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DESIGN AND DEVELOPMENT OF ERGONOMIC CHAIR

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Abstract:In today's day-to-day life, it is very difficult to have time to stay relaxed while doing work. According to the research, 48% of slip disc problems can occur in workers due toonly standing work There is a need to have arrangements such that when workers get free time and while working, you can sit and relax. Therefore, the idea of a standing chair comes into the picture. It gives you the ability to sit anywhere and everywhere. One can easily standand relax as if sitting, and can easily sit when I get some free time. This new concept is very useful for industrial workers. In this project, we willdesign and develop the ergonomic chair that can be introduced in every industry where workers can work efficiently, improve production, and lead healthylife without any problems like varicose veins etc.

Index Terms - Chair-less seating, Worker weight, relaxation,varicose load, healthy, improved production

1. INTRODUCTION

An ergonomic standing chair is a type of chair designed to promote proper posture and comfort while standing. These chairs are popular in workplaces and other settings where people need to stand for long periods, such as production and assembly lines. The design of an ergonomic standing chair is focused on providing support for the lower back, legs, and feet, and promoting good posture while standing. This is achieved through a combination of features such as a seat, footrest, and adjustable height. The development of ergonomic standing chairs involves a range of design and manufacturing processes including , material selection, prototyping, and quality control testing. The chairs are made using lightweight and durable material steel to ensure they can withstand prolonged use without compromising safety or comfort,Overall, the goal of designing and developing ergonomic standing chairs is to provide users with a comfortable and safe alternative to traditional seating options. These chairs are ideal for those who need to stand for extended periods while working and can help reduce the risk of health issues associated with prolonged standing, such as back pain, leg pain, and poor posture

2. LITERATURE REVIEW

Maki Toda 2020[12]The development of a chair specifically designed for people with disabilities, taking an ergonomic approach to ensure the chair is comfortable and supportive for the user. The author notes that people with disabilities often face challenges in finding a chair that meets their specific needs, as traditional chairs may not offer the necessary support or accessibility features.

Punnett,L.(2018) [15]Sitting in a chair for extended periods of time can contribute to a range of health problems, including musculoskeletal disorders, cardiovascular disease, and metabolic disorders.Chairs that are poorly designed or improperly adjusted can exacerbate the health risks associated with sitting, and may contribute to discomfort and pain.

Dehghan,m.,Nejati,v.(2019) [18]Chairs should be adjustable to accommodate different body types and postures, and that they should provide adequate support for the spine and lower back.chairs should be designed to promote postural balance, which involves maintaining a stable and comfortable position while sitting.

Durmus,d.&Ihan,m.n(2019) [19]Children and parents had different preferences when it came to chair design. Children tended to prefer chairs that were visually appealing and allowed for movement, while parents prioritized safety and adjustability. Both groups agreed that comfort was an important factor in chair design.The design of chairs for children, and that chairs should be designed with a focus on both user preferences and ergonomic factors. They also note that involving children and parents in the design process could help to ensure that chairs are more effectively tailored to their needs and preferences.

Park,J,Lee,S.Y,&Kim,.H.(2019)[20]The development of a chair specifically designed for individuals with spinal cord injury (SCI) involved the development of a prototype chair and a series of tests to evaluate its effectiveness in providing support and promoting functional activities for individuals with SCI.The prototype chair provided effective support for individuals with SCI and was able to promote functional activities such as sitting, standing, and transferring. The authors suggest that the chair could be a useful tool for promoting independence and quality of life for individuals with SCI.

3.BACKGROUND

Standing for some time is good for health, but only if you've not been forced to do it for hours. Excessive sitting is also dangerous as it badly affects the body's metabolic rate, resulting in the risk of disease like high blood pressure, diabetes, cancer, depression, etc. In workstations, main concerned is to enhance the productivity but very less concerned is given to the effect of work fatigue on the worker' s body. Even though the workplace is ergonomically designed but, in fact, they are not successful in relieving worker fatigue since most of the time they have to work for hours in a particular posture. Till now in the present era of fast growing technology, workstations do not have a device which can provide comfort to the worker. It is evident that sloping/kneeling chair preserves lordosis and sacral slope with upright as well as slumped posture than a flat one; it results in less tissue strain which in turns lowers back pain. So why it is preferable to sit on a sloping chair than flat one this means flexible wearable chair provides better comfort than that of flat one for the same working posture

The complications of prolonged standing are conditions that may arise after standing, walking, or running for prolonged periods. Many of the complications come from prolonged standing (more than 60% of a work day) that is repeated several times a week. Many jobs require prolonged standing, such as "retail staff, baristas, bartenders, assembly line workers, security staff, engineers, catering staff, library assistants, and hair stylists and laboratory technicians." The basic physiological change that occurs in the body during prolonged standing or sudden standing from the supine position is that there will be increased pooling of blood in the leg, which decreases the venous return, and so there will be decreased cardiac output, which ultimately causes systolic blood pressure to fall.(hypotension). This hypotension may cause the subject to faint or have other symptoms.of hypotension. Standing requires about 10% more energy than sitting.

4. Ease of Use

Ergonomic standing chairs are designed with user convenience and ease of use in mind. Here are some features of ergonomic standing chairs that make them easy to use:

1. Adjustable Height: Ergonomic standing chairs come with adjustable height mechanisms that allow users to adjust the height of the chair to their desired level. This feature enables users to find the most comfortable height for their standing position and can prevent the need to bend or strain to reach objects.
2. Footrest: Ergonomic standing chairs come with a built-in footrest that provides support for the feet and legs, reducing fatigue and making it easier to stand for longer periods.
3. Lightweight Design: Ergonomic standing chairs are typically lightweight and easy to move, making them convenient to use in different workspaces or locations.

5. POPULATION AND SAMPLE

In the context of studying the design and development of ergonomic standing chairs, the population may refer to all individuals who use or are in need of such chairs, while the sample refers to a smaller subset of individuals who are selected for the study. A research study on the effectiveness of an ergonomic standing chair in reducing back pain may have a population of all individuals who work in an office setting and experience back pain due to prolonged sitting. The sample for this study may consist of a group of 10 individuals who are randomly selected from the population to participate in the study. The selection of the sample is important in research as it can affect the validity and reliability of the findings. A representative and unbiased sample can help ensure that the findings are generalizable to the population and can be applied in a broader context.

6.DATA AND SOURCES OF DATA

The data used in the development of this chair shows that it is common practise to design for the 5th percentile (5%) female and the 95th percentile (95%) male. The 5 percent female value for a particular dimension (e.g., sitting height) usually represents the smallest measurement for design in a population. Conversely, a 95% male value may represent the largest dimension for which one is designing. The 5–95% range accommodates approximately 90% of the population. To design for a larger portion of the population, one might use the range from the 1st% female to the 99th% male.

7. MATERIALS USED

The majority of the pieces, including the chair base, the chair's bottom, the knee support, and the foot rest, are made of MS STEEL. For added comfort, foam is utilised in the knee support, and a wooden board serves as the foot rest.

8. METHODOLGY

The development of an ergonomic chair typically involves a multi-disciplinary approach that combines expertise from various fields such as engineering, ergonomics, and design. The following methodology can be used to develop an ergonomic chair:
Research and Analysis: The first step is to research the existing ergonomic chairs in the market, their features, and identify their strengths and weaknesses. This can be done by conducting surveys, reviewing literature, and studying user feedback.

- Ergonomic Assessment: Once the research is completed, an ergonomic assessment needs to be conducted to understand the needs and requirements of the users. This can be done by conducting interviews, surveys, and observing users in their work environment.

- Concept Development: Based on the research and ergonomic assessment, concepts for the ergonomic chair can be developed. This involves brainstorming ideas, sketching out designs, and creating prototypes.

- Prototype Testing: The prototypes need to be tested to evaluate their ergonomic features and usability. This can be done by conducting user tests, simulations, and experiments.

- Design Refinement: Based on the results of the prototype testing, the design can be refined and improved. This may involve tweaking the chair's dimensions, adjusting the angles and curves, and fine-tuning the materials used.

- Production: Once the design is finalized, the chair can be manufactured. Quality control measures should be implemented to ensure that the chair meets the ergonomic standards.

- User Education: Users need to be educated about how to use the chair correctly to maximize its ergonomic benefits. This can be done by providing instructions, training, and support.

- Overall, developing an ergonomic chair requires a thorough understanding of the users' needs and ergonomic principles, combined with expertise in design, engineering, and manufacturing

9. FIGURE AND TABLE

Fig1.1

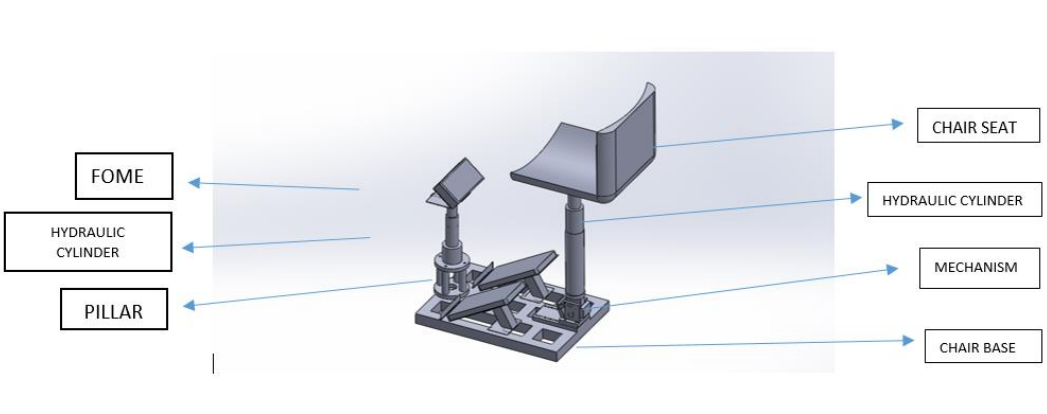

Fig 1.2

S.no	POSITION	Starting value	Ending value	Range
1	Bottom to seat	0(in mm)	730 (in mm)	(0 – 730)mm
2	Bottom to knee support	0 (in mm)	430(in mm)	(0 – 430)mm
3	Angle adjustment of seat	70 (in deg)	90(in deg)	(0 – 20)deg
4	Horizontal adjustment of seat	0 (in mm)	20(in mm)	(0 – 20)mm

Table1.1

10. RESULT

As a result, the proportions and materials stated above were used to create an ergonomic chair, and users considered the chair to be flexible and pleasant.

11. FUTURE WORK

Further design revisions will be made based on user input and expectations, and the improved design will be created and released to the market for use moving forward.

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