ERGONOMIC ANALYSIS OF WELDING OPERATOR POSTURES

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Abstract- Discomfort and pain are common in human-work activities and workers working in the industrial sector are easier to be exposed to the risk injuries. Occupational risk factors are the biggest entity causing health problems. Exposure to occupational hazards can adversely affect the human body, in turn reduce worker productivity and product/work quality and increase musculoskeletal problems. Observing the group of operators (welding) working throughout the day in the industry, which in turn helps in identifying the discomfort/pain experienced by the workers. The discomfort level of the workers can be evaluated by designing a detailed questionnaire and checklist to be present to the respondent. Ergonomic assessment tools like RULA (Rapid Upper Limb Assessment), REBA (Rapid Entire Body Assessment), OWAS (Ovaco Working Postural Analysis System) are used to assess the working postures and to analyze the discomfort frequency. Postures causing WMSD’s (Work-Related Musculoskeletal Disorders) are identified and recommending the guidelines to improve posture actions and to reduce the threat of WMSD’s.

Keywords- WMSD’s, RULA, REBA, OWAS

I. INTRODUCTION

Many manufacturing industries nowadays largely depend upon the human work activities/factors for overall growth and sustainability of their product/component in the current market. It is evident; therefore, that humans will remain an essential and integral part of manufacturing for a long time to come. Hence humans need safer and more comfortable working condition. The human factor is much more necessary and successful when completely integrated into the work environment. Ergonomic study provides some important suggestions and guidelines regarding human work activities in the manufacturing sector. Human factors and ergonomics (HF&E) is a multidisciplinary field incorporating contributions from psychology, statistics, and Anthropometry. Applied ergonomics includes application in office, industry, information technology and military design. Ergonomics aims to make sure those task equipments, information, and the environment fit each worker. By assessing people’s abilities and limitations, their jobs, equipment and working environment and the interaction between them it is possible to design safe, effective and productive work systems. Ergonomics risk factors are the aspects of a job or task that impose biomechanical stress on the worker. Nowadays worker productivity and occupational health, safety (OHS) are the vital factors in the growth of manufacturing industries. Some of the common problems occurring in the industries are improper management activities, hard environment conditions and poor workstation design. Consequently, many industrial workstations are poorly designed results in lower worker productivity and unnecessary injury at the workplace leading to the development of work related musculoskeletal disorders.

In the United States, the discipline of human factors and ergonomics is generally considered to have originated during World War II, although advances that contributed to its formation can be traced to the turn of the 20th century. Prior to the World War II, the focus was “designing the human to fit the machine” instead of designing machines to fit the human [7]. Excessive bending and twisting of the trunk have been related physiological costs and musculoskeletal injuries. WMSD’s problems result in low worker productivity, causing approximately 34% of the annual lost time (Ontario Ministry of Labor2009) [2]. Workers may suffer ergonomic injury/illness when work tasks include reaching, bending over, and lifting heavy loads. Effective application of workstation design can achieve between worker characteristics and task demands. This can enhance productivity, provides worker safety, physical and mental wellbeing and job satisfaction. The main objective of this study is to minimize the discomfort level among the workers working in welding operation using ergonomic assessment tools like RULA (Rapid Upper Limb Assessment), REBA (Rapid Entire Body Assessment), and OWAS (Ovaco Working Postural Analysis System) and to reduce WMSD’s symptoms related to occupational health, safety and suggesting ergonomic guidelines for better working postures.

II. PROBLEM FORMULATION

Worker safety and reducing work related risk activities are major concerns for industries (welding). Some of the common plays a vital role to reduce the risk of WMSDs and optimize the work productivity. Hence ergonomics plays an important role in reducing/curbing work related injuries. The many research / survey has been done on ergonomic factors to minimize fatigue and occupational risk, the
findings were limited because, information and data collected from the worker proved to be insufficient. In any metal fabrication industry, welding plays a vital role; it produces a stronger product than other methods. Welding is said to contribute to 50% of the nation’s gross national product. Welding often requires awkward body positions and time are key factors in causing injuries. Welders have a high prevalence of musculoskeletal complaints, including back injuries, shoulder pain, tendonitis, and reduced muscle strength. In this background, there is a lot of scope for improvement in the operating (welding) postures which in turn helps in increased productivity, worker safety and quality of work in welding-industry. Problems are mismatches between man and machine, improper layout design, unhealthy work environment and mainly illiteracy among workers. Small scale industries face serious occupational health and safety challenges. Workers working in a shop floor throughout the day will experience a certain level of discomfort in their body parts; this in turn affects quality, and productivity. Even though there are various studies which have discussed the effects of ergonomics on WMSDs, but few attempts have been made to investigate the relationship.

III. DESCRIPTION OF WORK ENVIRONMENT

Work done is carried out at in SHAH INFRA TOWERS (P) LTD, Which is a small scale fabrication industry located in DAVANGERE (DISTRICT) KARNATAKA (STATE), where towers/structure required for transmission, telecommunication and railways are fabricated. Workers performing welding operations were observed and awkward postures were identified. Better operating postures and guidelines are suggested.

IV. ERGONOMIC ASSESSMENT

4.1 Discomfort Assessment

An ergonomic approach to the assessment of an industrial workstation attempts to achieve an appropriate balance between the worker capabilities and work requirements to optimize worker productivity and the total system. Postural analysis can be a powerful and useful technique for assessing work activities. Risk of musculoskeletal injury associated with the recorded postures in the context of full ergonomic workplace evaluation can be a major factor for implementing change so the availability of the task-sensitive field techniques are of great assistance to ergonomic practitioner. This led to the development of the following ergonomic postural analysis tool- Rapid Upper Limb Assessment (McAtamney and Corlett) and Rapid Entire Body Assessment (Sue Hignett and Lynn McAtamney). Methods consist of scoring system based upon the action level performed by the each operator. There is no need of any special equipment as evaluation is based on standard charts and diagrams of postures involving each body segment. Questionnaire/checklist to identify discomfort in various parts of the body with different regions are shown in the below Table 1. Frequency indicates how many times the body part undergoes discomfort. Evaluation hour indicates level of discomfort as the work progress.

<table>
<thead>
<tr>
<th>Sl no</th>
<th>Parts of the body</th>
<th>Frequency</th>
<th>Side</th>
<th>Evaluation hour</th>
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<tbody>
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<td></td>
<td>Left</td>
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<tr>
<td>1</td>
<td>Eyes</td>
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<td>2</td>
<td>Head</td>
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<td>Trapezi</td>
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<td>5</td>
<td>Thorax</td>
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<td>6</td>
<td>Lumbar</td>
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<td>Shoulder</td>
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<td>8</td>
<td>Upper arm</td>
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<td>9</td>
<td>Elbow</td>
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<td>10</td>
<td>Forearm</td>
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<td>11</td>
<td>Wrist</td>
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<td>12</td>
<td>Hands/Fingers</td>
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<td>13</td>
<td>Buttocks</td>
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<td>14</td>
<td>Thigh</td>
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<td>15</td>
<td>Knee</td>
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<td>16</td>
<td>Lower leg</td>
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<tr>
<td>17</td>
<td>Ankle</td>
<td></td>
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</tr>
<tr>
<td>18</td>
<td>Foot/legs</td>
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</table>

One such questionnaire of the operator performing welding operations is shown in the fig 4.1 indicating various parts of the body with respect to the evolution period. From the fig 4.1 it was noticed that the operator experiencing pain in each parts of the body while performing repetitive task. Mode of the frequency from the fig 1 indicates the body parts like elbow, forearm, wrist, Hands and fingers, ankle and toes were experiencing high level of pain resulting in discomfort in respective regions of the body. Discomfort evaluation graph is generated for the working time intervals such as first, fourth and eight hours respectively as shown in fig 4.2. It helps in identifying the discomfort level of the worker as the time progress. Evaluation is done by questioning the worker, whether any sort of pain happening throughout the entire working shifts. Red, blue and green lines indicate discomfort evaluation for a time period. From the evaluation graph it was observed that during the first hour discomfort level was very minute (mild) and as the work progress certainly
there will be an increase in discomfort level where
the workers feels moderate discomfort whereas in
some parts of the body, level of discomfort is severe.
Finally, when the work reaches its final stage
discomfort level increase to peak level i.e., in this
condition the worker doesn’t able to work anymore
because there will be loss of muscle function, painful
joints at the end of the working shifts.

Fig 4.1 Discomfort Questionnaire

There is a discomfort questionnaire that
shows the different body parts and the level of
discomfort they experience.

Fig 4.2 Discomfort evaluation of body parts varying along with
time intervals

Parameters causing discomfort frequency considering
all body parts are shown in the graph 4.3. Frequency
indicates the discomfort level per cycle i.e. the completion of a product unit. It was observed from
the graph that frequency with respect to the body
parts shows the discomfort level varies depending
upon the work as they possess. Variation is due to the
specific part of body performs repetitive action, so
there is rise in the frequency level as shown the fig
4.3 Sometimes frequency increases to extreme level,
where discomfort in terms of pain remains all day
long i.e., insupportable condition.

Similar Assessment has been carried out on 10
workers (Welding operators) through checklist. All
the selected workers had given their responses, which
were analyzed. The majority of the respondents were
feeling pain and discomfort in different body parts.
After collecting discomfort assessment from the
operators (welding), it was observed that the
ergonomic awareness is very less and workers are
experiencing a high level of discomfort. Ergonomic
guidelines should be provided to reduce the
discomfort level.

Fig 4.3 Discomfort frequency before suggesting ergonomic
guidelines

4.2 ERGONOMIC GUIDELINES

The guidelines according to occupational safety and
health association (OSHA) for welding operator
provides suggestions and help to reduce the
discomfort level

- Use Fibrous glass gloves and protective
  sleeves to protect forearms
- Use aprons to protect from sparks during
  welding
- Helmet and welding torch should be made of
  lesser weight, so that the worker feels easier to
  handle
- Joints and elbows must be in neutral position,
  so that they can be stretched to the least
  possible extent
- Use accessories such as rollers, conveyers and
  trolleys, which in turn help in reducing manual
  handling
- Proper ventilation should be provided to
  remove contaminants in gases, vapor during
  welding
- Use Proper shield with dark glasses to protect
  eyes [9].
- Avoid positions where arms are raised above
  shoulder level

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- Avoid fixed work positions, which results in reducing blood supply to muscles
- Avoid bending over at the waist
- Position the welding item as flat as possible on a horizontal surface between waist and elbow height.
- Work with material between waist and elbow height for comfort and precision welding when working in a standing position
- Work with material slightly below elbow level when working in a sitting position.
- Use a foot rest if standing for longer periods
- Helmet should be provided with respiratory protection and made of electrical and thermal insulator and opaque to visible.
- It is proposed to activate the trigger with the index finger, so that the other fingers stabilize the welding torch grip

These guidelines if followed and implemented properly work related musculoskeletal can be minimized to a certain extent and it is possible to achieve a safer working environment. Overall improve productivity, safety of the workers, and quality can be achieved. Based upon the suggestions re-assessment has to be carried out to obtain improved discomfort, frequency and to get a uniform evaluation limit.

The discomfort is minimised by suggesting better postural frequencies and improved discomfort frequency is shown in the fig 4.4. Safer frequency level indicates decrease in body parts undergoing discomfort. The frequency of discomfort is almost reduced throughout the entire 8 hour shift is shown in fig 4.5. It was observed that discomfort frequency is reduced to safer evaluation limit other than hands/ fingers because main human body parts to perform a task at this workstation are hand. Hands are extensively used several times during welding leads to rapid discomfort. Evaluation level in the fig 4.6 shows that discomfort has been almost uniform throughout the 8-hrs shift and frequency level is reduced to obtain safer evaluation intervals.

V. ERGONOMIC ANALYSIS

5.1 Model Building: Ergonomic modeling involves modeling of manikin in CATIA V5 ergonomic design and analysis work bench along with the parameters required for assessment. Major role of the software is to create different manikin based on percentile using human Builder and human measurement workbench along with additional analysis of various postures. The process involves capturing of current working

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postures of the welding operator and analyzing the working postures in the Ergonomics Design and Analysis workbench. Analysis is based on the biomechanics criteria. The CATIA ergonomic tool measures biomechanical data on a worker for a certain posture. The forces acting on the manikin’s hands and body weight taken into account in the biomechanical analysis; these forces represent the load of carry, push, lift/ lower, or pull. Human builder consists of set of tools that are useful for the creation of human digital model (manikin), manipulation with the manikin, analysis, and their interaction with the products around it can be achieved by suitably constructing virtual environments. Human Builder provides very accurate simulation of humans and their interactions with products to ensure they will operate naturally in a workplace tailored to their tasks. Human Builder consists of a number of advanced tools for creating, manipulating and analyzing how manikins (based on the 5th, 50th and 95th percentile value) can interact with a product. The manikins can then be used to assess the suitability of a product for form, fit and function.

Once the constraints, angular limitations, and reference axis are fixed and position of manikin is fitted to the screen, analysis process has to be carried out with required working postures

5.2 Postural Analyses: Postural assessment can be a powerful technique for evaluating risk activities. A basic analysis of a work task assessment depends upon the questionnaires, interviews, questions on work-related injuries and video analysis. In addition, assessment method can be used for physical risk evaluation of job activities, specific to anech part or a type of activities. A need was perceived within the spectrum of postural analysis tools, specifically with sensitivity to the type of unpredictable work postures found in various industries. This led to the growth of the following postural assessment tools like RULA, REBA, and OWAS. These tools require no additional equipment in providing a quick assessment of the postures of the neck, shoulder, wrists, trunk and upper limbs along with muscle function and the external loads applied on the body. Numbers are used to represent working postures and based on action level scores can be obtained.

5.2.1 POSTURAL ANALYSIS USING RULA
RULA (RAPID UPPER LIMB ASSESSMENT) which is known as a pen-paper observational method, developed by Dr. E. Nigel Corlett and Dr. Lynn McAtamney of University of Nottingham’s Institute for Occupational Ergonomics. Developed to “investigate the exposure of individual workers to risk factors associated with work-related upper limb disorders” RULA is a quick survey method for use in ergonomic investigations of workplaces where WMSD’s are reported. It focuses on the neck, trunk and upper limbs, and is ideal for sedentary workers. It is a screening tool that assesses biomechanical and postural loading on the body.

The assessment commences by observing the welding operator working in the industry during several work cycles in order to select the tasks and working postures for evaluation. Selection is based on posture held for the greatest amount of the work cycle or where highest loads occur. During assessment photographs of welding operators working were taken to identify the awkward postures.

The RULA discomfort assessment showing risk level of all body parts is shown in the fig 5.2. It was observed that discomfort level is very high based on scores. It was noticed that most of the action performed was awkward resulting in serious Work-related Musculoskeletal Disorders (WMSD’s) symptoms of the neck, shoulders, and low back pain. Hence further investigation is needed and changes in working postures are necessary. Similar assessment has been carried out on 10 welders.
5.2.2 POSTURAL ANALYSIS USING REBA

REBA (Rapid Entire Body Assessment) was developed by Hignett, S. and McAtamney, to provide a quick and easy observational postural analysis tool for whole body activities (static and dynamic giving musculoskeletal risk action level. The development of REBA is aimed to divide the body into segments to be coded individually with reference to movement planes. It provides a scoring system for muscle activity caused by static, dynamic, rapid changing or unstable postures. To use the tool, the observers select the posture or activity to be assessed and score the body alignment using the REBA diagrams. REBA includes the assessment of legs along with lower body and trunk.

This method includes direct observation or assessment through video recordings which can be done in confined workspaces without disrupting work. Depending upon the observation made, corresponding posture is chosen for specific operation on each body segment form analysis workbench. This is then combined with a load score to form the coupling scores which are further processed into a single combined risk score using the table provided. Assessment consisting worker name and description of task performed is shown in fig 5.3

Posture analysis is carried out by interacting with workers working in welding section. From the assessment it was found that, workers working in welding section are unaware of work related musculoskeletal disorders. The Work-related musculoskeletal problems and the body pain perceived by the workers were collected from the worker. Similar assessment has been carried out on 10 welders.

5.2.3 POSTURAL ANALYSIS USING OWAS

The OWAS technique (Ovako Working Posture Analysing System) was developed by a Finnish steel company of OvakoOy. OWAS is a method for the evaluation of postural load during work. The method is based on ratings of working postures. OWAS identifies four work postures for the back, three for the arms, seven for the lower limbs, and three categories for the weight of load handles or amount of force used. The technique classifies combinations of these four categories by the degree of their impact on the musculoskeletal system for all posture combinations.

OWAS assessment depends upon the number of tasks performed by the each worker like bending, twisting, and both bending and twisting in a working shifts. Each posture defined in the OWAS main frame is indicated by respective digits corresponding to the specific task. OWAS also defines time spent in completing each task in terms of percentage. The degrees of the assessed harmfulness of posture–load combinations are grouped into four action categories, which indicate the urgency for the required workplace interventions. Results obtained from the action plan gets increased clarity with the introduction of color coding defined below.

- Green: No action required indicated.
- Yellow: Corrective action in near future.
- Orange: Corrective action should be done in as soon as possible.
- Pink: Corrective actions for improvement required immediately.
VI. POSTURAL EVALUATION

To evaluate postural analysis of welding operators, necessary welding equipments and accessories like welding gun, mask, and welding table are designed and modeled in CATIA V5 work bench. A virtual welding environment is created for proper evaluation. Posture evaluation of welding operator postures is carried out at Work done is carried out at in SHAH INFRA TOWERS (P) LTD. Which is a small scale fabrication industry. Workers performing welding operations were observed and awkward postures were identified through photographs and subjected to postural analysis.

6.1 RULA

To perform RULA analysis on welding operation, required equipments are modeled and assembled to the manikin in ergonomic analysis workbench to obtain virtual welding environment. Using posture editor commands and kinematics, manikin can be altered according to required postures.

RULA analysis is performed on head and spine segment as shown in the fig indicated in orange color. During welding, head including neck and trunk part undergoes rapid discomfort, which means bending forward to reach weld spot. Twisting of the trunk is mostly the result of inadequate workspace. Thus risk level is very high in those segments. During analysis posture is mainly static, i.e., posture is held for longer than one minute. Welding operation more often requires static posture for precision welding. From RULA analysis, it shows that the posture level is 7 and red in color. The problem parts are detected around the forearm, upper arm, and wrist indicated in yellow color.
Fig 6.2 shows awkward posture where shoulder is abducted from neutral position, and forearm is working across midline, wrist is twisted. During operation, shoulder, wrist, forearm were used simultaneously for welding purpose. In restricted workspace, where it is impossible to work in normal position, arms and wrist has to work across midline resulting in twisting angle and bending. Thus a very high rate of risk injuries occur in those parts. Analysis performed on manikin shoulder including forearm, wrist, upper arm is shown in orange color. RULA analysis shows that the posture level is 5 and orange in color.

Fig 6.3 shows manikin performing welding operation above the shoulder level. Sometimes where welding item is above the shoulder height then the arms are raised along with neck causing serious injury to shoulder, arm and neck segments. Working above the shoulder height is always a serious task leading to WMSD’s. Hence welding item should be placed as flat as possible on a horizontal surface between waist and elbow height. Score based on the posture action level indicates 7.

Since manikin required bending towards the right side to complete the task, forces acting and mechanical stress tends to concentrate more in right part of the body. Hence there will be severe discomfort observed. During welding, position of leg is also very important in order to maintain the whole body and posture in evenly balanced state. Sometimes when work requires excessive bending towards right or left segment of body it is very difficult to position the legs in balance condition. Hence bending of legs is inevitable. Static posture is taken into consideration. From the analysis it was observed that action level score is 7 and red color shown in the fig. 4.

VII. RESULTS AND DISCUSSION

The various welding postures were analyzed using the ergonomic tools like Discomfort questionnaire,

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RULA, REBA, OWAS. It was observed that postures carried out during welding are generally awkward in nature resulting in WMSD’s. By providing guidelines, discomfort level is minimized. This can be justified by graphical discussion. Analysis has been done for the postures behavior, by observing and comparing the graphs that were evaluated before and after suggesting guidelines, it was noticed that there is a lot of improvement in their postures action leading to safe and healthy working environment.

7.1 Discomfort Evaluation

This assessment has been done for normal working shifts i.e. from morning to evening.

The graph shows discomfort evaluation, earlier it can be seen that discomfort level was not uniform. It was observed that discomfort level reaches severe stage as the work progress where worker feels unable to work and loses muscle function for the specific body segments. At the end of the welding operation, body parts like neck, elbow, wrist, upper arm, shoulder, hands/fingers and legs experience enormous pain, indicated by red color lines. Apart from these, some other body parts also undergo discomfort but they are in mild and moderate condition as defined by green and blue color lines.

Discomfort level in terms of hours is uniformly distributed as shown in the fig 7.2. Throughout the entire working shifts all the body parts experience moderate type of discomfort, which can be considered as safer level compared to previous evaluation results.

7.2 RAPID UPPER LIMB ASSESSMENT

This assessment has been carried out for upper limb activities. During welding, body segments like forearm, wrist, neck, hands, shoulder and trunk will have simultaneous movements resulting in WMSD’s. Each welder, depending upon his working action, assessment has been conducted. Evaluating welder’s postures related to upper limb, it was noticed postures followed were improper and unsafe. They are unaware of safety and health aspects. Based on action level, scores related to specific task indicate immediate investigation and change in the posture level. Over 50% of the evaluated welders belong to action level 4 as shown in the fig 7.3 Similarly 20% of the welders belong to action level 3. These are the levels which are considered as critical and cause serious damage to muscles. Hence the posture actions need to be changed to reduce the risk level.

The reduced discomfort level after suggesting guidelines shown in the fig 7.4 Comparing with the
earlier graph. It was observed that, discomfort level is reduced with above 50% of welders belongs to level 2, which shows certainly there has been lot of improvement in working postures. Similarly, discomfort observed in level 3 and level 4 shown in the fig 7.4 is also minimized in the improved RULA control graph.

7.3 RAPID ENTIRE BODY ASSESSMENT
This method is based on systematic assessment of the complete body postural links to worker. It is similar to RULA analysis but the only difference is lower body segments is evaluated along with leg postures. The REBA control graph along with the welders discomfort level is shown in the fig 7.5. Earlier risk level was very high as noticed from the fig 7.5. Around seven workers (welders) are falling in between medium and very high risk limit. Hence it affects worker productivity. So risk level should be brought under control to overcome WMSD’s.

By comparing with the earlier graph (fig. 7.5) discomfort level is reduced, improved working posture is observed after providing proper suggestions. From the fig 7.6, it was noticed score between 2 or 3, in which 5 workers (welders) falling under low risk level. This suggests better improvement in working action. Number of workers (welders) representing medium and high risk level is also reduced as compared to earlier REBA discomfort which indicates little improvement.

7.4 MODEL BUILDING AND POSTURE EVALUATION
Digital human (manikin) is modeled in ergonomic analysis work bench and postures are assessed as per the welding operation. Awkward postures like bending forward, shoulder abduction, wrist twist, and
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side bending are evaluated. Results from RULA analysis indicate these postures action are unsafe and needs to be change. Fig 7.7 shows manikin performing welding operation. It was observed that wrist is twisted, legs are not in balance position, trunk is bent and shoulder is abducted. Scores also indicates immediate investigation in posture behavior is needed.

After providing guidelines, optimum welding posture is suggested. All the body segments are in neutral position as there is no presence of red color indication in detailed result shown in fig 7.8. Hence this can be treated as better posture for welding.

5 OVACO WORKING POSTURE ANALYSIS SYSTEMS (OWAS)

This ergonomic tool is based on a simple and systematic classification of work postures combined with observations of work tasks. Percentage of time in each pre-defined category can be computed. Based on each task performed by specific body segment, observations can be made as a whole or by each work phase separately. The length of the bar in graph shows the action category. Welding involves number of task (activities) like bending, twisting to complete the operation. When the number of task increases, consequently, level of exposure to risk injuries also increases.

Fig 7.9 shows task details of the worker (welder). Here there are two tasks are considered. In the first task shown in the above fig. 7.9, it was observed that, during welding, sometimes it is necessary to twist the trunk region and leg position in confined spaces resulting in risk injuries. Hence these postures are considered as awkward and hence the result indicates corrective actions should be implemented. Fig 7.10 shows another task where the worker (welder) is bending forward, keeping the leg in unbalance condition. Result indicates change in posture action. Corresponding time result for both the task is shown in the fig 7.11. Showing action level for the body segment involved in the task executed. Postures related to arms and legs need to be changed.
Fig 7.11 OWAS time result before suggesting guidelines

Fig 7.12 OWAS time result after suggesting guidelines

After suggesting proper ergonomic guidelines, better OWAS time result is shown in the fig 7.12. The length of the bar graph corresponding to arms and leg position representing level 1 and level 2 respectively which shows better improvement compared to previous time result graph.

CONCLUSION

- Present study is based on workers working in welding section. Among the various work postures, restricted (awkward) postures were found to be associated with occupational risk injuries.
- Ergo fellow, a simulation software consisting assessments tools like RULA, REBA, OWAS are carried out to evaluate the awkward welding postures and interpretation of result indicates safe working postures as recommended by OSHA.
- A simplified procedure for discomfort identification through standard ergonomic tools and suitable working environment with necessary guidelines is proposed and demonstrated.
- Postures adopted during welding are observed through photographs and manikin model in ergonomic design and analysis workbench module of CATIA V5 is developed with necessary tools required for welding.
- RULA analyses for various welding postures were evaluated. From the results, it was noticed that the postures carried out during welding were unsafe and objectionable. Suggesting interventions for better working environment to enhance worker productivity.
- After suggesting suitable guidelines, comparison results shows lot of improvement in welding postures. RULA shows 60% of development in working action; REBA indicates 50% of betterment in posture level. OWAS suggests improvement in workers workload.
- Software analysis and ergonomic assessment tools were very best source for identifying the workers discomfort levels and providing possible solutions for the action WMDS’S.
- It is evident that WMSD are a significant health concern, by implementing and properly following the ergonomic guidelines can reduce WMSD’s among the workers. This will benefit the company/industries to achieve better quality and increased productivity

SCOPE FOR THE FUTURE WORK

- In developing countries like India, the scale of use of human resources in small and medium entrepreneurs (SME’s) in labor-intensive industries is huge. In this situation, it must be obvious that very small improvements in working conditions or working methods can lead to large benefits.
- Suggested ergonomic guidelines should be implemented for the workers sake in order to create safe working environment.
This evaluation technique can be applied for any manual material handling activities in manufacturing industry and also in various occupational risk activities to evaluate and improve the work environment.

To provide them proper industrial training, creating ergonomic awareness, industrial hygiene expertise, alternative welding methods.

Employee suggestion scheme should be introduced where employees are given free hand to give a suggestion to management for any improvement from quality, cost, delivery, safety and morale point of view.

Conduct periodic health assessment to ensure the workers are working in good environment condition.

Workstation renovation also can ensure a safe and comfortable working environment.

Monitoring groups and systematic approach will and help the management in the implementation in order to reduce workplace hazards.

Safety aspects and application of safety equipment’s like hand gloves, goggles, positive air powered respirator, auto darkening helmets, heat resistant aprons etc., will ensure the workers safety.

REFERENCE


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