

Investigation of the Physical Risk Factor in Wall Plastering Job using WERA Method

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Abstract—This aims of this study was to investigate the physical risk factor among the workers in wall plastering by using new development of the ergonomic risk assessment tool which called Workplace Ergonomic Risk Assessment (WERA). Home building industry in three workplaces were randomly selected as a field study in this research where out of 43 workers in the wall plastering job were randomly selected as a subjects. During the site visit of the three workplaces, observation of the tasks were carried out by using WERA assessment. A structured interview with self-report charts (Body Discomfort Chart) were given to all subjects for each tasks. An analysis of WERA assessment, the wrist score for WERA body part was >4 in 86% of workers, while wrist pain or discomfort was reported by 86%, yielding a significant association between WERA body part score and self-reported pain ($\chi^2=16.12$; $p=0.000$). The WERA body part score for the shoulder regions during wall plastering job yielded a score >4 in 93% and caused shoulder pain or discomfort in 91%, the association being significant ($\chi^2=12.58$; $p=0.000$). The back regions for WERA body part score was >4 in 91% of workers, with 98% reporting pain or discomfort in the back regions, with a significant association ($\chi^2=9.98$; $p=0.002$). The result shows that statistically significant for the wrist, shoulder and back regions of the individual WERA body part scores to the development of pain or discomfort. It shows that the WERA assessment provided a good indication of work related musculoskeletal disorders which might be reported as pain, ache or discomfort in the relevant body region.

Index Terms—Physical risk factor, wall plastering job, Workplace Ergonomic Risk Assessment (WERA), home building industry, construction industry

I. INTRODUCTION

THE recent studies and statistics have shown that the rates of musculoskeletal injuries and disorders among workers in the construction trades are much higher when compared to those working in other industries [1-4]. Wall plastering job is the one of the major work in home building of construction industry. In general, construction

workers are at a high risk of developing work-related musculoskeletal disorders (WRMSDs) that are associated with exposure factors in this work environment [5]. According to a statistic report by the Department of Occupational Safety and Health, Malaysia (DOSH) about occupational accidents for the category of death until August 2010, 51 of victims were reported by construction industry. Manufacturing industry was the second highest where 45 of victims were reported behind the agriculture (26 of victims) and transportation (10 of victims) [2]. According to the statistic report about the numbers of accidents by industry year 2007 conducted by SOCSO, 2900 of cases were reported in construction industry [4]. For the number of occupational diseases by causing agent reported by SOCSO (2007), 26 cases were reported in occupational musculoskeletal disorders.

Despite the high prevalence of ergonomic risk factors in construction work [1, 6], therefore, the aims of this study was to investigate the physical risk factor among the workers in wall plastering job by using a new development of the ergonomic risk assessment tool which called Workplace Ergonomic Risk Assessment (WERA).

II. METHODS

A. Subjects and Wall Plastering Job

Home building industry in three workplaces were randomly selected as a field study in this research. From the three workplaces of home building industry, out of 43 workers in the wall plastering job were randomly selected as a subjects. This field study was conducted at Pahang, Johor and Selangor state in Malaysia, month of May to September 2010 (5 month).

In Pahang state, 16 workers were performed in wall plastering job. The job was based upon the procedure of work. Firstly, these workers need to climb the scaffolding in the work area. In a standing position on top of the scaffolding, these workers need to determine the areas of wall to be plastered. Before that, the other workers have carrying and lifting the plaster by using timber and place it on the top surface of scaffolding that has been cover by woods. After determine the areas of wall to be plastered, these workers need to bend their back with twisting the left side when take it a plaster from the ground by using the hawk and float tool. The hawk was a flat board, about nine inches square, that has a hard shape of the handle. Then, these workers were layered a plaster on the interior wall by covering a wall, using a hawk in his left hand and float in his right hand with reaching over the head in standing

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position. And again, these workers were repeated do a same step/procedure during their works completed.

The same step/procedure of work was performed by the other workers in Johor (n=14) and Selangor state (n=13). But, there were significant different from three workplaces in terms of task duration, material preparing, workplace condition and use of hand tool.

B. WERA method

The Workplace Ergonomic Risk Assessment (WERA) [7, 8] was developed to provide a method of screening the working task quickly for exposure to the physical risk factor associated with work-related musculoskeletal disorder (WMSDs). The WERA assessment consists of six physical risk factors including posture, repetition, forceful, vibration, contact stress and task duration and its involve the five main body regions (shoulder, wrist, back, neck and leg). It has a scoring system and action levels which provide a guide to the level of risk and need for action to conduct more detailed assessments. As the WERA tool is a pen and paper technique that can be used without any special equipment, it also can be done in any space of workplaces without disruption to the workforce.

C. Data Collection

During the site visit of three workplaces, observation of the tasks were carried out by using WERA assessment. Tasks were observed and videotape during the task duration in order to gather the data for the WERA assessment, including frequency of the activity such as standing, reaching, bending and twisting. From the videotape the angle of the some body segments relative to the vertical was estimated (back, shoulder, elbow and head). The most frequent postures of task adopted by the workers were taken into consideration for WERA assessment.

During the resting time and launch time, a structured interview was conduct by using self-report charts (Body Discomfort Chart - which have been shown to provide a valid measure of body discomfort) [9] were given to all subjects for each tasks. The body discomfort chart consist the question about the level of pain or discomfort in terms of pain or no pain in the six body part including the shoulder, elbow, wrist, back, neck and leg regions.

D. Data Analysis

To establish whether WERA assessment provided a good indication of work related musculoskeletal disorders which might be reported as pain, ache or discomfort in the relevant body region, chi square test (χ^2 -test) was used to determine the association between the physical risk factor score defined by WERA tool and any body reported pain, ache or discomfort from body part region that based on the number of task. Statistical analysis was performed using SPSS for Windows (version 15.0).

III. RESULTS AND DISCUSSION

A. Description of the Sample

From wall plastering job, out of the 43 workers were have the age range from 20 to 44 years (mean 32.67 ± 5.85) while the working experience ranges were from 2 to 12 years (mean 6.28 ± 2.33). Table 1 shows the demographics of the workers in wall plastering job.

TABLE 1. DEMOGRAPHICS OF THE WORKERS IN WALL PLASTERING JOB (N=43)

Job	Age (year)			Working Experience (year)		
	Mean	SD	Range	Mean	SD	Range
Wall Plastering	32.67	5.85	2-12	6.28	2.33	20-44

B. WERA Assessment

From the WERA assessment for 8 tasks in wall plastering job, the shoulder score was 4.63 ± 1.68 scores (range from 2-6). The highest for the shoulder score was in task 3, 5 and 7 where these tasks were extreme bent up for the shoulder posture or hands at above the chest level and have heavy movement with no rest. For the wrist score was 4.13 ± 0.83 scores (range from 3-5) and the highest score was in task 3, 5 and 7 where wrists are extreme bent up and down with twisting and have 12 times per minute for wrist repetition. In back score, the total mean age was 2.75 ± 1.03 scores (range from 2-4) where task 2, 4 and 6 have a highest score of 4 in which back posture was extreme bent forward with 3 times per minute for the repetition. The neck score was 5.50 ± 0.93 scores (range from 4-6) where task 2, 3, 4, 5, 6 and 7 have a highest score in which neck was extreme bent forward and bent back for more than 20 degrees. And the leg score was 4.75 ± 0.46 scores (range from 4-5) where all tasks have a highest score in which legs were moderate bent forward except task 1 and 8 in neutral position. Forceful score was 2.75 ± 1.03 scores (range from 2-4) where lifting the load less than 5kg for all tasks. The score for vibration and contact stress were 3.75 ± 0.46 scores (range from 3-4) and 3.75 ± 0.46 scores (range from 3-4) where the worker never used of vibration tool and using a hand glove when doing a wall plastering job. The score for the task duration was 4 score where more than 4 hours per day (taking 8 hours per day for task duration).

Task 1 and 2 (standing posture) have a final score in 27 in which indicated the low risk level while task 2,4 and 6 (bending posture) were final score in 40, which indicated the medium risk level and task 3,5 and 7 (reaching the overhead position) were final score in 38, which indicated for medium risk in action level. Therefore, the total final score for 8 tasks in wall plastering job was 36 ± 5.63 scores (range from 27-40) in medium risk level. These result shows that the task was still accepted but need further investigate and require to change [10]. Table 2 shows the final score and action level for 8 tasks in wall plastering job.

TABLE 2. FINAL SCORE AND ACTION LEVEL FOR 8 TASKS IN WALL PLASTERING JOB [10]

Tasks	Score for WERA assessment									Final Score	Action level
	SH	WR	BC	NC	LG	FC	VB	CS	TD		
T1	2	3	2	4	4	2	3	3	4	27	Low
T2	5	4	4	6	5	4	4	4	4	40	Medium
T3	6	5	2	6	5	2	4	4	4	38	Medium
T4	5	4	4	6	5	4	4	4	4	40	Medium
T5	6	5	2	6	5	2	4	4	4	38	Medium
T6	5	4	4	6	5	4	4	4	4	40	Medium
T7	6	5	2	6	5	2	4	4	4	38	Medium
T8	2	3	2	4	4	2	3	3	4	27	Low
Mean	4.63	4.13	2.75	5.50	4.75	2.75	3.75	3.75	4.00	36	Medium
(SD)	(1.68)	(0.83)	(1.03)	(0.93)	(0.46)	(1.03)	(0.46)	(0.46)	(0.00)	(5.63)	
Range	2-6	3-5	2-4	4-6	4-5	2-4	3-4	3-4	4		

Notes: SH for shoulder, WR for wrist, BC for back, NC for neck, LG for leg, FC for forceful, VB for vibration, CS for contact stress and TD for task duration.

C. WERA Validation

In wall plastering job (n=43), the relationship of the individual WERA body part scores to the development of pain or discomfort is statistically significant for the wrist, shoulder and back regions. The wrist score for WERA body part was >4 in 86% of workers, while wrist pain or discomfort was reported by 86%, yielding a significant association between WERA body part score and self-reported pain ($\chi^2=16.12$; $p=0.000$). The WERA body part score for the shoulder regions during wall plastering job yielded a score >4 in 93% and caused shoulder pain or discomfort in 91%, the association being significant ($\chi^2=12.58$; $p=0.000$). The back regions for WERA body part score was >4 in 91% of workers, with 98% reporting pain or discomfort in the back regions, with a significant association ($\chi^2=9.98$; $p=0.002$).

The neck score for WERA body part was 1-3 in 86% of workers, this score corresponds to the most neutral posture (standing position with hand below the waist). As neck pain or discomfort was reported by 70%, there was no association between WERA score and neck pain ($\chi^2=0.032$; $p=0.858$). Similarly, no association was found in leg score for WERA tool and reported pain or discomfort in those regions [10]. Table 3 shows the chi square statistical analysis (χ^2 -test) of WERA body-part score and number of workers reporting pain, ache or discomfort in wall plastering job.

TABLE 3. CHI-SQUARE STATISTICAL ANALYSIS (χ^2 -TEST) OF THE WERA BODY PART SCORES (LOW OR >MEDIUM) AND THE REPORTED PAIN, ACHE OR DISCOMFORT IN WALL PLASTERING JOB [10]

Body part	Pain	WERA score		χ^2	$p < .05$
		1-3	>4		
Shoulder	No	2	2	12.58	0.000
	Yes	1	38		
Wrist	No	4	2	16.12	0.000
	Yes	2	35		
Back	No	1	0	9.98	0.002
	Yes	3	39		
Neck	No	11	2	0.032	0.858
	Yes	26	4		
Leg	No	12	1	0.015	0.903
	Yes	28	2		

χ^2 -analysis of WERA body-part score and number of workers reporting pain, ache or discomfort in that region. The presence of pains, aches or discomfort was recorded as "pain", their absence as "no pain". For the WERA score, all the body part were scores either in 1-3 (Low), 4 (Medium) or 5-6 (High) for the risk level.

IV. CONCLUSION

The result shows that the workers have suffering in pain to the back, shoulder, wrist and elbow regions during their work in wall plastering job where these workers need to bend their back and twisting the left side when taking a mortar from the scaffolding in awkward posture. The relationship of the individual WERA body part scores to the development of pain or discomfort is statistically significant for the wrist, shoulder and back regions. It shows that the WERA assessment provided a good indication of work related musculoskeletal disorders which might be reported as pain, ache or discomfort in the relevant body region.

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