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ORIGINAL ARTICLE

Review on Current Issues related to Work Related Musculoskeletal Disorders

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Abstract: *Work-related musculoskeletal disorders (WMSDs) are one of the most common occupational ailments in recent decades, significantly limiting people's daily lives. Globally, WMSDs are the major cause of employee pain, impairment, absenteeism, reduced productivity, and large financial costs. WRMSDs are illnesses that develop over time because of long-term occupational exposure to varying-intensity loads. WRMSDs are produced by discomfort or injury to the muscles and bones of the upper limbs because of activity. Low-extremity illnesses, like upper-limb diseases, may be just as dangerous, There is a high prevalence of neck and upper extremity problems among computer users. Upper extremities diseases were more common in older personnel. The physiological outcome of prolonged, repetitive, or repeating muscle contractions with insufficient recovery is localised muscular fatigue (WMSDs). Muscle tiredness has a substantial impact on occupational task performance, hence preventing it is crucial. The key challenge in ergonomics is to create work that avoids WMSDs while retaining high levels of output quality and productivity. Uncomfortable postures are commonly recognised as a major contributor of MSD among construction workers. Because of their linearity, ergonomic metrics can be incorporated into assembly line design models. They can also be utilised to take use of efficient solution methods established for optimal line design which are beneficial in the assembly line industry. Real-time risk assessment for work-related musculoskeletal disorders (MSDs) has proven to be challenging to research. Working at a fast speed and performing repetitive activities, as well as maintaining non-neutral body postures, are all physical risk factors for WMSDs. This review discuses common issue related to WMSDs which includes upper extremity, upper limbs, carpal tunnel syndrome, awkward postures, muscle activity, muscle fatigue, assembly line and risk assessment. The aim is to provide an overview of the problems related to the subject matter.*

Keywords: Work Related musculoskeletal disorders, upper extremity, upper limbs, carpal tunnel syndrome, awkward postures, muscle activity, muscle fatigue, assembly line and risk assessment

1.0 INTRODUCTION

Work-related musculoskeletal diseases, also known as WMSDs, have become one of the most common occupational illnesses in the last few decades. These disorders considerably restrict the daily lives of their sufferers. [1] Musculoskeletal diseases, often known as MSDs, are injuries or abnormalities that occur in the muscles, nerves, tendons, joints, cartilage, and spinal discs as a result of working in a certain environment. The majority of patients report localised pain, numbness, and physical restrictions as their primary symptoms. The parts of the neck, shoulders, and lower back that

are most at risk are exposed. [2] Employment-related musculoskeletal ailments have been connected to occupational risk factors such as job position, posture, physical force, vibration, and mobility, in addition to psychological stressors and individual obstacles. One of the features that it has is its level of intensity. It is one of the most prevalent musculoskeletal ailments among hospital health care workers and nurses, and the frequency with which it occurs and the length of time it lasts can be used to estimate the amount of physical labour that is performed by these individuals. [3] WMSDs are the leading source of employee pain, disability, absenteeism, decreased productivity, and significant financial consequences. This is the case all across the world. WRMSDs can not cause death, but if they are not treated, they can progress to serious issues with the musculoskeletal system. WRMSDs are illnesses that develop over time as a result of long-term occupational exposure to loads of varied intensities. These illnesses are known as "work-related multiple symptom disorders." [4] Musculoskeletal disorders (MSDs) are a major problem in the construction business. Roofers have the fourth highest MSD rate of any employment in the construction industry. It is generally agreed upon that awkward postures are a major contributor to the development of multiple sclerosis among construction workers, despite the fact that there are a number of factors that increase the chance of developing MSD. [5] It is now generally accepted that a multidisciplinary approach is required in order to study work-related musculoskeletal issues and provide guidelines to help reduce the incidence of these diseases. Developing effective preventative techniques, on the other hand, continues to be a task that presents a significant amount of difficulty. [6]

The upper extremities of the human body are far more sensitive to WMSDs than the lower extremities are. This is the case when compared to other sections of the body. Computer users have a significantly higher risk of developing disorders in their necks and upper extremities. [7] There are a number of factors that can increase the risk of developing musculoskeletal problems. Some of these factors include actions that are repetitive and stereotypical, postures that are stationary, static loads, insufficient recovery time, muscular fatigue, and psychological stress. The study found that older workers were more likely to develop upper extremity diseases if the professions they held involved both force exertion and uncomfortable forearm positions [8]. [9] According to the Occupational Safety and Health Administration (OSHA), each year, up to 2 percent of the American workforce is affected

by a work-related musculoskeletal disorder (WRMSD). This contributes to more than one-third of all worker compensation costs for medical care and lost earnings (OSHA). The most common form of musculoskeletal disease is known as work-related musculoskeletal disorders or WRMSDs for short. When compared to the general population, the incidence of work-related upper-extremity musculoskeletal disorders (WRMSDs) is higher among those employed in office work, industry, agriculture, and a variety of vocations involving the manual handling of items. Workplace ergonomics projects that aim to reduce WRMSDs typically include reengineering of work stations and items as one of their components. Education and training to educate workers on good work habits such as muscle control and work station modification, in addition to administrative controls such as job rotation and adjustments in work rest intervals, are more complete strategies to address the problem. This research was conducted with the purpose of determining whether or not two employee education and training programmes that were thoughtfully created could assist healthy workers in avoiding upper extremity WRMSD symptoms and muscular tension. The investigation concluded that both of the programmes should be continued because of their positive effects. If you have more control over physically demanding or physically demanding work circumstances, either directly or indirectly, you may find that your muscle tension and symptoms improve. [10]

2.0 UPPER LIMBS

It is possible to generate force in a number of different ways with the hands, depending on where the force is generated. This includes the fingers, wrists, arms, and even the entire body. As a direct result of this, the manner in which one uses one's hands has a significant impact on the level of health that they possess. It is not uncommon for people to experience pain or injury in the muscles and bones of their upper limbs as a result of their participation in physical activities. Musculoskeletal problems, in particular, are brought on by suboptimal postures, excessive exercise, and repeated tasks. Low-extremity disorders, just like upper-limb disorders, are just as harmful; yet, there is little evidence to back up disorder as a symptom, linked risk factors, or wide data which has been recognised as well-defined lower-WMSD risk factors. Long ago, researchers discovered a correlation between WMSD and one's working environment, namely the physical risk factors that are associated

with one's employment. [3] Musculoskeletal issues, particularly in the upper limbs, may become increasingly prevalent as a result of the increased demand for meatpackers and their limited ability to manage the nature of their work. WRMSDs in the shoulder, wrist, and hand are more likely to occur when killing animals because the task requires repeated and forceful activities with the upper limbs. The WRMSDs were implanted in areas of the body that corresponded to frequent slaughtering postures and risk factors. These areas were chosen specifically for this study. The following is a list of biomechanical risk factors that are associated with employees working in slaughterhouses, which increase the likelihood of them acquiring upper limb musculoskeletal diseases (UL-WMSDs): There are a number of factors to take into consideration, including repetitiveness, high-frequency technical motions, excessive force, awkward postures, insufficient time for recuperation, the use of tools, and exposure to cold. It has been shown that reducing the speed of production, distributing rest breaks evenly throughout the workday, rotating workers through different jobs with varying biomechanical requirements, and increasing the total number of workers are all effective ways to reduce the risk of UL-WMSDs in the workplace. Take into consideration the following examples: reducing the amount of labour needed to accomplish cutting tasks by utilising blades that are extremely sharp and dressing appropriately for the temperature of the working environment [14].

3.0 CARPAL TUNNEL SYNDROME

Carpal tunnel syndrome, often known as CTS, is a common ailment that affects the wrist and can cause pain as well as restricted movement. Frontline workers and computer users are particularly at risk for developing CTS. [11] Assembly line employees sometimes experience issues inside their upper extremities, lower extremities, and even their backs as a result of WMSD. There are a variety of problems, some of which include carpal tunnel syndrome, vibration-induced white finger, and low back pain. [7] Musculoskeletal injuries can be broken down into two categories: those that result from cumulative trauma disorders (CTD) and those that are caused by the improper handling of manual objects (MMH). It refers to a group of conditions that can cause discomfort, dysfunction, or persistent pain in the muscles, joints, tendons, and other soft tissues, with or without obvious exterior symptoms such as a stretched or pulled ligament. CTD is a sort of physical injury that develops over time as a

result of repetitive stressful behaviours or postures. CTD can be caused by sitting in awkward positions for long periods of time. Another name for CTD is cumulative trauma disorder (often referred to as CTD). The wrist, the neck, the hand, and the shoulder are common locations where symptoms of carpal tunnel syndrome and neck tension syndrome manifest themselves. CMSDs have the potential to impact a huge number of individuals, including children, and can be brought on by a range of threats or environmental factors. They devote almost one-third of their waking hours to their studies, and in order to graduate from some colleges, students are required to spend and over five hours per day at the institution. [15] Typing on a computer keyboard, which requires the thumb to move up and down on the keyboard, can lead to DeQuerv syndrome, a condition that produces intense pain inside the radial styloid process, as well as in the forearm and thumb. Pain along the back of the wrist and on one side, referred to as the "thumb side," is caused by tissue inflammation and swelling in the tendons that control thumb mobility. These tendons are located in the extensor pollicis brevis and abductor pollicis longus. On the other hand, discomfort could be caused by inflammation of the tendon sheaths, which are the coverings that surround the tendons. Alterations in ischemic neurophysiology may take place if an inflamed muscle or other soft tissue presses against nerves in the surrounding area. In extreme cases, patients may also experience problems with their ability to coordinate their movements as well as weakness and pain in their hands and wrists. Symptoms include a rapid increase in sensitivity, numbness, and tingling, followed by a gradual weakening. The proliferation of input devices other than keyboards, such as the computer mouse, has led to the development of novel postures. This is because using these devices can result in difficulties affecting both the wrists and the shoulders. Carpal tunnel syndrome has been linked to activities performed for extended periods of time in the workplace that demand the wrists to be flexed and extended in a variety of directions. Injections of corticosteroids or cortisone-like drugs into the inflamed area are one of the non-surgical therapy alternatives that are accessible. Acupuncture and massage are two more non-surgical treatment choices. Surgery is the only treatment option for carpal tunnel syndrome, which can only be alleviated through surgical intervention. It is possible that a therapy called carpal tunnel release will be necessary in order to alleviate inflammation in the carpal tunnel and prevent long-term nerve damage. [16]

4.0 AWKWARD POSTURE

Musculoskeletal disorders (MSD) are a significant issue in the building and construction industry. Roofers have the fourth highest incidence of MSD of any employment in the building and construction industry. Uncomfortable postures are commonly regarded as a major element in the development of musculoskeletal illnesses (MSD) among construction workers. This is the case despite the fact that there are a number of factors that contribute to the development of MSD. [5] It is possible to generate force in a number of different ways with the hands, depending on where the force is generated. This might be in the fingers, the wrists, the arms, or even the entire body. Incorrect posture, excessive physical effort, and jobs that require repeated motion can all contribute to the development of musculoskeletal problems in a variety of fields and locations around the world. Occupation-related musculoskeletal disorders are extremely common in the construction industry. [11] As a consequence of this, the industry of steel manufacture is susceptible to a wide variety of physical and organisational risks, many of which are particularly harmful to workers who are doing front-line duties (e.g., manual materials handling [MMH], repetitive motions, high energy expenditure, and uncomfortable postures). When moving raw materials to the cooking area, it is important to keep in mind a number of ergonomic considerations, including the manual loading of cooking devices (such as trays, grill skewers, and so on), as well as awkward postures used by workers during the loading and unloading processes. It is possible to trace the success of the restaurant section back to the high expectations that were placed on the staff, in particular with regard to the distribution and preparation of food. The fact that this company needs to provide a big number of its workers with food that meets certain criteria and needs to be delivered on schedule increases the possibility that these dangers may materialise. One example of an ergonomic solution is equipping a car with container racks so that the driver does not have to adopt awkward postures such as hunching forward or twisting their body. This could also help alleviate other potential issues, such as forced overexertion and a high level of energy expenditure. Other adjustments, such as replacing tray washing machines in kitchens with manual cleaning, may also help to lessen the chance of harm, such as cutting one's finger. [1] There are a variety of factors that have been linked to low-back pain, some of which include lifting while in an awkward position, lifting frequently, and engaging in manual labour. In the past,

low back discomfort has been associated with excessive bending, side twisting, and flexing of the spine to extreme angles. The loading of the muscles and the compressive forces that operate on the intervertebral discs in the lumbar region are both affected by posture, as well as the positioning and weight of a load. [7]

5.0 ASSEMBLY LINE

An assembly line consists of a sequence of workstations, each of which performs a certain task repeatedly with the purpose of increasing the line's productivity and other metrics of efficiency. Because of the repetitive nature of their work, assembly line workers are at a higher risk of developing WMSD illnesses in their upper extremities, backs, and even lower limbs. These disorders include vibration-induced white finger, carpal tunnel syndrome, and low-back discomfort. [7] Musculoskeletal diseases, more often known as MSDs, are prevalent occupational illnesses that affect assembly workers due to the repeated motions and heavy workloads they are required to complete. The strategies that have traditionally been used to reduce the number of WMSDs that occur among assembly workers have focused on the individual assembly processes that take place at the station level. Increasing employee productivity in the workplace can be accomplished through a variety of tactics, some of which include task extension, job rotation, and the establishment of teams. According to the findings of one study, workers in new employment may not learn how to protect themselves from the potential hazards of their jobs quickly enough. Altering one's responsibilities might also lead to longer preparation times on the assembly line, which would ultimately result in lower production yields. When designing an assembly line, one of the most significant elements to take into consideration in terms of both productivity and ergonomics is the method through which assembly duties are distributed across the workstations. The distribution of tasks across the line's various workstations is what determines the line's various parameters, such as the length of each cycle, the amount of time spent waiting between cycles, and the number of fundamental indivisible work pieces that are required to put together finished products. When designing and planning an assembly line, job assignments and ergonomic assessments of the tasks that will be performed on the line are rarely performed at the same time. The possibility of workers contracting occupational diseases is factored

into the design of only a few assembly line types. As an example, heuristic algorithms make use of a physical demand need as a component of the optimization process in order to achieve optimal results. These algorithms are used to balance assembly lines. Another approach is to use goal programming to find a solution to a model that takes into account elements such as the amount of physical labour, the amount of processing time, and a variety of additional risks. Because of this linear relationship, ergonomic metrics may be included into traditional assembly line design models using mixed-integer programming methodologies (MIP). Due to the linear nature of these calculations, they may be put to use right away in order to incorporate ergonomic work characteristics for the upper body extremities into the design of assembly lines. They can also be used to make use of efficient solution methods that have been devised for optimal line design as well as commercial generic Mix Integer Programming (MIP) solvers, both of which are advantageous in the assembly line design sector of the industry. It is now possible to use a wide variety of ergonomic measurements in table-list format and include them into the general assembly line design challenges thanks to these linearization approaches. Due to the lack of effective methods for addressing ergonomics concurrently throughout the process of assembly line design, many trial-and-error task changes are conducted after the first job assignment has been completed. This is because the first job assignment has been completed. The ergonomic elements of line design were the subject of investigation in a number of earlier studies; however, those studies used non-linear ergonomic assessments rather than linear ones. Because of the non-linearity, it could be difficult to employ formulations that are more effective if they are linear while designing assembly lines. [18]

6.0 MUSCLE ACTIVITY

WRMSDs are believed to increase in conjunction with work stress or job strain, and it is possible that greater muscle is partially responsible for mediating their effects. Muscle fatigue is more likely to occur in tasks in which the same motor units are utilised repeatedly and there is little variation in the working environment. This increases the risk of developing muscle fatigue. It is much more likely for muscles to grow when they are stimulated often or for extended periods of time. There is a correlation between the overall length of static muscular tension and the number of periods during which muscle

tension falls below 1 percent of maximal voluntary contraction. Musculoskeletal problems can also be determined by the number of periods during which muscle tension falls below 1 percent of maximal voluntary contraction. [10]. During a colonoscopy, high-risk exposures may have occurred due to the force with which the thumb pinches as well as the length of time spent in a forceful pinch. The extensor muscle on the left wrist was hyperactive, with the insertion being the most detrimental aspect of the activity produced by the muscle. The American Conference of Governmental Industrial Hygienists carried out a study in which they contrasted the threshold limit value (TLV) for hand activity with the TLV for forearm muscle activity (ACGIH). In order to estimate the likelihood of musculoskeletal injuries occurring during a work shift, the ACGIH developed a model that takes into account both the hand activity level (HAL) and the peak hand force. On the HAL (0-10) scale, which was designed by the American College of Geriatrics and Internal Medicine, hand repetition and recovery time are both taken into consideration. A score of 0 indicates the least amount of hand activity, while a score of 10 indicates the most amount of hand activity. [19] Shoulder flexion and wrist extension, in addition to ulnar deviation angles, were linked to measurements of the ECRB, whereas shoulder abduction and wrist extension, in addition to ulnar deviation angles, were linked to measurements of the static and dynamic trapezius. It has been established that there is a connection between the dimensions and posture measurements that are taken and the degrees of muscle activation that are measured statically as well as dynamically. [20] The magnitude of the burden, the degree to which the activity is repeated, the amount of time spent working, insufficient breaks, and an immobile posture are the primary contributors to the risk. In addition, studies have shown that repetitive or monotonous patterns of muscular activity are associated with an increased risk of developing difficulties in the lower back and upper extremities during labour. [21] When used in conjunction with a postural analysis tool, the REBA is sensitive to the type of unplanned working positions that are widespread in the health-care and service industries. These postures can cause back pain and other health problems. A categorization system for posture was devised by making use of the RULA body part diagrams. This system classified the upper and lower arms, wrists, trunk and neck, legs, and feet. The method took into consideration the amplitude of external loads and forces, as

well as the muscular activity caused by static, dynamic, rapidly changing, or unstable postures, and the coupling effect between the two variables that were under investigation. [22]

7.0 MUSCLE FATIGUE

A holistic approach to the problem, which is now generally acknowledged, is required in order to understand WMSDs and provide ways for their decrease. On the other hand, the development of appropriate preventive methods is continuing to be a challenging issue. Because muscle fatigue has such a significant influence on the performance of occupational tasks, avoiding it whenever possible is of the utmost importance. Because of this, the primary obstacle faced by ergonomics is the problem of developing jobs in such a way that they prevent work-related muscle and joint disorders (WMSDs) while also maintaining high levels of output quality and productivity. [6] One of the most common sites of occupational exhaustion is seen in the longus and brevis heads of the extensor carpi radialis muscle group. The investigation of localised muscle fatigue as a means of gaining a deeper comprehension of the processes behind WRMDs is an essential contribution made by medicine. Localized muscular exhaustion, which is the physiological outcome of repeated, repeating, and recurring muscle contractions with insufficient recovery, could be a significant risk factor for work-related muscular diseases. This is because localised muscular exhaustion is the physiological result of repeated, repeating, and recurring muscle contractions (WRMDs). An increase in the perceived amount of effort required to exert a desired force, followed by an inability to produce that force, is the definition of muscle tiredness. Reduced-force contractions impair oxidative metabolism, which leads to muscle exhaustion, which can be a precursor to muscle disease. Muscle disease can occur as a result of muscle weariness. Researchers believe that signals derived from near-infrared spectroscopy (NIRS) could be utilised to determine how efficiently a person's muscles are functioning when they are engaging in physical activity. Oxygenation of the muscles during action on the upper extremities may shed light on the pathophysiological processes that underlie fatigue and exhaustion of the muscles caused by labour. There have been a few different attempts made to define the indications of muscular fatigue. Localized muscle weariness is characterised by a decrease in work output, such as a slowdown of production pace, as well as a loss in job precision. Additionally, localised muscle

weariness is associated with an increase in the risk of injury. Alterations in muscle biochemistry can also be used to make an indirect but reliable assessment of muscle tiredness. [Clarification needed] [Clarification needed] This is accomplished by monitoring the metabolic changes that take place in the muscle tissue. Ischemia, for example, reduces the amount of oxygen that is available, which in turn slows down the clearance of metabolites and causes tiredness in the muscles. This is one of the causes of muscular fatigue. As a result of muscle tissue using more oxygen from the circulation, the amount of oxygen that is present in the blood decreases, which is something that NIRS can detect. [21] The standard amplitude analysis was used to determine the amount of sEMG activity that occurred during repeated lifting, and the results were measured (ASA). For the purpose of making comparisons across a wide range of lifting weights and lifting postures, the mean SAA was used to represent the average value throughout repeated lifting. During repeated lifting actions, increased RMS sEMG amplitude can be regarded as an indication of localised muscle tiredness. The rate of muscle depletion was calculated by taking an average of the RMS sEMG activity that was collected during the duration of the endurance test. [22]

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