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Comparing the Posture Assessments Based on RULA and QEC Methods in a Carpentry Workshop

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Abstract: Musculo skeletal disorders are the major causes of discomfort and disability among workers, the main reason for increase in compensation payments and decrease in productivity among industrialized developing countries. Losses caused by this disorder, not only affect the individuals but also the community. The purpose of the present study was to compare postures assessments based on RULA and QEC (Quick Exposure Check) methods in a carpentry workshop. This descriptive, cross sectional study was conducted in a carpentry workshop in Paveh City, Kermanshah Province, Iran. To evaluate the ergonomic working conditions, RULA and QEC posture assessment tools were applied, simultaneously. Eventually, obtained information was analyzed statistically. Results showed that the QEC Method is more accurate than RULA Method. Also, RULA Method further considers the movements of the upper parts of the body. In the present study, RULA and QEC were 57% matched. Furthermore, in QEC Method, the greatest amount of stress belonged to the operator who worked with circular saw.

Key words: Posture, RULA, QEC, carpentry, disorder

INTRODUCTION

Encountering hazardous factors of work environment have been increased resulting in more exposure of worker's health to hazards as a result of industrializing, technology developing and promoting of qualitative and quantitative levels of business and production (Barkhordari *et al*., 2011a). Consequently, spreading the musculoskeletal disorders is one of the significant difficulties of occupational health in industrial and developing countries (Peters, 2001). Job related musculoskeletal disorders are major factors resulting in the waste of work time which cause in increase of costand workforce injuries (Costa and Vieira, 2010). Pain and discomfort in musculoskeletal parts are the main reasonsfor workers' absence. The studies showed that the cause of more than half of sickness absences is musculoskeletal disorder (Costa and Vieira, 2010). Prevalence and incidence of WMSDs (Work related Musculoskeletal Disorders) have greater intensity and acuity on industrial developing countries. Because in developed countries, the mechanization has some what reduced the pressure of physical activities, deleted and controlled the risk factors of WMSDs; whereas in industrial developing countries where a great amount of work is done manually, by body power or traditionally, workers are exposed to the risk of biomechanical factors and other factors aiding the WMSDs occurrence (Descatha *et al*., 2009). Several risk factors play role in the injuries which can be classified into biomechanical factors and environmental factors. Biomechanical factors such as improper body postures, force pressure for lifting and carrying heavy loads, repeated motions and static work, bending and continuous rotations. Environmental factors are including temperature, psychological and organizational factors including high production demand,

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low control and lack of social support as well as personal factors like gender and age (Choobineh *et al*., 2007a). Musculoskeletal disorders are defined as any damag to the tissues of musculoskeletal and nerve systems that decreases the cognitive performance (Poorabbas *et al*., 2003). It also, includes a wide spread set of inflammatory and severe conditions which have influence on muscles, tendons, ligaments, joints, nervesand blood vessels (Descatha *et al*., 2009). Clinical symptoms mainly contain tend on inflammation and related status (tenosynovitis, bursitis), nerve compression (carpal tunnel syndrome and sciatica) and osteoarthritis (Wilson, 2002). Classifying diseases and job impositions based on national importance, prevalence, intensity and prevention possibility by National Institute of job Safety and Health (NIOSH) shows that musculoskeletal disorders come to the second place after respiratory diseases. Therefore, musculoskeletal disorders are one of the confronting difficulties to the ergonomists (Choobineh *et al*., 2007b). Proper and improper posture, loading time, static ordynamic as well as individually or simultaneously, play important roles in disorders increase (Farhadi *et al*., 2014). Evaluatingof postures is one of the methods to investigate the stress and tension on body. Several different methods have been used so far. The most remarkable and popular of which are RULA, QEC and OWAS (David *et al*., 2008; De Bruijn *et al*., 1998). With attention to high performance speed, accuracy and reliability, risk level can be identified (Massaccesia *et al*., 2003; De Bruijn *et al*., 1998). According to the presented discussion, this study aimed to compare the postural assessment of RULA and QEC methods in a carpentry workshop.

MATERIALS AND METHODS

The purpose of the present study was to compare postures based on RULA and QEC assessment methods in a carpentry workshop, applying a descriptive and cross-sectional approach. The least and most numerous postures were evaluated using two methods (Massaccesia *et al*., 2003; De Bruijn *et al*., 1998). Then, after taking photographs of four duties including sawing, nailing while sitting, grinding and cutting tools with perpendicular blades. Images were analyzed using two mentioned methods; consequently, obtained information and data were imported to each method's special software and eventually, they were calculated, levels of remedial/corrective actions were detectedand necessary orders were suggested appropriately for each level of corrective doings (Table 1 and 2).

Table 1: The action level in postural assessment methods

Remedia action priority	Description
1	Natural and neutral postures with no adverse effect on musculo skeletal system. No remediation is necessary
2	Postures which may have adverse effect on musculoskeletal system. Near future remediation is needed
3	Postures which have adverse effect on musculoskeletal system. Immediate corrective doings are essential
4	Biomechanical pressure of the postures on musculoskeletal system is highly damaging. Very immediate remediation is necessary

Table 2: Frequency priority corrective action and QEC Method

	Remedial action priority (remedial action)			
Body status assessment method	Level 1	Level 2	Level 3	Level 4
RULA	0	0	50%	50%
QEC	0	0	100%	0

RESULTS

Results of the evaluated postures for duties including circular saw cutting nailing while sitting milling tool handling and cutting with perpendicular saw showed that inall postures performed by QEC Method, urgent remedial proceedings are essential. In RULA Method, 50% of immediat eessential corrective doings and 50% of very immediate necessary remedial proceedings were obtained.

DISCUSSION

Based on Fig. 1 most of the score of body assessments have been in nailing while seating and Fig. 2 demonstrates that quadruplet body part's scores based on QEC Method is more than other tasks. Also, the sitting position is very harmful in workplaces (Farhadi *et al*., 2014).

According to the analysis carried out by RULA technique, cutting perpendicular saw, cutting posture and sitting nailing position were at level 4 of remediation and cutter handling posture by milling tool and circular saw cutting were at level 3. Whereas, all postures in QEC Method belonged to level 3. Comparison of two selected methods showed that in procedures, sitting nailing and perpendicular saw cutting were at the dangerous levels.

Among the same other cases it can be mentioned that both milling tool for handling and circular saw cutting postures belonged to remedial group 3. All evaluated postures of QEC Method were at level 3 of remediation whereas in RULA Method, 50% of them were at level 3 and 50% at level 4. By evaluating the obtained results, it can be inferred that the difference between the two methods might be due to the fact that in RULA Method, more attention is paid toupper movements. Also, the

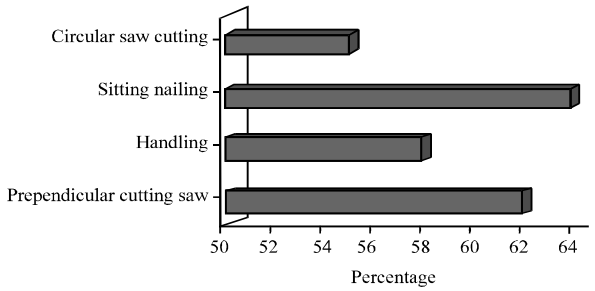

Fig. 1: Percentage of whole body exposure based on QEC Method

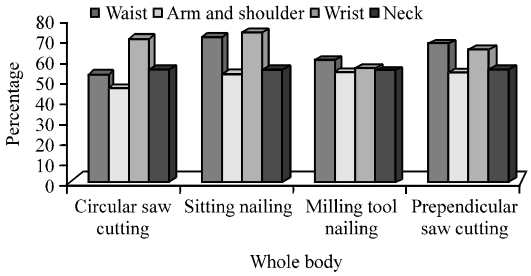

Fig. 2: Quadruplet body part's scores based on QEC Method

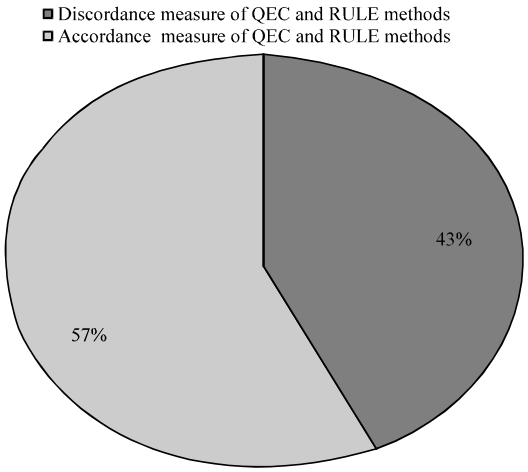

Fig. 3: Accordance measurement

amount of force needed to do the job is intended to be separated from pointing rate of the body. According to the levels of staying in milling tool handling, circular saw cutting as well as perpendicular saw cutting and sitting nailing postures, the results showed that RULA Method has an advantage in that all were in a group. Even though, the postures of the QEC Method are also, in a group but there was a 4% or slighter differences and this could in dicatemore accuracy of the QEC Method. The results of the assessment showed that in the mentioned sites, the ergonomic risk in carpentry jobs is very high and the majority of staff has musculoskeletal disorders. According to conclusions, most of them suffer from skeletal disorders such as waist wrist and shoulder pain. The accordance measurement of the methods was 57% (presented in Fig. 3) and has been proven in some studies (De Bruijn *et al*., 1998). In a study conducted by Barkhordarietalin an alloy industry (Barkhordari *et al*., 2011b), the obtained results showed that QEC and RULA methods had a plausible relationship and correlation since the force on the workers is considered in QEC and RULA methods. Thus, it repesents the great overlap of the two methods (Barkhordari *et al*., 2011a). QEC Method is highly recommended for evaluation of worker's posture instead of RULA Method. Although, QEC Method is not lonely an appropriate tool for risk assessment but there is a general agreement that the method is an enhancing completion for total assessment of risk happening (David *et al*., 2008). Further, studies on wood and carpentry industryis recommended to achieve more accurate and widely information (Kalte *et al*., 2014); meanwhile, appropriate education is required with emphasis on ergonomic stouse work tools and work places (Karchani *et al*., 2011) for ergonomic risk reduction, work site designing. Also, appropriate work toolsare recommended to be applied for reduction of human roles in the industry (Khandan *et al*., 2012, 2013).

CONCLUSION

The results of the assessment of the workstation posture illustrated a high ergonomic risk in this job and the majority of workers in these occupations suffer from musculoskeletal disorders such as backache, wrist and shoulder pain. The results also showed that QEC Method is more accurate than RULA Method.

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