Ergonomic Assessment of Body Working Postures among the Employees of a Car Services Workshop Using OWAS Technique

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ABSTRACT

Aims Musculoskeletal disorders are the most common work-related complications in industrial environments. Inappropriate body working postures are considered as one of the most important risk factors for musculoskeletal disorders. The aim of this study was the ergonomic assessment of body working postures among the employees of a car services workshop, using OWAS technique.

Instruments & Methods This study was a descriptive cross sectional study conducted in 2017 in a car services workshop selected through simple random sampling method. The study sample was one of the representatives of Iran Khodro Company in Ahwaz. Based on the study sample, 960 different body postures were recorded. Using OWAS method as a posture assessment method, each of the occupations was photographed for 40 minutes at 30 second intervals. The data were evaluated by Excel 2012 software and the photographs were evaluated by OWAS method.

Findings Workers' work environment was ergonomically appropriate. Generally, 95.0% of the working postures were related to Level 1, indicating that most of the workstations did not need to be modified. The repetitive movements had the highest body working postures score.

Conclusion Just in the case of car repairers, there was a need for redesigning the workstation. In other cases, the tasks of repairing, coloring, and pressing were related to Code 1.

Keywords Musculoskeletal Disorders; Postures; Ergonomic

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CITATION LINKS

[1] Musculoskeletal disorders self-reported by female nursing students in central Japan: A complete cross-sectional survey [2] Course of low back pain among nurses: A longitudinal study across eight years [3] Occupational medicine practice [4] Decuple ergonomic principles [5] Prevalence of musculoskeletal disorders and work-related risk factors among the employees of an automobile factory in Tehran during 2009-2010 [6] Determine the prevalence and risk of musculoskeletal disorders in employees of an industrial unit [7] Ergonomics in automobile industry [8] Current techniques for assessing physical exposure to work-related musculoskeletal risks, with emphasis on posture-based methods [9] Interventional ergonomic study to correct and improve working postures and decrease discomfort in assembly workers of an electronic industry [10] Musculoskeletal problems among workers of an Iranian rubber factory [11] Methods of posture assessment in occupational ergonomics [12] Survey of correlation between two evaluation method of work related musculoskeletal disorders risk factors REBA & RULA [13] Posture analysis by OWAS method and prevalence of musculoskeletal disorders using nordic questionnaire among workers of Sourak tobacco factory in 2013 [14] The welders posture assessment by owas technique [15] Musculoskeletal disorders among construction apprentices in Hungary

Introduction

Musculoskeletal disorders are one of the common causes of occupational injuries and disabilities in industrialized and developing countries [1, 2]. Work-related musculoskeletal disorders usually involve back, cervical spine, and upper extremities. These disorders are the most common occupational diseases and injuries and the main cause of workers' disability.

Musculoskeletal disorders are the cause of 7% of all diseases in the community, 14% of the referrals to doctors, and 19% of cases admitted to the hospitals, and 62% of people with musculoskeletal disorders have movement restrictions [3]. Working in difficult and uncomfortable conditions can cause temporary discomfort in all parts of the body so that working in such situations for a long time may lead to other discomforts in the musculoskeletal or peripheral nerves systems and, ultimately, to different disabilities. Also, the main complaint of people, who constantly work in standing position, is about the pain in legs and lower back areas [4].

The automotive industry is one of the most important and largest industries in the country, in which a large part of the workforce are working. The important factors in this industry include the speed of production line, the time period of each process, the workplace space, the repetitive movements, inappropriate body working postures, job rotation, load lifting, heavy objects transportation, applying force, and standing for a long time, when combined simultaneously and in a non-ergonomic way increase the potential for musculoskeletal complications [5].

Different risk factors are involved in causing these injuries, which can be divided into physical, psychological, organizational, and individual factors [6]. In Eskandari et al.'s study conducted on one of the automotive company's employees in Tehran, the highest prevalence rate of musculoskeletal disorders was related to tire fitting (92.8%) and exhaust storage installation jobs (88.4%), and the lowest prevalence rate was related to car door installation unit (43.7%) [5]. In their study, undesirable body working postures, manual loads lifting and carrying, and back bending and twisting while working were identified as the most important risk factors for musculoskeletal disorders in the back area [7].

Since inappropriate body working postures is one of the most important risk factors for musculoskeletal disorders, in many methods for assessing the risk of musculoskeletal disorders, posture analysis is considered as the basis for assessment [8]. In many methods for assessing the work-related musculoskeletal disorders (WMSDs), worker's exposure to the individual physical risk factors during work is studied and investigated, based on which the risk of injury is determined, and methods for improving work conditions are presented in order to remove undesirable body postures and thereby reduce the risk of musculoskeletal disorders. As long as no corrective action is performed to improve the body physical condition, the probability of WMSDs would increase over time [9].

The RULA, REBA, OWAS, and QEC are among the methods used for improving the body postures. In most of the above methods, body posture is evaluated by taking pictures or film in such a way that after filming, the researcher observes the film, and in different situations, stops the film and detects the code of each organ [10]. As a method for analyzing inappropriate body working postures, Ovako Working Posture Analysis System (OWAS) is one of the evaluation methods approved by the Occupational Safety and Health Administration (OSHA). There are some methods, by which the potential rate of musculoskeletal disorders throughout the body is evaluated [11, 12].

Therefore, due to the importance of this topic and high prevalence rate of musculoskeletal disorders among the automotive industry workers, the aim of this study was the ergonomic assessment of body working postures among the employees of a car services workshop, using OWAS technique.

Instruments and Methods

This study was a descriptive cross sectional study conducted in 2017 in a car services workshop selected through simple random sampling method. The study sample was one of the representatives of Iran Khodro Company in Ahwaz. The total number of the participants was 17 men, including 15 car services employees and 2 administrative staff.

In order to assess the risk of musculoskeletal disorders in workers, OWAS method was used in car technical services department, including mechanical, car wash, flattening, battery, front suspension, and coloring, gaslight units.

Using OWAS method as a posture assessment method, each of the occupations was photographed for 40 minutes at 30-second intervals. Finally, based on OWAS method, photographs of each posture were evaluated, and the level of corrective actions was determined by analyzing the obtained results.

OWAS method is one of the methods used for posture evaluation. This method was developed for the first time in 1973 in Finland in a steel production company. This method often identifies the postures in the posterior region (4 postures), arms (3 postures), legs (7 postures), and displaced load weight (3 positions). Intra-reliability of this method tested in various industries and professions was close to 90%. Comparing the body postures assessment results, using OWAS method

and posture measurement results, using SELSPOT electronic system showed that OWAS method gives an almost right picture of body postures and, therefore, has an acceptable reliability [11].

The most important issue in performing postural evaluation is to determine the intended posture for evaluation. To this end, the jobs or tasks should be analyzed. In job analysis form, the main tasks and sub-tasks of the main tasks are written. After measuring the duration of each one of these subtasks, the one allocating to itself the highest percentage of job cycle time is selected for evaluation as a sub-task. After determining all the intended sub-tasks, during the direct observations, the score of OWAS method is recorded.

The data were evaluated by Excel 2012 software and the photographs were evaluated by OWAS method.

Findings

All of the participants were male with the mean age of 34.5±8.9 ranging from 23 to 56 years.

In terms of priority level of corrective actions, all the studied workers were placed in groups 2 (15.0%), 3 (30.0%), and 4 (55.0%), indicating that the workers' work environment was ergonomically appropriate. Generally, 95.0% of the working postures were related to Level 1, indicating that most of the workstations did not need to be modified (Table 1).

Table 1) Frequency and percentage of combined postures and related corrective actions level

Corrective Actions Level	Percentage	Posture Code
1	95	3111,3111,1131,1131,1611,11313111,3111,1121,1211,1161,1161,1161,1161,1121,3131,3121
2	5	3311
3	0	0
4	0	0

The repetitive movements had the highest body working postures score (Diagram 1).

The most work pressure was imposed on neck, shoulders, legs, and hands, which over time would be converted into serious musculoskeletal injuries.
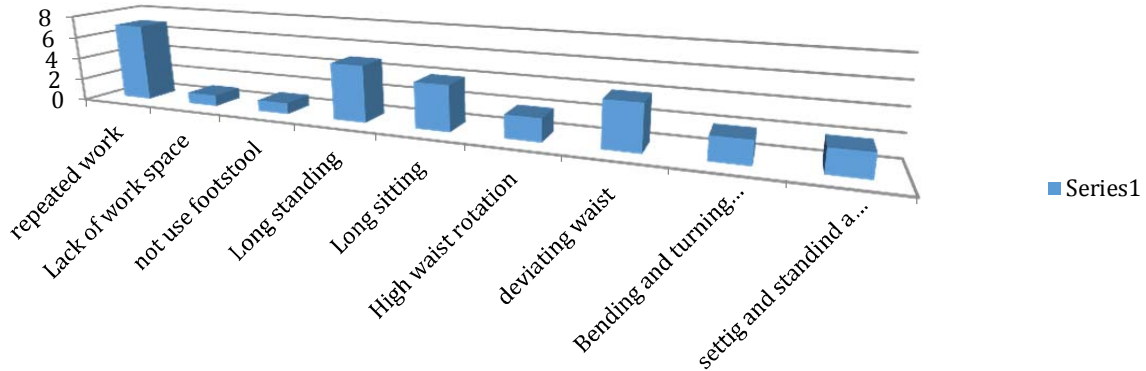
Diagram 1) Frequency distribution of body postures in different working phases

Discussion

The aim of the present study was the ergonomic assessment of body working postures among the employees of a car services workshop, using OWAS technique. Inappropriate body working postures cause musculoskeletal disorders, and as a result, reduce labor productivity. Using OWAS method, the back, hands, and feet working postures were evaluated, and at the end, the final codes ranging from 1 to 4 were derived by OWAS general grouping method.

In examining the workstations, a number of body postures were identified as dangerous postures, including back posture in curved and complex modes, hands in one hand upper shoulder height and both hands above shoulder height, and legs in

standing on two legs for a long time and sitting for a long time.

In this study, the risk of musculoskeletal disorders evaluation results showed that workers in car services sector were placed in Groups 1 (95.0%) and 2 (5.0%) by OWAS method in terms of the priority level of corrective action.

In Sadeghi *et al.*'s study, using OWAS method, 58.5% of cases had normal, 34.7% stressful, 4.0% harmful, and 2.5% very bad body postures [13]. Also, in this study, among the workers' body postures, the highest scores were assigned to repetitive movements and standing for a long time, respectively.

In a study conducted by Esmaeilian, using OWAS method at the tile factory in Tehran, the most

important problems in the workstations were improper work surface height, inappropriate access limits, and limited lateral spaces [14]. In another study conducted by Rosecrance *et al.*, it was found that the high prevalence rate of musculoskeletal disorders (50%) among the construction industry workers was due to unfavorable body working postures and long term static postures [15].

In this study, after analyzing the ergonomic evaluation results, it was recommended that small pillars be used for sitting, ergonomic factors be trained, and ergonomic tables and chairs be used in the acceptance and clearance warranty sections. Consequently, considering the ergonomic principles in the work and implementing training programs not only maintains the health of effective human workforce in human societies, but also reduces huge financial costs imposed on the poor countries economy. For example, by designing the workplace correctly, it is possible to reduce imposed costs such as the costs of disability, incidents, and lost time; reduce work time; remove excess work movements, save energy, and in one word make improvement; and increase the level of human health and economic prosperity. All of which can be achieved by correct recognition of this new knowledge.

The following steps are to be taken: continuous ergonomic training, the use of stools in standing jobs, and avoiding the back rotation and repetitive movements in the repairers' tasks.

Small society and not cooperating with other agencies were the limitations of the study.

Conclusion

Just in the case of car repairers, there was a need for redesigning the workstation. In other cases, the tasks of repairing, coloring, and pressing were related to Code 1.

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