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Ergonomic assessment of press machine using RULA method

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Abstract:

Implementation of ergonomics principles in small scale industries helps to reduce the musculoskeletal disorder in the workers. In small scale industries usually tasks are repeated, stressful and carried out with the available machinery or sources. While working in industry workers passes through various awkward postures which leads to fatigue, stress and accidents also. It is not immediately possible to change the machine or to have automation. Little ergonomic modification in the existing workstation will help to reduce musculoskeletal disorder and will increase the productivity of the worker. The study was conducted on analysis of workstation in press shop. The ergonomic study of this workstation is by using CATIA V5 R20 Software analysis tool. Photographs and videos were collected for doing posture study. Considering the workstation RULA analysis were conducted.

Keywords: Ergonomics, Workstation, Posture, RULA, Biomechanics analysis, Musculoskeletal disorder (MSDs).

Introduction

The economic growth and technological improvements have led to greater demand and development of machines and devices used in industrial settings. With these dramatic changes there has also been greater interaction between man and machines. [1] Ergonomics plays an important role in workers' productivity. Workstation layout and work design are two major factors of ergonomics of worker's efficiency. Now, manufacturers found that instead of investing lots of money on man, machine, material, method (4m),improving ergonomics of workplaces is cost saving. Ergonomics found great need when market demand is high and manufacturers need more output within short period [10].
While working on machine or workstation one need to handle lots of tasks like material handling, tool handling, control system operating etc. For each of these tasks different members of human body are coordinating with different resources. State of working involves standard sequence of different motions of machine and human, if workers are not following specific sequence of motions it results into poor efficiency of worker and lead to less productivity of workstation. Ergonomic of workstation involves effect of workstation design and layout on worker's perception towards behaviour with machine, tool and resources like bins, control button etc. Ergonomic study is important to identify non-value added activities, frequent movements, complex tasks, fatigue causing factors etc. [9].

Designers of workplaces have usually three major tasks:

a) Integration of information about processes, tools, machines, parts, tasks, and human operators;

b) Satisfaction of design constraints which often conflict each other;

c) Generation of acceptable workplace designs to all parties involved.

However, while completing these tasks, designers face the difficult task of incorporating ergonomic information about the human operators into their designs. Although today tasks and processes are mechanized or automated as the technology has advanced, many tasks are still performed manually in several industrial settings. In this context, it seems clear that matching the abilities of the operator with the task requirements as well as with working environment and physical constraints are important aspects to be necessarily considered within effective workplace design [5]. Workers suffer from fatigue and injury during long hours of monotonous work when proper workplace/working environment is absent. This may indirectly contribute to decreased productivity in an industry. Human factor issues arise in simple systems and

consumer products as well. Hence the ergonomic principles have been widely used in the design of both consumer and industrial products [2].

Musculoskeletal disorders (MSDs) continue to be a tremendous burden in industry with back injury and shoulder disorders being among the most common and costly disorders because of not having proper workstation. In industrialized countries, upper limb work-related musculoskeletal disorders (UL-WMSDs) are the most common form of occupational diseases [7].
So, there is need to implement the ergonomic principles in an industry to cope up the above all conditions. Objective of this study is to analyze the press machine ergonomics and to conduct the Rula analysis. To improve the comfort level, modifications are to be made so that stress level will get reduce and worker will work in more ergonomic environment.

2. Methodology

2.1 Modelling of existing workstation

This study is done in a press shop. Workers was said to carry their tasks as usual and then videos and photographs were taken. Various tasks carried out in the industry are observed to identify the awkward postures. Using CATIA V R20 software modelling of the actual press machine is done. Exact measurements of the Press machine, operators seating arrangement, small carrete of job etc. are taken. These measurements were used for modelling of the workstation. In same software, using ergonomics feature manikin having dimensions of Industrial Workers was developed. Simulation of this is done and exact postures like real are prepared. RULA analysis of work related disorders in Press Industry worker using Digital Human Modelling in CATIA V5 R20 software is performed.
The awkward postures were selected when the worker was doing the job of strip (patti) pressing. Various components can be made by using strip pressing. The strip are having dimensions ranging from 0.5 mm to near about 2 mm. Length of strip is near about 1.5 m. Hence when punching is done the strips is to be slide from right hand side to left hand side. Initially it does not need support but when it comes with considerable length to left side, there is need to give support to it. Then in this case left hand is moved from neutral position to the extreme left side position which causes stress to induce in the worker. The concerned position are as follow:

Fig: 2.1 Worker giving support to strip with medium extension of left hand

Fig 2.2 Worker giving support to strip with more extension of left hand

The postures are modelled by using CATIA V5 R20 software as follow:

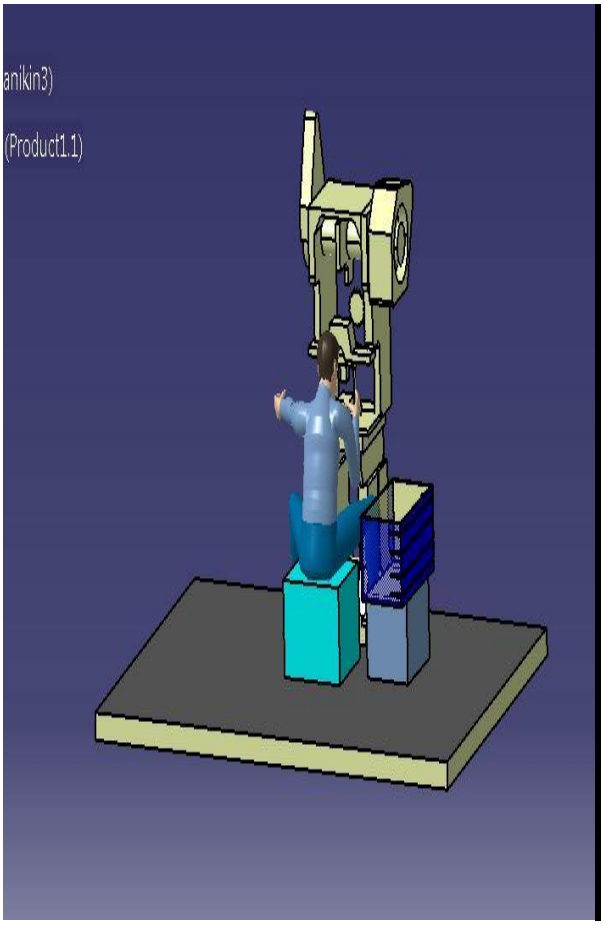

Fig 2.3 Modelling of posture 2.1

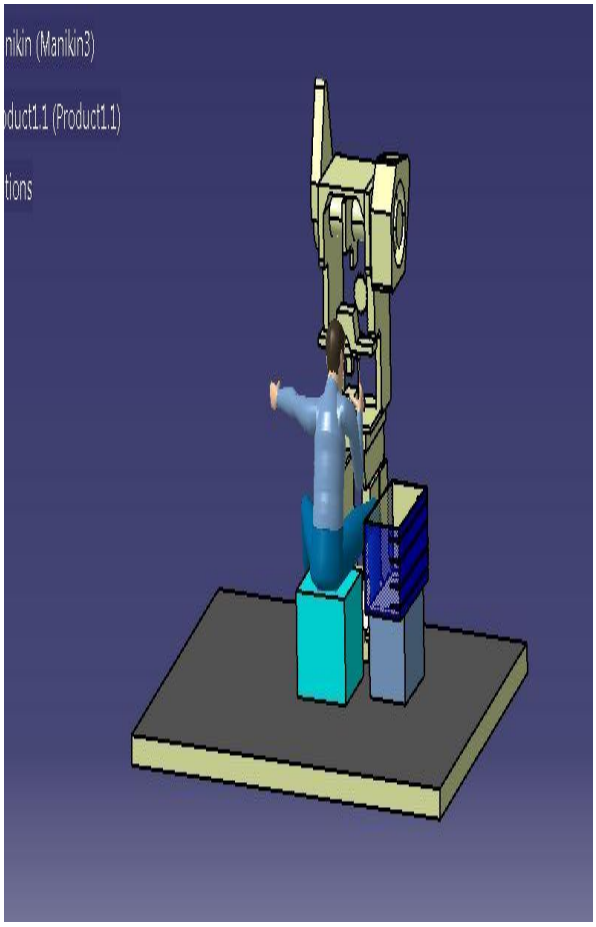

Fig 2.4 Modelling of posture 2.2

2.2 Rula analysis

RULA allows manikin's upper limbs analysis based on parameters such as distance, weight and frequency. It is used to canvas many aspects of manikin posture based on various variables and user data, such as lifting distance, lowering distance, auction duration, object weight and task frequency. It takes care of work specific variables such as external support to the manikin, the balance of the manikin and orientation of arms of the manikin with reference to the body and feet. RULA score depicts acceptability of the task and posture and gives suggestions whether task or posture is acceptable or should be investigated further or should be changed soon or immediately [4].

RULA is a postural targeting method for estimating the risks of work-related upper limb disorders. A RULA assessment gives a rapid and organised assessment of the postural risks to a worker. The RULA action levels predict the earnestness about the need to change how a person is working as a function of the degree of injury risk. RULA analysis of above postures is done in CATIA V5 R20 software.

The results are as follow:

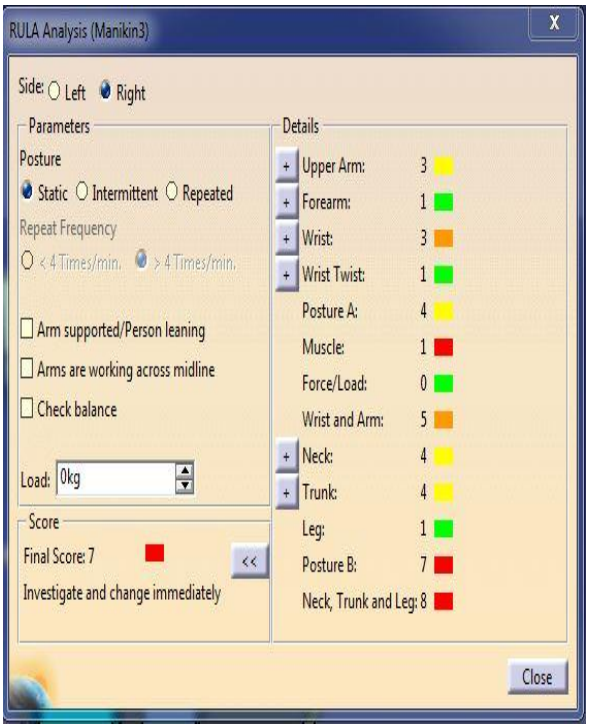

Fig 2.5 Rula analysis of posture 2.1

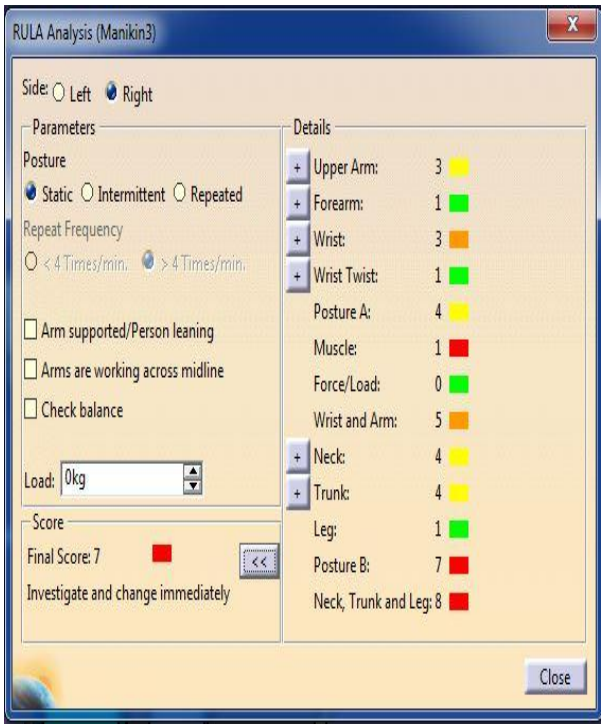

Fig 2.6 Rula analysis of posture 2.2

The above Rula analysis shows that, in both cases postural score is 7 and the colour is red. It indicates the need to investigate and change the posture immediately. Results shows that there is more stress on the parts muscle, neck, trunk and leg. As both the postures are near about similar to each other the results are also similar. Now as these postures are stressful there is need to eliminate the postures by having the ergonomic modifications in the existing workstation.

3. Result and Discussion

While observing the industry, it was found that, there are so many awkward postures which causes physical stress in workers. These awkward postures were repeated many times. So there was need to analyze these and to remove it or to have a substitute over it. The Rula analysis for existing workstation shows score of 7 for both postures. This indicates that there is need to have investigate and change immediately in the existing workstation.

4. Conclusion

Ergonomic principles are not much followed in small scale industries. Study reveals that activities found in press shop results in high risk and potential injuries to the worker. Thus further investigation is needed to avoid MSDs. Awkward postures are analysed using Rula analysis. It shows workers were working in highly stressful environment. Modifications are needed in the existing workstation to reduce the Rula score i.e. to have more comfortable workstation. Finally is concluded that ergonomic assessment is necessary to identify the workstations suitability for worker.

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