, Faculty of Mechanical Engineering,
University of Žilina,
Univerzitná 1, 010 26 Žilina.
E-mail: beata.furmannova@fstroj.uniza.sk, Tel.: + 421 41 513 2711

Martin Gašo, Ing., PhD.
Department of industrial engineering, Faculty of Mechanical Engineering,
University of Žilina,
Univerzitná 1, 010 26 Žilina.
E-mail: martin.gaso@fstroj.uniza.sk, Tel.: + 421 41 513 2137

Abstract: The research's objective is to examine the merits and drawbacks of an ergonomic chairless chair product in a manufacturing environment. The initial section presents the product and a particular project. The subsequent section demonstrates its application in the workplace. The final part is devoted to assessing the utility of chairless chairs in a production setting. There is a need for wider adoption of this product due to its capacity to enhance ergonomic conditions and reduce work-related ailments. Additionally, the article serves as an appraisal of the product's performance in a manufacturing context, scrutinizing both its pros and cons.

Keywords: industrial engineering, ergonomics, well-being, ergonomic product

INTRODUCTION

One fundamental component of the work system involves the individual worker and their combined physical and mental capabilities. Ergonomics seeks to tailor the job to the individual, involving the optimization of all physical and psychological aspects of work [1-4, 15].

The primary objective of industrial ergonomics is to create a work environment intentionally designed to mitigate the chances of discomfort and pain. It primarily focuses on preventing *Musculoskeletal Disorders* (*MSD*) development [4, 6, 7].

In the field of ergonomics, there are two distinct approaches. The reactive approach pertains to situations where ergonomic risks and issues are typically not addressed until problems have already arisen among employees, such as discomfort, pain, and functional disorders. Unfortunately, this approach is prevalent in many industrial enterprises. While most companies do not apply ergonomics at al [5, 6, 8].

On the other hand, the proactive approach is characterized by the allocation of time and effort to ergonomic considerations during the initial phases of workplace implementation. An illustrative case involves the requirement for employees to stand throughout their entire work shift. As a response, certain larger companies are striving to introduce measures aimed at enhancing workplace comfort and eliminating the occurrence of conditional diseases [9, 11, 12].

These measures include the utilization of exoskeletons, which play a significant role in alleviating the strain on employees' muscle groups that are subjected to high stress [13, 14, 16].

1 CASE STUDY

The purpose of the case study was a project with a primary objective of enhancing the working environment in the workplace. Additionally, the aim was to determine the product's impact on employee well-being. This will help mitigate the onset of various work-related illnesses.

The goal of the project was to verify an ergonomic product in the production process in a selected situation. The case study was carried out in an unnamed company in the production department.

2 PRODUCT SPECIFICATIONS

The tested product was an exoskeleton. It is specifically a chairless chair, which serves to reduce the load on the lower limbs during work. Testing will make it possible to reveal not only positives from the field of ergonomics but also negatives.

In Fig. 1 below, you can observe the product that is slated for experimentation in specific production departments.

Fig. 1. Representation of the product under evaluation [10]

Fig. 1 provides an image of the product being tested within the company's production domain. The illustration showcases the complete product framework, the supportive waist belt, seat attachment, the seating surface, and adaptable carbon components for accommodating various body sizes. The overall weight of the product amounts to 3 kilograms [10]

Fig. 2 provides a direct illustration of the product being tested on an individual in a production setting.

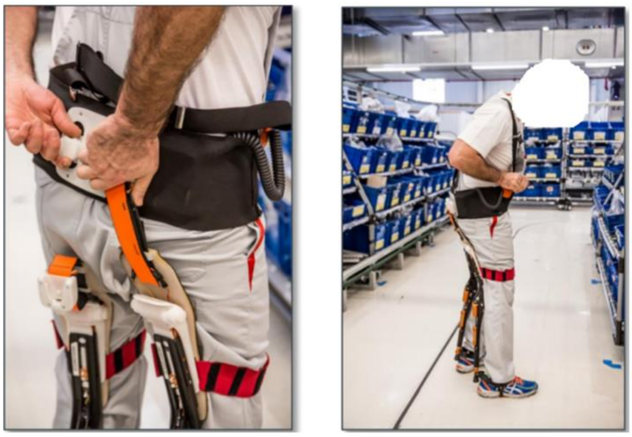

Fig. 2. The product in use by an employee during the production process [10]

Key specifications of chairless chairs [10]:

- the chairless chair allows employees to take a seat even during brief assembly breaks,
- two adjustable carbon elements facilitate the transfer of body weight to the ground,
- it enhances posture and diminishes strain on the legs,
- the need for standing throughout the work shift is minimized.

3 TESTING THE PRODUCT ACROSS VARIOUS JOB POSITIONS

In this section, you can observe the evaluation of the chairless chair in various work postures. The evaluation encompassed five departments with the participation of 25 employees and extended over 7 days, spanning both morning and night shifts.

3.1 Cockpit pre-assembly

Part of this workplace is that the employee performs assembly and pre-assembly work activities. It is specifically about the pre-assembly of the cockpit. The employee ensures the performance of two pre-assembly activities. The first activity is related to the pre-assembly of the switch on the steering column. The employee installs the switch on the steering column in a combination of walking, sitting, and standing. The second activity is related to the assembly of the instrument panel. A standing worker installs an instrument panel on the cockpit. In Fig. 3, you can observe an employee working in this particular position while utilizing the chairless chair. The illustration demonstrates the substantial assistance the chairless chair provides to the employee in their tasks within the production process.

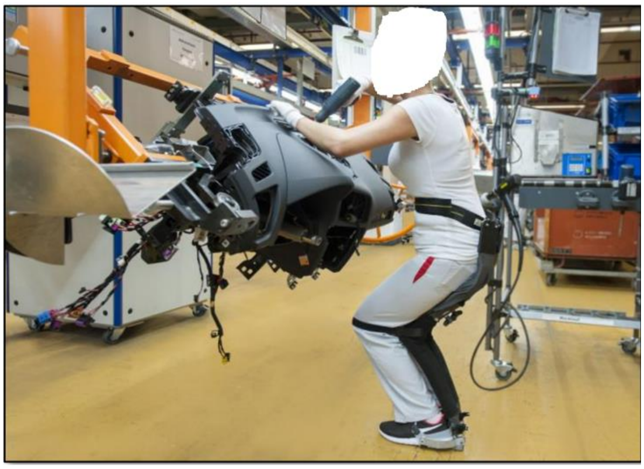

Fig. 3. The utilization of a chairless chair by an employee in the course of the assembly and pre-assembly processes [10]

Tab. 1 displays the assessment of the execution of the conducted test.

Tab. 1. A summary of the implementation of execution during the test

The implementation of the test:
• It was implemented on 4 employees.
• It was tested for 4 hours.

Tab. 1 provides a summary of the outcomes from the testing of the cockpit pre-assembly.

The examination was specifically conducted as follows:

- on four department employees,
- for four hours.

Tab. 1. Evaluation of the advantages and enhancements of the test

Advantages/Enhancements:
• There is no need to manipulate the chair.
• Better posture.
• Relief through a combination of sitting and standing.
• Reduction of operation time.

From Tab. 2 it is possible to see a summary of the advantages and enhancements of the testing.

The benefits of the performed test are:

- no requirement for manual chair adjustments,
- improved body posture,
- alleviation achieved through a combination of sitting and standing,
- reduced operation time.

4 ASSESSMENT OF THE TEST RESULT

In this section, you can find an assessment of the pros and cons associated with the utilization of a chairless chair in the production process.

The evaluation of pros and cons can be seen in the following Tab. 3 and Tab. 4.

In the following Tab. 3, it is possible to see the overall pros of a feasible solution.

Tab. 3. The pros of a feasible solution

Pros:
The function of the seating: • Knee relief. • Provides a comfortable feeling.
• Introducing this device will guarantee the highest employee satisfaction.
• Enhanced comfort during work.
• Efficient for bending down.
• A fantastic concept when optimized.

Tab. 3 highlights the benefits derived from the test results. One of the significant advantages of utilizing a chairless chair is its capacity to offer knee relief and work comfort and enable maximum flexibility in bending.

In the following Tab. 4, it is possible to see the overall cons of a feasible solution.

Tab. 4. The cons of a feasible solution

Cons:
Comfort: • Excessive weight. • Discomfort during walking. • Risk of tipping backward. • Issues with dressing and undressing.
• The existing chairless chair's comfort level makes it impractical for widespread long-term use.
• It necessitates a certain level of physical fitness.
• Belt: slipping, excessive warmth, heaviness.
• Equipment hygiene concerns.

Tab. 4 points out the drawbacks evident in the test outcomes. One notable shortcoming includes the device's weight, its challenging usability during walking, and concerns regarding internal hygiene.

CONCLUSIONS

The primary objective of the article was to assess the applicability of an ergonomic product within the workforce. The chairless chair, categorized under exoskeletons, offers a solution aimed at enhancing workplace comfort and safeguarding employee health. Specifically, it is designed to alleviate the strain on employees' vulnerable muscle groups. This evaluation is of significant value to the field of ergonomics as it not only validates the merits of such solutions but also uncovers hitherto unnoticed drawbacks. Thus, the essence of the article lies in showcasing the product's use in the production process, shedding light on its advantages, as well as its limitations.

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