



Musculoskeletal Disorders among Plastering Workers

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ABSTRACT

Introduction: Work-related Musculoskeletal Disorders (WMSDs) represent one of the leading causes of occupational injury and disability. Construction workers are at high risk of developing the WMSDs. This study conducted to estimation the prevalence of WMSDs and evaluation the risk of awkward postures among plastering workers. **Methods:** Study cases consist of 100 plasterers that selected randomly. The Nordic Musculoskeletal Questionnaire (NMQ) completed to collection the data and determination the prevalence of WMSDs. The risk of WMSDs assessed via Rapid Upper Limb Assessment (RULA). SPSS was used to statistical analysis via Independent t-tests, one way ANOVA and multinomial logistic regression test. **Results:** NMQ showed the highest prevalence of Musculoskeletal Disorders (MSDs) in the shoulders, neck, back and wrist during the last 12 months. RULA assessment revealed that 24 Percent of workers have average grand score of Seven. By increasing one unit in RULA scores, chance of disorders has increased in most body part. By enhancing one year of work history, the chance of back disorders has increased. A significant relationship confirmed between average scores of RULA assessment and development of WMSDs. **Conclusion:** Relatively high frequency of poor postures and WMSDs among the plasterers denoting the high risk circumstances that required special attention. Awkward postures and repetition play an important role as one of the risk factors for these disorders. Ergonomic interventions must be focused on reducing the exposure to physical risk factors specially, awkward postures and repetition.

Key words: Musculoskeletal Disorders, Nordic Questionnaire, Plastering Workers, Rapid Upper Limb Assessment.

INTRODUCTION

MSDs are injuries of muscles, ligaments, tendons, nerves, blood vessels, bones and joints that caused or aggravated by work and can occur from a single event or cumulative trauma.¹ MSDs make a major burden on workers, health systems, and social care entities worldwide and are the primary reason for long-term sickness absence and related work disability in the construction industry.² A subdivision of MSDs is called WMSDs, which refers to any MSDs that caused by working circumstances or activities.³

Workers in different construction occupations are at risk for different WMSDs mainly due to different biomechanical risk factors.⁴⁻⁶ Wall plastering is one of the major occupations in construction industry and due to the highly dynamic nature of this duty and physical alterations of construction site, the quiddity and magnitude of ergonomic hazards change daily. This makes characterizing the ergonomic hazards more challenging than repetitive jobs.⁷

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WMSDs characterized as multi-factorial problems. These factors includes physical force, repetitive motion, awkward or static postures, heavy lifting of materials, contact stress, vibration, extreme temperatures,⁸ psychosocial factors, mechanical pressure concentration and insufficient recovery time.⁹

To assessment of physical risk factors, a wide range of exposure assessment techniques have been developed which categorized as self-reported method, observational method and direct measurement. The most frequently used methods are observational approach which are widely used for posture assessment, determining physical workload and conducting research ergonomics.¹⁰

RULA is a technique for assessing the postures during ergonomics investigations of workplaces which, work-related upper limb disorders reported. This tool requires no special equipment in providing a quick assessment of the neck, trunk and upper limbs postures along with muscle function and the external loads. A coding system used to generate a corrective action list, which indicates the level of required interventions to reduce the risks of injury from physical load.¹¹

Self-reports methods based on questionnaire are applicable to a various workplaces and able to estimate WMSDs symptoms among a large numbers of populations because of low costs for selecting sample size.¹⁰ The NMQ quantifies musculoskeletal pain and activity prevention in nine body regions.¹² Little researches has investigated

the prevalence of WMSDs in wall plastering occupation, therefore this study was established to estimation the prevalence of WMSDs and evaluation the occupational exposures to risks of awkward postures among plastering workers.

MATERIALS AND METHODS

Subjects and Wall Plastering Duty

Because of the wide variety of construction occupations, we have chosen to focus on plastering workers. In this study, 100 plasterers of Tehran city randomly selected as study cases. Among the duties of plastering work, only whitewash tasks studied and other tasks excluded. Plastering operation consist of three steps: 1) plastering the lower section of the wall to access point of worker; 2) the upper section of the wall to the ceiling; and 3) ceiling of the building. Scaffolding is needed to establish in the stages 2 and 3 which workers have to perform plastering operations on approximately 20 cm width wooden timbers.

Postures Sampling

Each plastering process involve applying a container of gypsum plaster, therefore, the average time of one process was set according to the number of used containers by each plasterer in an hour. Posture sampling intervals determined via dividing the average time of each working process by 10 postures sample as required, after So at these intervals, 10 postures photographed in a working process and ultimately 1000 postures gathered considering the total number of 100 plasterers.

Postures Analysis

In order to assessment of plasterers exposure to physical work-related musculoskeletal risk factors, analytical items of interest extracted from any pictures and were entered in RULA software. Hereby the grand score of each subject's postures was determined and then averages of these scores formed the basis for statistical analysis.

Demographic and WMSDs Data Collection

The two- section questionnaire completed for 100 plasterers to collection of data: In first section, workers demographic data (including age, work history, height, weight, medical and health history) questioned. In second section, to determine the prevalence of WMSDs,

general section of Nordic questionnaire (NQ) was completed. By which, respondents are asked if they have had possible pain or discomfort in nine parts of their musculoskeletal System (neck, shoulders, upper back, elbows, low back, wrists/hands, hips/thighs, knees and ankles/feet) during the last 12 months which have prevented normal activity.

The questions, objectives and research process have explained before completing the questionnaires. Volunteers and whose have had at least one-year work history, participated in the study. Workers with a history of trauma, injury or fracture in back, neck, elbow and arm also those had an experience of diseases affecting the musculoskeletal system or joints, such as rheumatoid arthritis, lupus, arthritis, gout, diabetes or thyroid, excluded from study.

Statistical Analysis

SPSS software (ver. 18) was used to statistical analysis. Independent t-tests and one way ANOVA applied to analyze the correlation between demographic variables, the results of the NQ and physical assessment of plasterers postures. Multinomial logistic regression test used to determine the effects of age, work history, Body Mass Index (BMI) and awkward postures on developing the odds ratio of WMSDs.

RESULTS

Demographic Characteristics

Mean and standard deviation of age, work history and BMI of plastering workers participating in this study summarized in Table 1.

Table 1

Musculoskeletal Disorders

Review the results of the NQ showed that the highest prevalence of MSDs affected the shoulders (78%), neck (76%), back (74%) and wrist (74%) parts during the last 12 months. Whereas, the participants have been expressed the lowest rate of MSDs in the thigh (25%), leg (27%), ankle (28%) and elbow (40%). Back and forearm discomfort was seen in 52 and 50 percent of subjects, respectively (Figure 1).

The results of RULA assessment revealed that 24 percent of workers have average grand score of 7, 55 percent average grand score of 5 and 6, and ultimately 21 percent of those were obtained average grand score of 3 and 4. So according to this ratings, fourth level of corrective actions were determined for 24 Percent, third level for

Table 1: Demographic Profile of Workers in Plastering Duty (N = 100)

Age (year)			Work History (year)			BMI		
Range	M	SD	Range	M	SDF	Range	M	SD
18-58	2.59	23.52	17-32	8.08	12.77	1-37	7.98	32.49

Table 2: The Effects of Different Variables on Developing the WMSDs

WMSDs	Variables	OR ^a	95.0% C.I. for OR		P ^b
			Lower	Upper	
Neck	RULA score	2.15	1.38	3.33	0.001
Back	RULA score	1.81	1.25	2.63	0.002
Low back	RULA score	2.09	1.35	3.23	0.001
	Work History	1.07	1.00	1.15	0.038
Shoulder	RULA score	2.70	1.69	4.31	0.000
Wrist	RULA score	1.59	1.08	2.35	0.018
Elbow	BMI	0.89	0.81	0.97	0.014
	RULA score	2.65	1.59	4.40	<0.001

a: Odds Ratio ; b: Logistic Regression

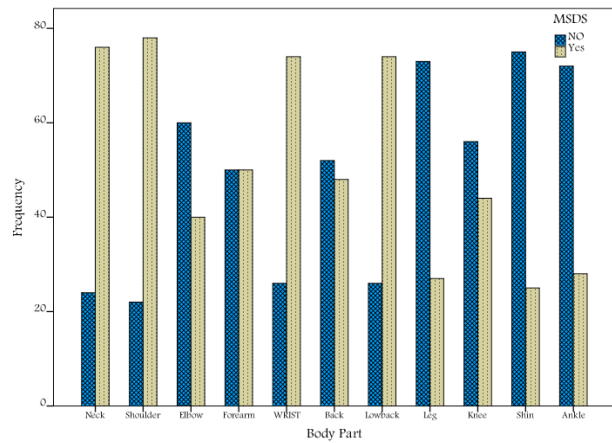


Figure 1: Frequency of WMSDs in Different Body Parts during the Last 12 Months

WMSDs	Pain or Discomfort	RULA Average Scores			
		N	M	S.D	Pa
Shoulder	No	22	4.40	1.25	<0.001
	Right	21	5.61	1.32	
	Left and Right	57	5.92	0.94	
Elbow	No	60	5.13	1.29	0.001
	Right	8	5.87	0.99	
	Left and Right	31	6.22	0.88	
Wrist	No	26	5.03	1.31	0.081
	Right	49	5.67	1.23	
	Left and Right	23	5.78	1.16	
Forearm	No	50	4.90	1.32	<0.001
	Right	28	5.96	0.74	
	Left and Right	21	6.38	0.74	

a: One way ANOVA

WMSDs	Pain or Discomfort	N	RULA Average Scores		Pa
			M	S.D	
Neck	No	24	4.42	1.77	0.001
	Yes	76	5.76	1.16	
Back	No	52	5.00	1.63	0.001
	Yes	48	5.92	1.03	
Low back	No	26	4.54	1.86	0.004
	Yes	74	5.75	1.12	

a: Independent T-test

55 Percent and second level for 21 Percent of the plasterers, respectively.

Association of WMSDs with Age, BMI and Work History

The independent variables such as age, BMI, and work history had no significant correlation on developing the WMSDs of different parts of the body. Via controlling these variables, multinomial logis-

tic regression showed that by increasing one unit in RULA scores, chance of getting disorders in neck, back, low back, shoulder, wrist and elbows have increased 2.1, 1.2, 2.1, 2.7, 1.6 and 2.6 times, respectively. Enhancing one year of work history also has increased the chance of back disorders to 1.1 and by increasing one unit of the body mass index, chance of elbows disorders was 0.9 times greater (Table 2).

Association of WMSDs and Average Scores result from RULA

One-way ANOVA confirmed a significant relationship between the mean scores obtained from RULA assessment and development of WMSDs in different body parts such as the shoulder, elbow and forearm except in the case of wrist disorders (Table 3).

Independent t-test showed a significant association between the mean scores obtained from RULA assessment and disorders of the neck, back and low back (Table 4).

DISCUSSION

Construction is a component of large and developing industry where many workers engaged in. This work consistently ranked among the most dangerous occupations. Although work tasks are varied, they characterized as having high peak hand forces, periodic repetitive motions, and awkward postures.¹³ Although few sources of information specific to plastering are available, data suggest that individuals in this work are at high risk of injuries.¹⁴ Due to the increasing of society population and the need for housing in Iran, many peoples employed in different sectors of this industry including the plastering duties and number of these workers is increasing daily.

Bending and twisting the body, lifting and handling the gypsum containers, working in the height above shoulders along with high repetition motions occurred during the plastering process suggests relatively high frequency of poor postures among the plasterers. In this paper, review the results of the NQ showed the high prevalence of WMSDs in plasterers that affected the shoulders, neck, back and wrist of workers during the last 12 months. Other studies mentioned that plastering workers suffered from pain of the back, shoulders, wrists and elbows during the walls plastering job where these workers need to bend and twisting their back when taking a mortar from the scaffolding in awkward postures.¹⁵ Others cited that more than half of construction workers suffered from occasional or frequent musculoskeletal complaints.¹⁶ These complaints reduce the workers' ability and willingness to continue to remain in their job until retirement.¹⁷ The low back was the most commonly site reported for work-related musculoskeletal symptoms, and the most common reason for seeking care from a physician and missing work.¹⁸ According to a survey on working conditions, in Lithuanian construction industry with respect to eight major construction works including plastering, more than 59 percent of the interviewees indicated that they often were suffering from pains in the low back region and 12 percent complained of constant pains. Complaints about the frequent pains in the legs were reported by 54 percent of the interviewees and 6 percent of the workers suffered all the time. Many of the construction workers were also suffering from pains in the neck-shoulder region, as well as in the elbows and hands.¹⁹

In our study, age, BMI and work history had not significant effects on developing the WMSDs in different body parts. Other researchers noted that moderate overweight is not associated with increased risk of work disability among construction workers, but obesity increases the risk of work disability.^{20,21}

Working postures and movements are important variables in occupational safety since both are the mechanical variables and main factors in determining the work load.²² Also close relationship among awkward posture and WMSDs is approved.²³ Sufficient evidence described poor posture and heavy physical work as physical factors that result in back disorders.²⁴ Therefore, the main risk factors causing the ergonomic problems among plastering workers includes awkward postures, bending/twisting, quick and repetitive motions

and working above shoulder height similar to other studies.²⁵ In this study, 79 percent of working postures have a high or very high risk of causing disorders in various parts of the body. This means that plastering workers are very susceptible to developing the WMSDs. The significant correlation between the RULA grand scores and WMSDs in different body parts (neck, shoulder, back and low back) emphasizes that awkward postures may play an important role as one of the risk factors for these disorders.

In general, to retain construction workers in the field, it is essential to monitor the WMSDs, select specially effective intervention measures focused on assessing and reducing the exposure to awkward postures and repetitions and minimizing the time that workers spend in awkward postures.

CONCLUSION

Due to high occurrence of WMSDs in plastering job, scrutiny the risk factors of these disorders seems to be an essential stage to improve the work conditions. Therefore, it is imperative to minimize the

exposure levels and prevention of the occupational WMSDs by following recommendations:

- Worker training programs to increase the awareness and knowledge of risk factor.
- Exercise and stretching movements in different body parts before starting to work.
- Selection the trowels in appropriate size and weight by plasterers.
- Commensurate scaffolds must be placed in the correct distance from the wall.
- Designing a tool, which keeps the containers in appropriate height of scaffold.
- Considering the short recovery periods at specific intervals during the job.

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