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SYSTEMATIC REVIEW ON VARIOUS RISK ASSESSMENT TECHNIQUES OF MUSCULOSKELETAL DISORDER

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Abstract

Musculoskeletal disorder (MSD) affects maximum workforce and remain a vast form of occupational hazards. With a view to reduce MSDs this paper focuses on the study of musculoskeletal disorder and different methods to reduce the MSDs. Ergonomics is very important in any industry to minimize the risk associated with the task. Variation in demand of the product force the worker to work faster which tends to improper use of methods which will increase the risk of an MSD. The purpose of this review paper is to enlighten various risk assessment techniques to measure the musculoskeletal disorder.

Keywords - Musculoskeletal disorder, Ergonomics, Risk assessment techniques.

1. INTRODUCTION

A musculoskeletal disorder is simply an injury or disorder to the human body's musculoskeletal system. Work related musculoskeletal disorders (WMSDs) are conditions in which

I. The work environment and performance of work contribute significantly to the condition and/or

II. The condition is made worse or persists longer due to work conditions. (U.S. Department of health and human service, pp. 97-141)

Musculoskeletal disorders affect a significant proportion of the workforce and consequently are a major problem in several economic activity sectors in industrialized countries (Denis, 2008). The musculoskeletal system is made up of tendons, ligaments, nerves, soft tissue, etc. and is designed to enable your body to move. We can think of an MSD as a "movement system disorder". Over the course of time soft tissues begins to outrun the body's recovery system. This creates a muscle imbalance that over the course of time develops into an MSD. The Bureau of Labor Statistics of the Department of Labor defines MSDs as musculoskeletal system and connective tissue diseases and disorders when the event or exposure leading to the case is bodily reaction (e.g. bending, climbing, reaching, twisting), overexertion or repetitive motion . MSDs do not include disorders caused by slips, trips, falls or similar incidents. (Harward, 2004)

"Ergonomics is the scientific study of man-machine interaction at the workplace. The basic objective of ergonomics is to fit man and machine together to improve the worker's performance, reduce stresses and fatigue at work. Application of ergonomics is very significant in area where manual activities directly affect physical and mental health of the employee. Ergonomics plays vital role to improve health and productivity at workplace. All the industries had taken initiative to redesign their workplace to overcome musculoskeletal disorders and injuries. (Kushwaha, 2015)

The work related musculoskeletal risk factors include repetition, application of excessive force, vibration and awkward postures and this paper gives clear links between these risk factors and the prevalence of MSDs. (Chiasson, 2012)

Work is important to individuals and their families. It enables people to define their self-identity and build their self-esteem as well as providing monetary income. A major review concluded that, on balance, well-designed work carries net health benefits. Conversely, poorly designed work and unemployment is major social determinants of health inequalities. It therefore follows that health professionals need to consider the impact of their patients' medical disorders on their work. Patients with musculoskeletal disorders (MSDs) often have disabling symptoms, which may or may not limit the type or duration of work that they are able to do. In some cases, a patient's work may have contributed to the development of their MSD or may lead to deterioration in their disorder. However, health-care professionals must be mindful that work can also have a therapeutic role in helping patients to maintain function. (Madan, 2015)

2. RESEARCH OBJECTIVES

Objective of this study is to provide strengths and limitations of different risk assessment techniques of musculoskeletal disorder and to help the people to choose the best suited method/methods to analyse a task to reduce musculoskeletal disorder. This information should be useful for practitioners when choosing a method for ergonomic improvement in an industry.

3. RISK ASSESSMENT METHODS

3.1 Quick Exposure Check

Quick Exposure Check (QEC) is posture based technique combining the observer's assessment with the worker's answers to closed questions; it allows musculoskeletal disorder risk factors to the back, arms, neck and upper extremities at a workstation to be assessed. In addition to an overall score for the whole body, this method provides a risk index for each targeted area. The assessment takes posture movement frequency, effort and shift length into account as well as psychosocial risk factors and exposure to vibration.(Chiasson, 2012)

3.2 Rapid Upper Limb Assessment

The Rapid Upper Limb Assessment was developed to provide rapid objective measure of musculoskeletal risk caused by mainly sedentary tasks where upper body demands were high and where work related upper limb disorders are reported. It is a screening tool that assesses biomechanical and postural loading on the body. It focuses on the neck, trunk and upper limbs and is ideal for sedentary workers. It is simple, quick and easy to complete.(Upadhyay, 2015)

3.3 Rapid Entire Body Assessment

Rapid Entire Body Assessment provides a quick and easy measure to assess a variety of working postures for risk of work-related musculoskeletal disorders. It divides the body into sections to be considered independently, according to movement planes and offers a scoring system for muscle activity throughout the entire body, stagnantly, dynamically, fast changing or in an unsteady way and where manual handling may happen. This is referred to as a coupling score as it is significant in the loads handling but may not always be using the hands. REBA also gives an action level with a sign of importance and requires minor equipment.(Madani, 2016)

3.4 Occupational Repetitive Actions

Occupational repetitive action is a commonly applied method of evaluating the musculoskeletal load of the upper limbs caused by repetitive tasks and the risk of developing musculoskeletal disorders. It is dedicated to movements of the arms below the shoulder level. It focuses on movements of the forearms without considering exposure caused by the posture of the arms. (Ochipinti, 1998)

3.5 SNOOK Tables

Snook tables were developed at Liberty Mutual Insurance Company. This method is based on experiments using psychophysical evaluation and can be used to find the per cent of an industrial population capable of sustaining the efforts in lifting, lowering, pushing, and pulling. Snook table provide guidance that what proportion of population that should be able to do the tasks as a regular part of daily work.(Snook, 1991)

3.6 Washington Industrial Safety and Health Act

In the late 1990's, this tool was developed in Washington state as a part of a regulatory effort in order to control exposures to musculoskeletal risks in the workplace. According to Labor & Industries Washington state, the common factors in this checklist include awkward posture, high hand force, highly repetitive motion, repeated impact, heavy, frequent or awkward lifting and moderate to high hand arm vibration. (Rahman, 2017)

The table 1 shows a brief review of different assessment techniques used in different areas.

Table 1: Different assessment techniques used in different areas.

Referred No.	Paper Details	Method/Technique used	Observation
1	Ergonomic assessment and workstation design of shipping crane cabin in steel industry by (Kushwaha, 2015)	RULA	Ergonomic assessment of existing shipping crane cabin has revealed the root causes and RULA helps to determine the causes.
2	Rapid Entir e Bo dy Assessment (REBA) by (Hignett, 2000)	REBA	REBA is aimed to give an action level with an indication of urgency with scoring system.
3	The Risk of Musculoskeletal Disorders for Workers due to Repetitive Movements during Tomato Harvesting by (Cecchini, 2013)	OCRA	This index is used in this experiment to evaluate the risks to the upper limbs due to repeated strain.

4	Musculoskeletal symptoms and ergonomic hazards among material handlers in grocery retail industries by (Rahman, 2017)	WISHA	Most of the workers are exposed to ergonomic hazards mainly due to awkward posture and high repetitive motion risk level. Supposedly, the interventions must be reviewed by the workers based on their own experiences and needs.
5	A practical method for the assessment of work related musculoskeletal risks- Quick Exposure Check by (Guangyan, 1998)	QEC	QEC is a new method which has been developed for practitioners to assess exposure to the risks of WMSDs. Based on test results obtained this tool is found to be sensitive for assessing the change in exposure before and after an ergonomic intervention
6	An ergonomic evaluation of handle height and load in maximal and submaximal cart pushing by (Resnick, 1995)	Snook tables/Push Pull	This technique is used when there are heavy loads to be moved from one point to another, this technique reduces WMSDs significantly then other methods.
7	Ergonomic risk assessment using postural analysis tool s in a Bus Body building unit by (Qutubudin, 2000)	RULA, REBA, QEC	Evaluation of High risk of the various Work-related Musculoskeletal disorders (WMSDs) in the working methods in the bus body building company.
8	Comparing the results of eight methods used to evaluate risk factors associated with musculoskeletal disorders by (Chiasson, 2012)	RULA, REBA, OCRA, QEC	This paper helps to determine the influence of each parameter on the total task allocated.

4. STRENGTHS AND LIMITATIONS OF RISK ASSESSMENT TECHNIQUES

The following table 2 shows the strengths and limitations of different risk assessment techniques used in above case studies.

Table 2 Strength and limitation of different assessment techniques

Referred No.	Technique	Strengths	Limitations
1	Rapid Upper Limb Assessment (RULA)	RULA has a strong focus on posture therefore it may also be called as Posture analysis technique. RULA is fast, observational so that a person without the knowledge of that topic can also perform this task.	RULA does not apply to the entire body. RULA is helpful only on extreme postures, if they are of short duration, In other cases such as jobs involving forces, repetition and longer duration RULA may underestimate the risk.

2	Rapid Entire Body Assessment (REBA)	REBA provides quick measure to assess a variety of working postures for risk of musculoskeletal disorder which divides the body into different parts. Unlike RULA this assessment technique can be applied to whole body.	REBA should be applied with the help of professionals or practitioners only. Analyst will decide which part to consider so it can be biased sometimes.
3	Occupational Repetitive Actions (OCRA)	OCRA gives different factors such as duration of daily work of repetitive tasks, recovery time etc. Workers are involved in this technique.	Time study is also required which is costly and time consuming as well. Assessment can be biased.
4	Washington Industrial Safety and Health Act (WISHA)	It gives the solution in two categories, Hazard and Caution so one can directly focus on exact problems.	It gives the solution based on duration only so the postures are not considered in this tool.
5	Quick Exposure Check (QEC)	QEC includes the assessment of back, wrist, neck, shoulder with respect to repetitions, and it is based on workers perception. Each exposures or risk factors are calculated by score table and the final score is calculated from the combination of two high level exposures to two low level exposures respectively.	The final scores are hypothetical because workers are involved. The result may be biased or non-technical. This system is not sufficient to define the risk factors, this only provides basis for the effects of changes before and after an intervention.
6	SNOOK Tables	It can be applied only in push/pull criteria so it removes carrying from the picture which automatically reduces strain on the body.	Less precise method because it considers only psychophysical measures not the biomechanics. It only provides guidance, it does not give the exact solution it gives the proportion.
7,8	RULA,REBA,QEC,OCRA	It helps the practitioners to assess a task in great complexity and to get the result by comparing them	If there are several tasks then there will be an issue correlating the RULA and REBA technique, the practitioner has to decide any one of them.

5. CONCLUSION

From the methods used in case studies and the strengths and limitations suggest that each and every assessment techniques are helpful in any intervention but only one assessment tool does not give the desired solution, the combination of different techniques should be used to get the optimum result. This paper provides the basic information on different assessment techniques and the strengths and limitations of them respectively. From the literature studies combination of QEC, REBA, OCRA should be preferred when the task is divided into many small tasks. Combination of RULA and REBA always gives different solution because both assessment techniques differ from each other. Therefore this paper helps the practitioners to select the best suited technique/techniques according to the task at hand. Future scope should be more on combining different techniques to get the optimum result by correlating them with each other.

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