

Design and Development of Human Hoist

Prof.A.B.Tupkar

*Department of Mechanical Engineering
Priyadarshini College of Engineering, Nagpur, Maharashtra, India.*

Adwait Dodke, Aniket Tiwari, Mangesh Chopde, Prashant Bagde, Pranav Amle, Praveen Kale, Bhagwat Shinde.

*Department of Mechanical Engineering
Priyadarshini College of Engineering, Nagpur, Maharashtra, India.*

Abstract- The study will include the ergonomics risk factors in relation of human and their nature of work. Based on the literature, the most significant ergonomics risk factors are awkward posture in handling job task, force and repetition of specific movement including vibration. Other ergonomics risk factor includes uncomfortable static position, contact stress of muscles and tendon and also extreme temperature condition. It is very aptly called the Human Hoist because of what it does and even though it was originally created with able-bodied mechanics in mind (who get down on their backs a lot; hoping to save them pain down the line), it's one of the contraptions that could help disabled people to come along in a long time. With the flick of a switch, this machine goes from "sitting mode" to full on tilt-you-back-so-you're-laying-on-your-back mode.

Key words: Ergonomic, anatomy, Elevator, elevating

I. INTRODUCTION

Ergonomics is derived from Greek word "Ergon" that means work, "Nomos" that means law. Together it means law of work. Ergonomics relates to motion study & human comfort. Ergonomics is the science of designing job, equipment, workplace to fit the people and their work. It is the scientific relation between man, machine and work environment.

Industrial ergonomics is the science of fitting work systems and work environment to human. Hence, ergonomics is an intrinsic element of labour intensive industries in which human plays a central role.

Ergonomic improvements involve prevention of occupational health and safety risks, improvement of work environment factors to enhance human well-being, productivity and quality through reduction of human error and discomfort.

Since early 90's, as it has been revealed that micro ergonomic interventions by experts could yield minor improvements, organizational dimensions of ergonomics have gained importance. Need to address organizational aspects of ergonomics commenced research in macro ergonomics (Hendrick, 1991)¹ and participatory ergonomics (Noro, 1991)² concepts. Ergonomics was found to fall short without effective management of applied ergonomics efforts. Among the organizational aspects of industrial ergonomics, leadership is important for effective management of ergonomics projects.

Industrial ergonomics project (IEP) managers should lead a multilateral process. On one hand they assume responsibility of reporting to top management about progression of project. On the other hand, they should maintain participation and acceptance of work force which is crucial in generating solution to ergonomic problems and implementation of ergonomic improvements^{3,4} (Axelsson, 2000, Macleod, 1995). In all types of an industrial environment, physical work is considered as a work system. Consisting of men and machine, so every attempt must be made to select a high degree of compatibility between

II. RELATION BETWEEN PROPOSED PROJECT AND ERGONOMICS

Project is directly based on sitting position & working posture. Relation of human sitting and their nature of work. Repetitive strain injuries from repetition, vibration, force, and posture are the most common types of issues, and thus have design implications.

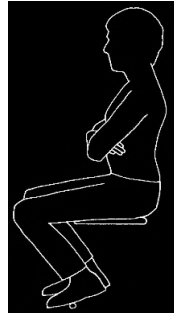


Fig.1. Shows Unsupported sitting posture



Fig.2. Shows Supported sitting posture

Physical ergonomics is concerned with the impact of anatomy, anthropometry, biomechanics, physiology, and the physical environment on physical activity. Areas of focus in physical ergonomics include the consequences of repetitive motion, materials handling, workplace safety, comfort in the use of portable devices, keyboard design, working postures, and the work environment.

The study will include the ergonomics risk factors in relation of human and their nature of work. Based on the literature, the most significant ergonomics risk factors are awkward posture in handling job task, force and repetition of specific movement including vibration

Other ergonomics risk factor includes uncomfortable static position, contact stress of muscles and tendon and also extreme temperature condition.

It is very aptly called the Human Hoist because of what it does and even though it was originally created with able-bodied mechanics in mind (who get down on their backs a lot; hoping to save them pain down the line), it's one of the coolest contraptions that could help disabled people to come along in a long time. With the flick of a switch, this machine goes from "sitting mode" to full on tilt-you-back-so-you're-laying-on-your-back mode, but it doesn't stop there. Oh no, it gets cooler

Ergonomics can also reduce the potential for ill health at work, such as aches, pains and damage to the wrists, shoulders and back, noise-induced hearing loss and work-related asthma. Consider the layout of controls and equipment – they should be positioned in relation to how they are used. Place those used most often where they are easy to reach without the need to stoop, stretch or hunch. Making sure protective measures such as extraction hoods or respirators are easy and comfortable to use means they are more likely to be effective at reducing exposure to hazardous substances.

III. CURRENT DIFFICULTIES

The most significant ergonomics risk factors are awkward posture in handling job task. Increasingly constrained as the work process systematically automates activities that previously required changes in posture.

Today's working postures of chair and sledge are not comfortably flexible. Stresses and fatigue occur when working prolong. Most people prefer sitting, because it requires less overall effort by the large muscles than when they stand. Sitting also stabilizes posture and often helps us work.

Many of us spend most of our day (at work, at home, driving, and out) sitting. However, continuous sitting has disadvantages and potential long-term consequences.

People have difficulty tolerating unsupported, seated postures in static positions for more than a short while (Reinecke et. Al., 1985). Reinecke et al (1992, 1994) describe a pneumatic device they developed to induce

continuous passive motion in the lumbar region in order to negate some of the detrimental aspects of constrained sitting.

When allowed to move freely, people are usually in constant motion (branton, 1967, 1969, jurgens 1980). They often alternate through postural cycles continuously over the day² (branton and grayson, 1967). Unfortunately, today's computer workers' are becoming increasingly constrained as the work process systematically automates activities that previously required changes in posture (grieco, 1986; waersted and westgaard, 1997).

In industry due to improper siting and working posture several accidents are happened and cause injury and ill health ultimately reduce the performance and productivity.

AS PER LITRETURE REVIEW 1,HEALTH AND SAFETY EXECUTIVE.

ERGONOMICS AND HUMAN FACTOR AT WORK

The company assessed the work by considering ergonomics principles and, after getting ideas from the workforce, came up with the following modifications: They replaced the impact wrench with one with minimal reaction force so that little shock was transmitted to the hand. They also suspended the wrench so Eddie didn't have to support its weight. They modified the workplace layout so workers had better access to all sides of the engine, avoiding the need to adopt poor working postures. They implemented a job rotation scheme so the five workers on the line were moved around a number of different tasks. Some of these tasks still required the use of vibrating tools, but the overall personal exposure was halved. As a result of the modifications there was: a reduction in vibration exposure; no need to adopt poor and constrained postures; reduced boredom and fatigue for Eddie's team; improved productivity

Productivity and worker safety can be increased by using proper tool for worker safety. Stress on human body as reduced it directly increase the capability of work. All of the above can be achieved by using such a hoist which can not only can be adjust but also can be restrict at any angle.

AS PER LITRETURE REVIEW 2

RESEARCH INTO THE USE OF HOISTING EQUIPMENT BY CARE WORKERS

The researcher undertook this project following numerous enquiries from service purchasers,providers and users on the subject of how many carers should be present during a hoisting transfer. It appears that it is now a generally accepted practice for care providers to always supply two carers where hoisting is involved because it is perceived as a safety issue. The researcher is not opposed to safety and will always advocate safe systems of work and safe working practices, however there is little evidence to support the argument that using two carers will make hoisting operations safer, and indeed the media report a number of cases where two carers were present and serious accidents occurred (Appendix 3). Many of these cases resulted in prosecutions which are detailed on the HSE Prosecutions website.

It may be useful at this point to clarify what is meant by the term 'hoist' as there are several types;

- 'Active' hoists, also known as Standing Hoists are used to transfer the user to and from the bed, chair, toilet and so on by assisting the user to a standing position by means of a sling placed around the lower back. The sling then passes under the arms and is attached to a carry- or spreader-bar on the hoist's lifting boom. The boom is raised by an hydraulic arm which pulls the user to a stand, with the user's feet on the floor or footplate throughout the manoeuvre. The user is required to have some weight bearing ability, and should be able to participate in the stand. Active hoists have a wheeled chassis and are manoeuvred by the operator.
- 'Passive' hoists, also known as mobile or full-sling hoists also assist the service user to transfer to and from the bed, chair, toilet and so on, but do not require any active involvement from the user. The hoist uses a full length sling which supports the entire body of the user, in either a seated or reclined position, and is attached to the hoist

spreader bar. The user is lifted completely off the ground during the transfer. Passive hoists also have a wheeled chassis and are manoeuvred by the operator.

- ‘Ceiling Track’ or ‘Overhead’ hoists are a variation of the passive hoist. These have the lifting motor connected to a system of tracking which is attached to the ceiling of a room. The user is still transferred by means of a full body sling attached to a spreader bar but as the motor runs along the track the operator does not need to manoeuvre a chassis. In some cases the user is able to operate the controls of a ceiling track hoist. It is sometimes argued that the risks to the operator are lower when using a ceiling track hoist because they do not have to manoeuvre a heavy chassis. However, it must be remembered that the operator is still required to apply and remove a sling and manage the transfer which may include moving other equipment such as wheelchair and commode, with potentially complex positioning needs. There is a significant cost to those purchasing care, which may of course include the service user, if two careers are supplied to operate hoists possibly several times a day over the course of many weeks, months or even years. The costs are not just in paying for the time of the care workers but also in the on-costs of National Insurance and tax, holiday and sickness pay, uniforms, travelling expenses, training and so on. There are costs to care providers in organizing two people to be in the same place at the same time, again potentially several times a day which can be a significant logistical challenge - countless ‘care hours’ are wasted while waiting for the second person to arrive. Many service users already feel that their privacy is being compromised by having careers coming into their home several times a day, and this is exacerbated by the presence of two careers, who may of course not be the same two every time. The use of a hoist may also be a source of some anxiety and the service user could feel overwhelmed by the combination of people and equipment. Moreover, it can be argued that in having to provide two careers for some care packages, that provision for other service users may be restricted or unavailable because of the lack of resources i.e. careers. The question of whether it is appropriate for informal careers (i.e. the service user’s family members) to be the second career is also considered as part of the research, as this could have an impact on the logistics and costs of some care packages. However, it should be stressed that this is only where they are willing and able to assist, and it should not be seen as a substitute for appropriate provision by a care agency.

With current concerns over the economy and rising costs, purchasers will need to look at every opportunity to ensure that outgoings are as cost-effective as possible. As long as ‘suitable and sufficient’ risk assessments are carried out and safety is never compromised there may be many instances where the service users care needs can be safely managed by one career or, perhaps, one formal career with assistance from an informal career where this is appropriate. This should not be seen as a ‘reduction in service’ - which is unlawful without good reason - but as the same care package i.e. the same number of visits for the same

IV. PROPOSED HUMAN HOIST

Now here is an invention that could only come across over the above mentioned difficulties which often occurs in industries, workshops, service stations, hospitals. The Human Hoist, the mechanics choice of tools in the 21st century. It’s basically a creeper for getting under a vehicle on steroids. With the *Human Hoist* you can easily go from a sitting position all the way to laying on the ground within seconds and then right back up again. That has instant appeal to anyone that uses a mechanics creeper for a living. This is a major time saver for any mechanic that would speed up production and eliminate the need for a second mechanic handing you tools. The hoist is powered with built in hydraulics and spring torsion for full automation and adjustments at any level.

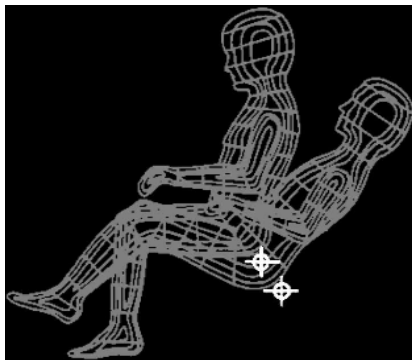


Fig.3. shows relative motion of body in sitting & laying down



Fig.4. Shows Proposed design of human hoist

The human hoist is basically used for industrial work, to increase the productivity, in the sense of men working hours and human health. The basic working principle of the human hoist is based on Pascal's law of fluid pressure. The restoring of the posture can be achieved by the torsional strength of spring.

The body stress fatigue, rapture can be reduced at some level it helps to increase the ability to do work in proper way and precisely maintain the quality of work. The human hoist is also can be used by disabled person after few modification.

Each person has their own unique postural dynamics relating to their physiology, their habits, the products they use, and the actions required of them. Even so, there are characteristics associated with our postures that are common to us all.

V. PROPOSED HUMAN HOIST

1. Collection of data and study of ergonomics.
2. Scientific approach data for the human comfort for the project.
3. Design and analysis of the human hoist, by using software like Nx, ansys. CAFEM, 3D-CAD.
4. Fabricate of the prototype of the human hoist.
5. Testing the prototype. Fabricating the working model of project.

VI. ADVANTAGES

1. The human hoist helps to improve the safety of worker during working operation.
2. Decreased healthcare costs (fewer injuries, lost workdays, claims).
3. Improved productivity in the sense of men working hours, capital.
4. Reduced operating costs and time.
5. Increased revenue (due to lower costs, more productivity, less equipment problems, etc.).
6. Improved product quality, work processes and quality of work life.
7. Valued as a recruiting tool (due to improved working conditions).
8. Improve competitive advantage (due to higher productivity, lower costs and improved quality)

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