CMDQ in Musculoskeletal Discomforts during welding lab work in technical education institution

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Abstract. The health constraint faced by completion welding task. The quality of task is affected by the Work-related Musculoskeletal Disorder (WMSD) which limits the movement of the student. The comfort on body part or the other work is pain sensation on discomfort body, known as physical ergonomic, is important to prevent the occurrence of the WMSD. Proper ergonomic postural body considers the condition of the workers while doing the assigned work. The objectives of this study are to identify the current problems related to ergonomic during welding lab work in technical education institution, to analyse the actual problem by using Cornell Musculoskeletal Discomfort Questionnaires (CMDQ) to recommend the good ergonomic postural body based on the condition of the study. The study was done at a Technical vocational education an training institution (TVET) as called polytechnic in the Klang Valley of Malaysia. The condition of the student affects the task due to health deficiency. From the findings, the

workers are exposed to the awkward postures which leads to the Work-Musculoskeletal Disorders (WMSDs). The results show that the workers are exposed to the WMSD in different level of risks which causes high performance among the students.

1 Introduction

Many Malaysia technical education institution has been accredited by The Engineering Technology Accreditation Council (ETAC). One of compulsory requirement of ETAC for diploma engineering is minimum requirement for lab task is 30 Student Learning Time (SLT) and equal up to 1200 hour during along diploma program. One of lab task for diploma mechanical engineering student are welding. In the technical education sector, the health of the students may be exposed to the hazards such as the work-related musculoskeletal disorder. Normally, the injuries happen either at the muscles, tendons, nerves, blood vessel or ligaments.

Musculoskeletal disorder (MSDs) may occur because of continuously performing repetitive tasks, working in repeated and sustained or difficult postures, performing strenuous physical work, and using forceful exertion [1].

To improve the quality of the task for good grade, student performance is important. Task performance as an indicator has been a general subject for examination in several studies on musculoskeletal disorders that influence the students condition If the students facing health problem, it indicates they will get the lower grade for the lab work subject and can't achieve the outcome of the syllabus. Heavy lifting and awkward work postures are the physical working condition that relate with skip or absenteeism to the lab work session. As the condition of the students affects the quality of task, hence the students' needs to have a comfortable workplace which is ideally free from hazards.[2]

The comfortable workplace is known as the proper ergonomic working environment. Ergonomics is the information such as the behaviour of the human, limitation and capacity of human that applies on the machines, designs of tools, tasks, and environment for secure, comfort and beneficial for human use [3]. A bad worksite design leads to the difficulties for the workers such as fatigue and injuries. Besides, the injuries relate to the low productivity of the workers and increase the cost to the company where the workers need to rest, and the company needs to bear the losses [4]. In the study of the occupational risks, there are few ergonomics analyses tools available to determine the risks of the worker at the workplace. There methods identified and classified the risks into several parts which are

self-reports, observational methods, and direct measurements [5]. In this study, the ergonomic tool used to identify the occupational risks on the workers are Cornell Musculoskeletal Discomfort Questionnaires (CMDQ) to sense the discomfort of the body part. The selection of the CMDQ is based on the tasks doing by the students which are awkward, repetitive work and involves the entire body parts.

2 Methodology

This study was conducted at polytechnic in Malaysia to Diploma in mechanical Engineering students, Polytechnic Banting Selangor and Politeknik Sultan Salahuddin Abdul Aziz Shah. The first step for this study was to study the process flow of the welding lab work process by assessing the overall work lab areas. Then, by doing interview sessions and observations. The chosen subjects were answered the CMDQ to sense the discomfort of body during perform lab work.

The study was aimed to identifying discomfort body part against students during the welding lab work activities. A total of 15 students who are currently carrying out welding lab work have been selected randomly to answer the CMDQ assist by step by step instruction from. This study is pilot study for CMDQ to study MSD engineering student while lab work, so 15 persons of student it’s enough.

Selection of CMDQ method for this study is due to compliance with the Ergonomic Risk Assessment Guidelines At The Workplace (2017) by DOSH Malaysia. Besides that, CMQ is a basic and concise assessment of early screening before implementing a MSD assessment. There are several other Ergonomic Risk Assessment (ERA), but they are not exhaustive and are focused only on the upper body.

Ultimately, the study will propose some ergonomic risk control to ensure the lab work of the weld does not provide health impact to the students, as well as to provide occupational disease to students.

2.1 Cornell Musculoskeletal Discomfort Questionnaire (CMDQ)

Dr. Alan Hedge from Cornell University has developed the International musculoskeletal Discomfort Questionnaire (ICMQ) which is now more commonly known as a Cornell body skeletal and hand-based questionnaire (CMDQ) which is one of the important muscle assessment instruments in the MSD field. In addition, CMDQ also assesses MSD which interferes with ability to work. The survey elements within CMQ are divided into gender as well as the effects of work activities carried out which are the effects of work standing, the impression of sitting work and the impression of the wrist (Hedge 1999). [6-8]

Generally, CMDQ are related to detecting and recording discomfort in the entire part of the body. There are two

parts of a questionnaire body that is discomfort in the body and the Cornell hand, which is to be a common part of the body and dedicated to hand.

The whole body questionnaire is divided according to male and female genders and divided into standing and sitting works at the workplace. While the questionnaire form is divided into the left and right hand side.

However, CMDQ is only intended for the inconvenience screening of body parts only and it cannot be used as a diagnostic tool where various factors should be considered in the assessment of the body framework

For this study, a questionnaire for the whole body with standing positions are used to screen and identify students who have risk MSD. For this study focus on CMDQ standing at work tools for entire body only.

The scores outcome from the questionnaire can be analysed in 4 method, First, just sum up overall value score of first by just counting the number of symptoms per person, secondly by summing the rating value for each person, third by considering a weight rating to identify the most serious problems based on the frequency of symptoms within a certain period of time. If you have never experienced the symptoms 0, the frequency of symptoms 1-2 times a week, the brushing of 1.5, 3-4 times a week with a weight of 3.5, each day with a weight of 5 and several times each day equal to 10.

The final method is based on the total multiply of the CMDQ element with weight of frequency. the frequency score

divided to never is 1, 1 to 2 times a week is 2, 3 to 4 times a week is 3, once a day is 4 and final for the frequency is 5 times a day. It is followed by a discomfort, which is not comfortable to be 1, uncomfortable is 2 and very uncomfortable is 3. While the work outage score refers to no weighting disorder is 1, the occasional annoying is 2 and very disturbing work is 3.

In this study, first method was implemented according to ergonomic risk assessment guidelines at the workplace (2017) by the Department of Occupational Safety and Health (DOSH) and it simply to analyse all ergonomic risk assessment data have been done.

2.2 Pain sensation

A pain scale measures is a referred to severity of pain intensity. Pain scales are a common tool in medical and used wide in medical field. Pain scales are a necessity to assist with better assessment of pain and patient screening. Pain measurements help determine the severity, type, and duration of the pain, and are used to make an accurate diagnosis, determine a treatment plan, and evaluate the effectiveness of treatment.

Pain scales are based on trust, behavioural, or imaginary data, and are available for neonates, infants, children, adolescents, adults, seniors, and persons whose communication is impaired. Pain assessments are often regarded as the 5th Vital Sign".[9]

The activities of daily living (ADLs) is a term used to collectively describe fundamental skills that are required to independently care for oneself include eating, dressing, getting into or out of abed or chair, taking a bath or shower, and using the toilet. The term activities of daily living was first coined by Sidney Katz in 1950 [10-11] .

ADL is used as an indicator of a person's functional status. The inability to perform ADLs results in the dependence of other individuals and or mechanical devices. The inability to accomplish essential activities of daily living may lead to unsafe conditions and poor quality of life. Measurement of an individual's ADL is important as these are predictors of admission to nursing homes, need for alternative living arrangements, hospitalization and use of paid home care. The outcome of a treatment program can also be assessed by reviewing a patient's ADLs [12-15].

The Numeric Rating Scale (NRS-11) is an 11-point scale for patient self-reporting of pain. It is based solely on the ability to perform activities of daily living (ADLs) and can be used for adults and children 10 years old or older [16]. Table 1 show the pain rating level using numeric rating scale.

They have four level followed by indication of ADL. Lowest level of pain is 0 scale, mean no indication to ADL problem, followed by scale of to 3 is mild pain and indicate nagging, annoying , interfering little with ADL, next scale 4-6 for moderate scale and indicate significantly problem with ADL. The last level is severe pain is scale of 7-10 and indicate of disabling and unable to perform ADL

Table 1 Rating Pain Level

Scale	Level of pain	Indication
0	No Pain	
1–3	Mild Pain	nagging, annoying, interfering little with ADL
4–6	Moderate Pain	interferes significantly with ADL
7–10	Severe Pain	disabling; unable to perform ADL

3 Results

From the interviews and the observations, it was shown clearly that the subjects were exposed to the awkward postures during long working hours.

Figure 1 Body position during lab work welding process

According to figure 1, the findings showed at figure 2 that all body parts have discomfort. But they level are different

according to data as figure 2. The most discomfort of body part is upper back is 14 student and only one student don't have problem for their upper back, then followed by followed by neck is 13 student and lower back is 12 and right shoulder is 11 students. Only 9 students have discomfort for the left shoulder. it's had a difference between left and right because of the dominance of hand. the most less discomfort is the left upper arm is 2 students.

For students, wrist have discomfort for right wrist is 8 and 6 students for left student. It is because when perform welding process, student needs to twist the wrist. while for upper arm student have discomfort for left upper arm only 2 and upper arm right is 6. then followed by right forearm is5 and left forearm only 3 students. This result refers the torso area for body part. The most significant discomfort is among main body part such as neck, shoulder, upper back, and lower back because of body bending level.

For the lower body part, the most significant discomfort starts from thighs until below the body part. It is because only 4 students have discomfort for hip. Then for right thigh and left thigh 9 and 8 student. Followed by right knee is 11 and left knee is 8. Result for lower leg and feet same for both body part. For right lower leg and right feet is 10 students followed for left lower leg and left feet is 9.

Even Though total respondent is 15 students but many student discomforts for left and right body part. All student has discomfort for lower body part exclude hip it is because welding position for this process need to welder standing for long time and body position in awkward posture.

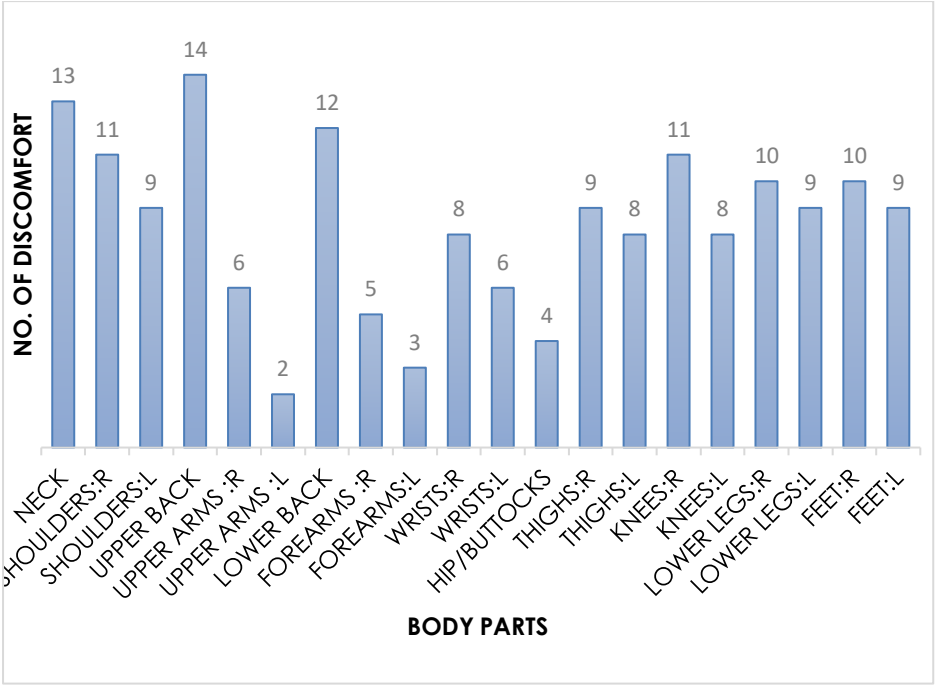

Figure 2: Analyse of CMDQ for 15 respondents

4 Discussion

The current study contributed additional evidence to literature about the considerable prevalence of musculoskeletal discomfort among an welder. The study identified the severe musculoskeletal discomfort allies with welding process during lab work[3]. This finding is consistent with findings of past studies by Farioli (2014), which showed that which showed that musculoskeletal disorders are main causes of work disability among the employees and also can give very serious effects on employee's health and efficiency.[17] Further more musculoskeletal disorders also can happen to students in technical institutions during lab work. Hence, this study was show to noticeable position of welder is a part of factor contribute significantly to prove MSD for student in technical institution

5 Conclusions

Based on the study, it was found that it had met its targets and objectives. The use of CMQ as a tool for the part of the body's discomfort can identify the discomfort during the welding lab work activity.

Result CMQ for 15 respondents had all respondents suffered from discomfort after implementing lab work depending on the specific part of the body. Improvements to the body's posture position is needed. The

musculoskeletal discomfort survey seemed to
be very helpful to screen the work lab, especially in the welding process to upgrade health, well-being, and performance. The results are also useful for assessing the ergonomics risks factors in the future study.

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