EVALUATION OF RISK FACTORS ASSOCIATED WITH WORK-RELATED MUSCULOSKELETAL DISORDERS OF UPPER LIMBS EXTREMITY AMONG PRESS WORKERS

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ABSTRACT

Objective: Exposure assessment of individual press workers to risk factors associated with work-related upper extremity muscoluskeletal disorders (UEMSDs).

Design: This was a workplace field based, descriptive and analytical study.

Place and duration: The study was conducted in presswork shops of an automobile manufacturing industry in Tehran, Iran during 2004-2005.

Patients and Methods: Nordic Musculoskeletal Questionnaire (NMQ) and Rapid Upper Limb Assessment (RULA) ergonomics posture based method were applied among 50 workers who work in bending, impact and hydraulic press shops. Then RULA and NMQ results were analysed and compared against each other through SPSS statistical package.

Results: The results of this study showed that among all 50 press workers high and low prevalence of pain existed in low back (60%), shoulder and back (16%-18%), respectively. Whilst in other part of body such as thighs and legs, wrist and neck it varies from 22%-44%. In addition, RULA and NMQ results were comparable for bending press workers only and it revealed that 75% of workers have score three for arm, forearm and wrist and 63% of workers have score two for neck, trunk and foot. Also, significant differences were observed between RULA body part scores (1 or >I) and the reported pain in neck and trunk (1df p=0.011 and p=0.026, respectively).

Conclusion: Press workers are involved in musculoskeletal disorders in performing their job and RULA method can be considered a useful method for evaluation of WRMSDs in presswork shops of automobile manufacturing industry.

KEY WORDS: Ergonomics, Upper extremity muscoluskeletal disorders, RULA, NMQ, Press workers, Risk factors.

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INTRODUCTION

In recent years investigations of work-related musculoskeletal disorders (WRMSDs) has attracted considerable attention because of its importance in assessing ergonomics risk factors involved in industrial workplaces. WRMSDs have been found to be associated with numerous occupational 'risk factors', including physical work load factors such as force, posture, movement and vibration,[1-3] psychosocial stressors,[4-6] and individual factors.[7] The level of exposure to physical workload can be normally assessed with respect to intensity (or magnitude), repetitiveness and duration. Various methods are now available for assessing exposure to the risks associated with work-related musculoskeletal disorders, or identifying potentially hazardous jobs or risk factors within a job. These include observational methods, instrumental or direct methods, self-reports and other psycho

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physiological methods and recently the application of these techniques was reviewed critically.[8] However, only several risk factors of WRMSDs are known and it was found that they are highly dependent to occupations. Further studies are needed for better understanding of these factors in detail. In this paper exposure assessment of individual workers to risk factors associated with work-related upper extremity musculoskeletal disorders (UEMSDs) were examined through Nordic Musculoskeletal Questionnaire[9] and Rapid Upper Limb Assessment[10] in presswork shops of an automobile manufacturing industry in Tehran, Iran during 2004-2005.

SUBJECTS AND METHOD

Fifty male press workers (in bending, impact and hydraulic press shops) were enrolled in the study as case group and 50 administrative staffs as control group in an automobile manufacturing industry in Tehran during 2004-2005. Nordic Musculoskeletal Questionnaire (NMQ) and Rapid Upper Limb Assessment (RULA) method were applied for both case and control groups. In NMQ method period prevalence (12 months), point prevalence (7 days) and intensity of musculoskeletal troubles (i.e. aches, pain, discomfort, numbness or tingling) in different anatomical areas (i.e. neck, shoulders, elbows, wrist/hands, upper back, lower back, hips/thighs/buttocks, knees and ankles/feet) were identified and questioned from individuals or workers. Optional, more details were included as part of the NMQ on the neck, shoulder and/or low back. It includes participant's lifetime prevalence of and sickness absence due to such 'trouble', and the effects (if any) on work/leisure activities. Additional questions were added to the NMQ based on the literature regarding other possible risk factors for low back pain such as age, gender, cigarette smoking, and work and leisure activities. The RULA method uses diagrams of body postures and three scoring tables to provide evaluation of exposure to risk factors. The risk factors under investigation were described as external load factors.[11] These factors include: numbers of movements; static muscle work; force; work postures determined by the equipments and furniture; and time worked without a break. In addition to these factors that was cited,[11] other important factors which may influence the load, but may vary between individuals included: the work postures adopted, unnecessary use of static muscle work or force, speed and accuracy of movements, the frequency and the duration of pauses taken by the operator. In addition, there are factors that altered an individual's response to a particular load, individual factors (such as age and experience), workplace environmental factors and psychosocial variables.[11] In RULA method, the body is divided into segments, which formed two groups of A (includes the upper and lower arm and wrist) and B (includes the neck, trunk and legs). The range of movement for each body part is divided into sections according to criteria derived through interpretation of relevant literature. These sections are numbered so that the number one is given to the range of movement or working posture where the risk factors present are minimal. Higher numbers are allocated to parts of the movement range with more extreme postures indicating an increasing presence of risk factors causing load on the structures of the body segment. This system of scoring each body part posture provides a sequence of numbers that is logical and easily remembered. According to RULA method[10] a score is calculated for the posture of each body part. Score one indicates the most neutral posture and score four shows the worst position. The combined individual scores for shoulder, elbow and wrist give score A, and those for neck, trunk and legs give score B. These scores are added to scores A and B to obtain scores C and D, respectively. Combination of scores C and D, called grand score (ranging from 1 to 7), shows the musculoskeletal loading associated with the mender's posture. Low grand scores (1 or 2) indicate acceptable working posture (action level 1). For grand scores of 3 or 4, further investigation is needed and changes may be required (action

level 2). Prompt investigation and changes are required soon for scores of 5 or 6 (action level 3). Finally, immediate investigation and changes are required for grand score of 7 (action level 4). Job analysis indicated that press-working operations consisted of 4 tasks and they include: ''Transportation of metal pieces from storage box into press feeding table'', ''Transportation of metal pieces from press feeding table into press operational zone'', ''Pushing press running buttons with two hands'' and ''Transportation of pressed metal pieces into collecting box'' In this study NMQ and RULA results were recorded, analysed and compared statistically by, Fisher and t test through using SPSS computer software package for all case and control groups under this study.

RESULTS

Table-I shows some personal details of press workers that participated in the study. The daily working hours of press workers were long; 60% of press workers worked more than 8 h/day. Fig-1 presents the prevalence of musculoskeletal complains during the last 12 months among 50 press workers and clearly shows that the prevalence of low back pain, and shoulder and back pain in press workers are 60% and 16%-18%, respectively, but in other parts of the body such as thighs and legs, wrist and neck it varies from 22%-44%. Comparison between reported pain prevalence in both body parts groups of A and B is presented in Fig-2. It was observed that reported pain

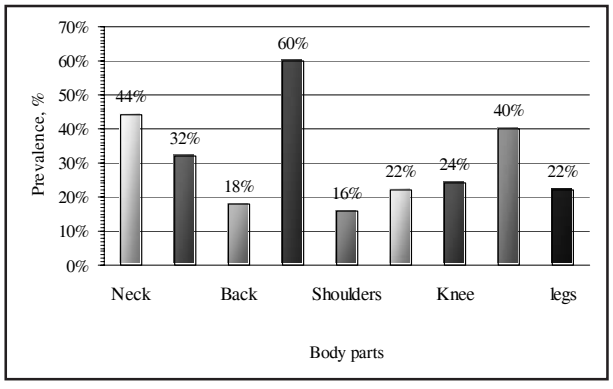

Fig-1: The prevalence of musculoskeletal complains among press workers during the last 12 months (n=50).

Table-I: Personal details of the metal press workers (n = 50)

Age (year)			*Work experience (year)*			*Weekly working hours*	
Mean	SD	Range	Mean	SD	Range	Mean	SD
29	8.5	20–55	4.9	7.3	1–12	61.1	7.7

prevalence in hydraulic press workers (in body part groups of A and B, 34%, 48%, respectively) compared with bending and impact press workers is higher. The results of Rula final posture score together with frequency and action level among press workers is tabulated in Table-II. It showed that most press workers are categorised in final posture of 3 and less than 40% of them are classified in action levels of 3 and 4. The relationship between the subject's score defined by grouping and any reported pain, ache or discomfort from that body part region as tabulated in Table-III clearly shows that there are significant differences between RULA body part scores (1 and >1) and the NMQ results in neck and trunk (= 6.41(1df), p = 0.011 and = 4.94 (1df), p= 0.026, respectively).

DISCUSSION

In this study, a Rapid Upper Limb Assessment (RULA) was selected for use as a quick and systematic objective assessment of the posture, forces and activities undertaken by the automobile press workers. RULA is a tool that assesses biomechanical and postural loading

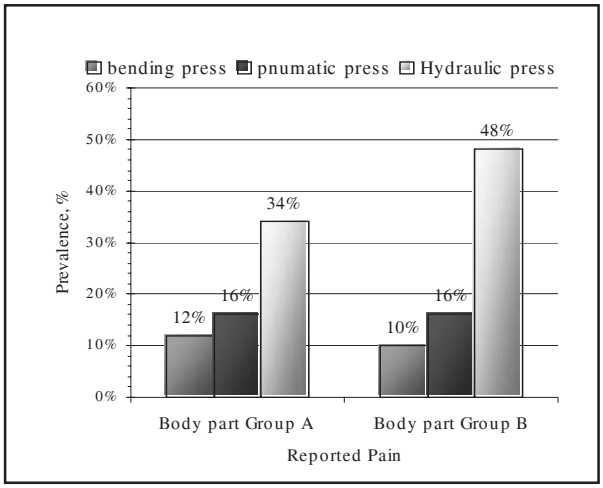

Fig-2: Comparison of the reported pain in body part group A and B of press workers.

Table-II: Rula posture score, frequency and action level among press workers (n=50)

Job title	Final A group score	Final B group score	Exerted force score	Muscle use score	Final posture score	Action level
Hydraulic press	3	4	1	1	7	4
Hydraulic press	3	4	1	1	7	4
Hydraulic press	4	4	2	1	7	4
Hydraulic press	4	4	2	1	7	4
Hydraulic press	4	4	3	1	7	4
Hydraulic press	4	4	3	1	7	4
Bending press	3	5	0	1	6	3
Impact press	3	3	1	1	6	3
Impact press	3	3	1	1	6	3
Hydraulic press	3	3	1	1	6	3
Hydraulic press	3	3	1	1	6	3
Hydraulic press	3	3	1	1	6	3
Impact press	4	2	1	1	6	3
Impact press	4	2	1	1	6	3
Impact press	4	2	1	1	6	3
Hydraulic press	4	4	0	1	6	3
Bending press	3	4	0	1	5	3
Hydraulic press	3	2	1	1	5	3
Hydraulic press	3	2	1	1	5	3
Hydraulic press	3	2	1	1	5	3
Hydraulic press	3	2	1	1	5	3
Bending press	4	2	0	1	4	2
Impact press	4	2	0	1	4	2
Impact press	4	1	0	1	4	2
Impact press	4	1	0	1	4	2
Hydraulic press	2	2	0	1	4	2
Bending press	3	2	0	1	3	2
Bending press	3	3	0	1	3	2
Bending press	3	2	0	1	3	2
Bending press	3	2	0	1	3	2
Impact press	3	2	0	1	3	2
Impact press	3	1	0	1	3	2
Impact press	3	1	0	1	3	2
Impact press	3	2	0	1	3	2
Impact press	3	1	0	1	3	2
Hydraulic press	2	1	0	1	3	2
Hydraulic press	2	1	0	1	3	2
Hydraulic press	2	2	0	1	3	2
Hydraulic press	2	2	0	1	3	2
Hydraulic press	3	2	0	1	3	2
Hydraulic press	3	2	0	1	3	2
Hydraulic press	3	2	0	1	3	2
Hydraulic press	2	2	0	1	3	2
Hydraulic press	3	1	0	1	3	2
Hydraulic press	2	1	0	1	3	2
Hydraulic press	2	1	0	1	3	2
Hydraulic press	2	1	0	1	3	2
Supervisor	2	1	0	0	2	1
Supervisor	2	1	0	0	2	1
Supervisor	2	1	0	0	2	1

Table-III: Statistical analysis of the RULA body part scores (1 or >1) and the reported pain, ache or discomfort in the region.

Body part	Reported pain	Posture score		Type of test	p value
		1	> 1	X^2	
Neck	Pain	7	15	6.41(1 df)	0.011
	No pain	19	9		
Trunk	Pain	6	24	4.96 (1 df)	0.026
	No pain	10	10		
Arm	Pain	6	2	Fisher exact test	0.009
	No pain	10	32		
Wrist	Pain	4	12	Fisher exact test	0.442
	No pain	5	29		
Group B	Pain	7	29	Fisher exact test	0.042
	No pain	7	7		

on the whole body with particular attention to the neck, trunk and upper limbs and also a survey method developed for use in ergonomic investigations of workplaces where work related upper limb disorders are reported.[10] Furthermore, RULA assessment requires little time to complete and the scoring generates an action level which indicated the level of intervention required to reduce the risks of injury due to physical loading on the automobile press workers.[11] Although, the experience of the observer play an important role in postural analysis, but using RULA by untrained people in ergonomics can provide accurate, rapid initial assessments of jobs that may result in upper limb disorders.[12]

The results of this study showed that the RULA body scores in group A are higher than those in group B for all press workers and a good agreement observed between NMQ and RULA results for bending press workers, only.

Statistical tests (χ^2 and Fishers exact tests) showed that there are significant relationship between reported pain and RULA scores in neck and trunk, arm and body part in group B ($p<0.05$) but this was not for wrist (see Table-III) for all press workers. In addition, the prevalence of the reported musculoskeletal disorders (NMQ) for impact press workers for both body part groups (A, B) were found to be same, whilst for hydraulic press workers body part group B was higher than group A. It can be concluded that differentiate in NMQ and RULA results may be due to firstly; there was no space for sitting chair (as observed by author) for impact and press workers in the field and they have to bend frequently during their work. Secondly, hydraulic press workers have been worked in standing posture for the whole shift and in spite of their posture scores for their legs were found to be but due to the factor that they had pain in feet, NMQ results have been affected by their claim. However, musculoskeletal disorders are mostly prevalent in studied automobile press workers and RULA method could be considered as a useful method for the evaluation of risk factors associated with WRMSDs as investigated by previous researchers.[10,11,13-16] It is suggested that other MSDs risk factors assessment should be tested for hydraulic press workers and validated by NMQ as well as medical test

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