

Assessment of Musculoskeletal Disorder Risk in watch assembly Industry

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Abstract— Watch assembly is repetitive, monotonous and highly visual demanding task and has been identified as a likely contributor to the development of work related musculoskeletal disorders (WMSDs). A large number of the young workforce was engaged in assembling units where the design of the workstation and work environment does not adequately fulfill the ergonomic requirements for correct manual assembly. Due to the poor ergonomically designed workstation workers had to adopted the awkward work posture which leads to musculoskeletal disorders (MSDs) and the occupational health hazards. Therefore, a survey of watch assembly industry was conducted to assess the prevalence of work-related musculoskeletal disorders among female workers.

The 120 respondents were selected from two units among which one was carrying out manual assembly and another one automatic assembly line. RULA (Rapid Upper Limb Assessment) was used to assess the working postures and recommend the changes to be made. To examine the prevalence of body pain body map was used. Frequency and percentage were used for the analysis of data.

This study has shown that women workers involved in assembly work were confronted with WMSDs. Watch assembly workers carrying out repetitive tasks with hands and fingers, and working in awkward postures had high pain prevalence in the neck, upper back and lower back pain. Thus it is clear that due to adoption of awkward postures at work for a prolonged period of time, the female assembly workers suffer from high rate of work related musculoskeletal disorders.

Keywords— Assembly workers, work-related musculoskeletal disorders, body pain, watch assembly, RULA.

I. INTRODUCTION

Watch assembly is repetitive, monotonous and highly visual demanding task. Although it is a light assembling task still it causes eyes problems, neck or backaches, joints and others problems which raised the needs of greater attention

on the risk factors that affect female workers' health and safety. Now days in electronic industries a greater number of workforces constitute women employees because they perform monotonous rota jobs patiently. The prevalence of musculoskeletal pain is higher among women than men (1). The large number of the young workforce was engaged in assembling units where the design of the workstation and work environment does not adequately fulfill the ergonomic requirements for correct manual assembly. Due to the poor ergonomically designed workstation workers had to adopted the awkward work posture which leads to musculoskeletal disorders (MSDs) and the occupational health hazards. Repetitive work is common in the assembly industry and has been identified as a likely contributor to the development of shoulder and neck work related musculoskeletal disorders (WMSDs). Work related musculoskeletal disorders (WMSDs) are currently one of the most critical problems faced by the ergonomists in the workplace. In industrially developing countries, the incidence of MSDs is rapidly increasing because of the poor working condition and the lack of an effective work injury prevention program. The present study aims primarily to evaluate the prevalence of MSD in women engaged in watch assembling task by using RULA method. It is a survey method developed for use in ergonomic investigation for work related upper limb disorders (2). It is a screening tool that assesses biomechanical and postural loading on the whole body with particular attention to the neck, trunk and upper limbs. Neck pain was found to be most prevalent pain. Posture, body fatigue, prolonged computer usage and lack of ergonomic knowledge etc were found to be causal factors determining work related musculoskeletal disorders (3).

Many studies in the past have focused on work related musculoskeletal disorders. An ergonomic survey was conducted to examine the affect of ergonomic factors in handicraft industries of Jaipur district, Rajasthan, India. It was found that impact of ergonomic factors on industry was increased absenteeism of workers due to pain in shoulders,

back and cervical spine area (4). Another study conducted an ergonomic assessment of LPG workers and used work discomfort questionnaire which revealed that awkward work posture causes ill effects on their various body segments. Majority of workers complained of severe injury to back-34%, shoulder-20%, knee 20%, neck-16% and toes-10% (5). A study on Uttarakhand weavers was conducted by and used self assessment of body pain through self report Body Discomfort rating Chart based on Brog's 10 point rating scales along with frequency and severity of occurrence of pain. From subjective assessment for frequency of pain, it was found that most frequent pains were reported in neck, shoulders, lower back, hands and ankle (6). Similar study conducted to examine the level of musculoskeletal disorders in Madhubani art workers by using REBA. The result of the study revealed that due to high temperature, low light level, prolonged sitting hours and close attention seeking work causes high prevalence of musculoskeletal disorders and visual stress among Madhubani art workers. REBA suggested action level i.e. investigate and change soon (7). Hence the aim of the research was to investigate the risk of musculoskeletal disorder in watch assembly Industry.

II. MATERIALS AND METHODS

The present study was carried in the watch assembly industry which has two assembly units' i.e. manual assembly line and auto assembly line.

RULA METHOD

For the present study assessment tool namely RULA (Rapid Upper Limb Assessment) was used to assess the working postures and recommend the changes to be made. The Rapid Upper Limb Assessment (RULA) was developed earlier by Mc Atamney and Corlett (1993), to provide a rapid objective measure of musculoskeletal risk caused by mainly sedentary tasks where upper body demands were high and where work related upper limb disorders are reported. RULA assesses the posture, force and movement associated with sedentary tasks; such tasks include computer tasks, manufacturing or retail tasks where the worker is seated or standing without moving about. The use of RULA results in a risk score from one to seven, where higher scores signify greater levels of apparent risk.

POSTURAL DISCOMFORT ANALYSIS

Postural discomfort questionnaire was used to measure subjective qualitative judgments of different assembling workers regarding postures and discomforts at various times throughout the day. The questionnaire comprised of simple

body map divided into 10 regions. The respondents pointed the marks according to their pain in body map. After this frequency and percentage was calculated.

III. RESULTS AND DISCUSSION

1. Demographic Data

The result of demographic profile of the women involved in watch assembling task are presented in table 1.

Table:1 Demographic data of the female assembly workers

N=120

	Mean \pm SD
Age	22.64 \pm 1.53
Years worked in assembling unit	3.6 \pm 1.0
Height	47.74 \pm 5.44
Weight	155.16 \pm 5.48

It was found from the data that the average age of the female workers were 22.64 \pm 1.53 years and the average numbers of years they had worked in assembling unit was 3.6 \pm 1.0 years. Average height and weight of the female workers were 47.74 \pm 5.44 and 155.16 \pm 5.48 respectively.

2. Rapid Upper Limb Assessment (RULA)

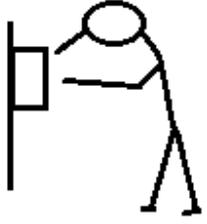
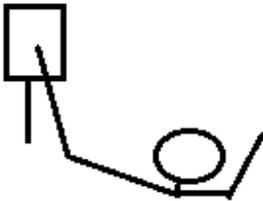
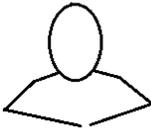
RULA assessment sheet was used to analyses the posture of workers involved in different activities of manual and auto line. The most frequent postures adopted by the workers were taken into consideration. The results of the RULA assessment of the workers are shown in Table 3. The posture codes of the RULA (Table-2) indicate that, working postures of workers of electronic assembly industry in different assembling activities represents that usually assembly workers adopt stressful and awkward postures during maximum activities which demand corrective measures immediately.

Table.2: Classifications of Risks according to Scores of RULA Assessment Tools

1 or 2	Acceptable posture
3 or 4	Further investigation, change may be needed
5 to 6	Further investigation, change soon
7	Investigate and implement change

Table.3:RULA Survey Results

S.N.	Activities (Manual)	Score	Result
1	Dial hand fixing 	5	Further investigation, change soon
2	Casing 	5	Further investigation, change soon
3	Back cover fixing 	3	Further investigation, change may be needed
4	Inspection 	5	Further investigation, change soon
5	WR Test	5	Further investigation, change soon

			
Activities (Automatic)			
6	Hour hand fixing 	4	Further investigation, change may be needed
7	Hands clearance 	4	Further investigation, change may be needed
8	PMH fixing 	4	Further investigation, change may be needed
9	Movement unloading 	4	Further investigation, change may be needed
10	Encasing 	3	Further investigation, change may be needed

11	Balancing 	4	Further investigation, change may be needed
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It was clear from the grand score that in manual assembling process workers adopt poor working posture. Their risk score was in the range of 5-6 which indicated it required further investigation and change soon whereas in auto line they fall in the range of 4-5 and considered for further investigation and changes may be needed. Thus the Rula score indicated that the female assembly workers at high risk of WMSDs. Similar study done by Ojha and Vinay (2015) on assembly workers of Indian automobile industry and revealed that the postures codes of the RULA indicate that, working postures of workers of automobile industry in different assembling activities represents that usually assembly workers adopt stressful and awkward postures during maximum activities which demand corrective

measures immediately. Therefore it can be concluded that female assembly workers suffer from high rate of work related musculoskeletal disorders due to adoption of awkward postures at work for a prolonged period of time (8).

Postural Discomfort Analysis

Continuously working in awkward postures during certain activities causes discomfort in different parts of the body. Even though in very young age, adopting poor posture for prolong periods, the workers were likely to suffer from serious musculoskeletal disorders in the future (9). In order to identify the body pain among female workers the survey was conducted and the result was presented figure-1.

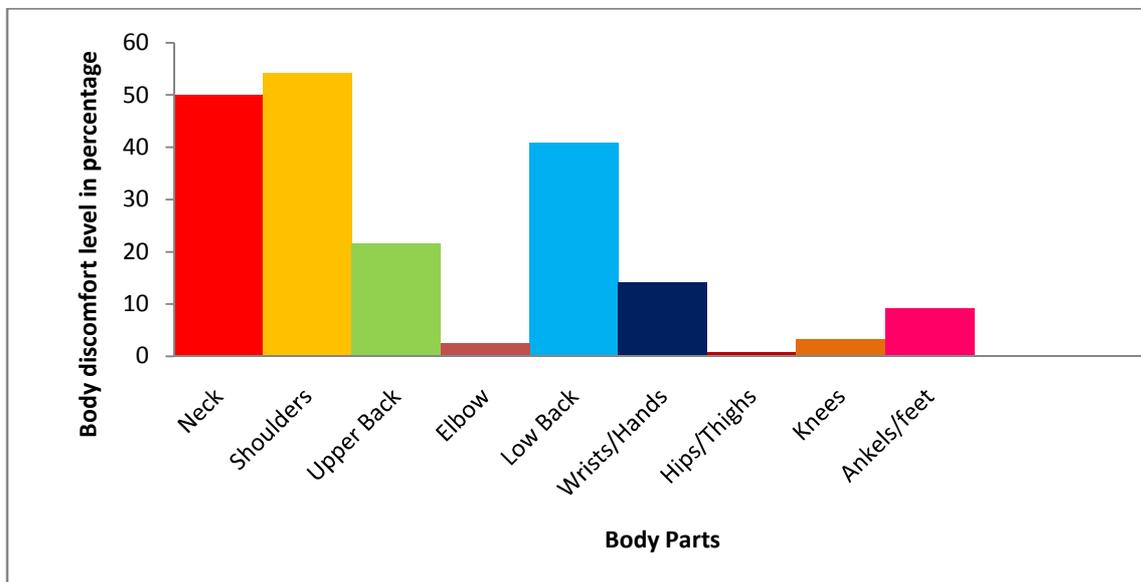


Fig.1:Percentage distribution of workers experiencing pain in various parts of the body

It can be seen from the figure-1 that most of the female workers suffering from shoulder pain (54.16%) whereas hips/thighs pain was low (0.83%). A large number of the respondents had neck, shoulder, upper back and lower back pain and this could be due to awkward body posture for a

prolonged period of time. In general, the results in this study were in accordance with (Harlow *et al.* 1993) among electronics assembly women workers in Tijuana, Mexico , where the prevalence rate for wrist pain was low and

prevalence rates for back, neck, shoulder and leg pain (except for ankle or foot sites) were high (10).

IV. CONCLUSION

It is concluded that due to adoption of awkward postures at work for a prolonged period of time, a large number of the female assembly workers had neck, shoulder, upper back and lower back pain. Therefore they suffered from high rate of work related musculoskeletal disorders.

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