Chapter 6
Ergonomic Assessment of Material Handling in CV Joint Assembly

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ABSTRACT

Work-Related Musculoskeletal Disorders (WRMSD) is one of the most common problems that affect productivity in industrial processes. This chapter presents the ergonomic evaluation of the main tasks in a Constant Velocity (CV) Joint assembly process. Tasks selected and evaluated using ergonomic methods were the transport of manufacturing parts on carts, parts supply at the workstation, materials handling within the workstation, and loading of the finished product on pallets. The ergonomic evaluation was performed by applying both Rapid Entire Body Assessment (REBA) method, and Rodgers' Biomechanical analysis. The analysis showed the existence of very high and high risk levels. Body regions most affected were elbow, shoulder, trunk, hip, legs, arm, and wrist. Ultimately, this research highlights the urgent need to perform corrective actions and further assessment for the CV Joint assembly process tasks studied.

1. INTRODUCTION

High frequency of Work-Related Musculoskeletal Disorders (WRMSD) has been reported for assembly tasks performed in the production of automobile parts. Low and high back, neck, right ankle, and right wrist (in that particular order), were the most common sites of trouble in workers within this kind of process, as reported by Serratos, Hernandez, and Negrete (2014). The work herein presented refers to the ergonomic evaluation of Constant Velocity (CV) Joint assembly process. This entails putting together

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semi axes, bells, tulips, and other components. A report by Hernandez-Arellano, Brunette, Ibarra-Mejia, and Balderrama (2014), shows that the average cycle time to assemble a CV Joint is 30 seconds (±10 s). The semi axis is the first piece to be manipulated by the worker. It weighs typically a minimum of 3 kg. By the end of the assembly process, the CV Joint weighs up to 14 kg. The facility where the study was performed produces over 50 different models of CV Joints. The operations performed by workers are manual loading-unloading of pieces (to/from the machines), and inspection of parts. Occasionally, the workers operate the control panel of the Hydraulic Presses.

The main objective of this study is to perform the ergonomic risk assessment of manual materials handling activities involved in the assembly of Constant Velocity (CV) Joints at a manufacturing company located in Central Mexico.

2. BACKGROUND

2.1 Work-Related Musculoskeletal Disorders

Manual materials handling is a key factor in distribution processes within a production facility (Buckle & Devereux, 2002; Aptel, Aublet-Cuvelier, & Cnockaret, 2002; Heran-Le Roy, Niedhammer, Sandret, & Leclerc, 1999). It is well known that manual materials handling is a hazardous activity, particularly for the low back (Troupetal,1988; Kumar,1994 cited by (St-Vicent, Denid, Imbeau, & Laberge, 2005). Despite the existence of a wide variety of automated systems that assist in the performance of materials transportation, manual handling still represents nowadays the best option when supplying required components to a continuous-flow production line.

Appearance of musculoskeletal complaints -which may start as a minor hindrance and later develop into severe chronic damage-, has long been cited in ergonomics literature as a frequent work-related occurrence. This has brought about the term Work-related Musculoskeletal Disorders (WRMSD). Recently a tendency to review the soundness of such proposed relationship has appeared, and a number of papers where this issue is tackled have been published. A conclusion is common to the majority of these documents: although there still remains to ascertain beyond doubt the validity of the link between work circumstances and musculoskeletal damage, the evidence firmly suggests the existence of certain factors that seem to play a role in either giving rise to the unwanted outcome, or in worsening a pre-existing, non-work related pathological condition. Thus, Punnett and Wegman (2004) mention a series of work-related factors repeatedly identified as influential on the apparent WRMSD development. These include "rapid work pace and repetitive motion, forceful exertions, non-neutral body postures, and vibration."

WRMSD describe a wide range of inflammatory and degenerative diseases and disorders and present a major challenge to workers and their employers in virtually every industry sector (Silverstein & Clark, 2004). These conditions result in pain and functional impairment and may affect the neck, shoulders, elbows, forearms, wrists and hands (Buckle & Devereux, 2002). WRMSD of the upper limb (WRMSDs-UL) account for over two-thirds of all occupational disorders recognized in countries as France. This broad term encompasses a vast array of disorders whose development is facilitated by environmental factors present at the workplace. Numerous epidemiological studies have established the key role of occupational activities in the genesis of WRMSDs- UL (Aptel, Aublet-Cuvelier, & Cnockaret, 2002). The high incidence of WRMSDs-UL indicates a need for greater emphasis on prevention through engineering