UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ERGONOMICS ASSESSMENT OF GRINDING TASK

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Management)

by

SARIPUDDING BIN SALING

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I hereby declare that this report entitled **"Ergonomics Assessment of Grinding Task"** is the result of my own research except as cited in the references.

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management) with Honours. The members of the supervisory committee are as follow:

……..…....…

Supervisor

ABSTRACT

Grinder is a hand tool that always use in manufacturing field. The function of this hand tool is in finishing process and for cutting. When using this tool in long time period, it can give bad side effect to worker health cause of vibration and working posture. So, this study is conduct to make analysis of a grinding task based on ergonomics knowledge. The objective of this study are to conduct a postural analysis of grinding task, to evaluate the level of vibration in grinding task and to propose ergonomic interventions in reducing problems related to the grinding task The study focuses done at FKP workshop by using grinder brand BOSCH GWS 7-100. The subject used for experiment in this study is healthy student FKP. The analysis will do by using RULA and HAVPro tools. The result from this study will help worker to avoid the health problem occur to them by following recommendation given.

ABSTRAK

Pencanai ialah satu alat tangan yang selalu digunakan dalam bidang pembuatan. Fungsi alat tangan ini adalah untuk proses penghalusan dan untuk memotong. Bila menggunakan alat ini dalam tempoh masa yang panjang, ia boleh memberi kesan sampingan kepada kesihatan pekerja yang berpunca daripada getaran dan postur bekerja. Oleh itu, kajian ini dijalankan untuk membuat analisis mengenai kerja mencanai berdasarkan pada pengetahuan dalam ergonomik. Objektif kajian ini adalah untuk melakukan analisis postural kerja mencanai, menilai tahap getaran di kerja mencanai dan mencadangkan penyelesaian ergonomik dalam mengurangkan masalah yang berkaitan dengan kerja mencanai. Tumpuan kajian dilakukan di bengkel FKP dengan menggunakan pencanai berjenama BOSCH GWS 7-100. Peserta digunakan untuk eksperimen dalam kajian ini ialah pelajar FKP yang sihat. Analisis akan dilakukan dengan menggunakan RULA dan alat HAVpro. Keputusan daripada kajian ini akan menolong pekerja untuk mengelak dari masalah kesihatan berlaku pada mereka dengan mengikut cadangan yang diberi.

DEDICATION

For my beloved parents:

For my supportive siblings

&

My treasured friends

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LIST OF ABBREVIATIONS

FKP	-	Fakulti Kejuruteraan Pembuatan
HAVS	-	Hand Arm Vibration Syndrome
MSDs	-	Musculoskeletal Disorders
PSM	-	Projek Sarjana Muda
REBA	-	Rapid Entire Body Assessment
RMS	-	Root Mean Square
RSI	-	Repetitive Strain Injuries
RULA	-	Rapid Upper Limb Assessment
UTeM	-	University Technical Malaysia Melaka

CHAPTER 1
INTRODUCTION

This chapter explains the background of the case study, objective, scope, problem statement and the potential benefit of this study. The basic fundamental of grinding task, vibration and working posture will be discussed in background of study. Problem statement will discover why this research carried out. The objective and potential benefit of this research will be highlighted at the end of this chapter.

1.1 Background of study

Now a day, workers always exposed to safety and health problems. They can have injured by environment, machine and tools their use anytime and everywhere. So that, all organization or company concern about worker safety and health. The healthiness of worker gives effect for their productivity and performance and at the same time it will effect also company production. Until now, many experiment and case study conduct to make analysis about worker health and safety in working environment. Furthermore, workers now are protected by laws and labor society.

In manufacturing field, many workers not realized they get side effect from their daily task. It can happen especially for repeated task. In repeating task, worker must do same job many times in same position for long time. Sometimes, the side effect does not appear immediately but it takes times to show the effect. They can get injured because by their working posture or by tools they used. The bad thing is they are not aware of the dangers that occur to them.

There are many methods used to ensure the workers safety and health guaranteed. One popular way is to use ergonomic analysis. Ergonomics is a word that means the science of work and a person's relationship to that work. In engineering term, ergonomics is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well being and overall system performance. Ergonomists contribute to the design and evaluation of tasks, jobs, products, environments and systems in order to make them compatible with the needs, abilities and limitations of people.

Grinding process is example tasks that possible give bad side effect to worker. Normally, grinders used with abrasive cutting tools to bring a workpiece to an accurate size and produce a good high surface finish. In grinding process, the surface work is brought into contact with the revolving grinding wheel. The grinding machine consists of a power driven grinding wheel spinning at the required speed. This revolving wheel is produced by motor and its produce vibration. By get certain frequencies and levels of vibration can permanently damage internal body organ and white fingers syndrome.

Besides vibration, technique during doing task also possible give affect to worker healthy. Bad posture can cause musculoskeletal pain and even disability. Musculoskeletal pain is pain that affects the muscles, ligaments and tendons, along with the bones. Symptoms that might be felt include back and neck pains, headache, fatigue and, potentially, even breathing issues. In extreme cases bad posture can even lead to internal organ damage by restricting the blood supply to these areas.

1.2 Problem Statement

Hand grinder tools used for cutting and finishing process. This tools work using rotation wheel that produce by motor. The mechanism of hang grinder tools produce vibration that can affect worker health. Besides that, sometimes grinder process takes time to finish and worker exposed to health problem caused by bad working posture.

There are no any guide or reference that worker can use to avoid this problem. Furthermore, some of the side effects from grinding task not appear immediately. So, worker not realized that they have health problem. Maybe, it's late to overcome the health problem when is appear.

1.3 Objective of Study

The objectives of this study are:

(a) To evaluate the level of vibration in a simulated grinding task;
(b) To conduct a postural analysis in a simulated grinding task;
(c) To recommend a proper way for grinding task to reduce risk.

1.4 Scope of Study

This study about the effect on human by hand tools grinder during grinding task. The research only focus on working posture during grinding task and the level of vibration produce by the grinding task. There are many type of grinder but for this study grinder brand BOSCH GWS 7-100 will be used. The subject of experiment is FKP student and the testing place at FKP workshop.

1.5 Potentials Benefits

Some of the adverse effects caused by the grinding work not appear immediately. Workers do not realize they are exposed to danger and they also not know the level of the danger. The result from this study can be used by worker as a reference to avoid from exposed to the problem. They will work by following the suggestion from the result.

1.6 Outline of Report

Generally, PSM 1 report is divided into three chapters. The first chapter is the introduction of the report. It discusses about the background of study, problem statement, scope, objective and case study potential benefit.

Chapter two is the literature review which will do based on journal, books, internet resources and previous studies done on the related topic. This chapter will discuss about overview of grinding task, grinding task effect on human and methods and tools used in evaluating hand tool ergonomics. The discussion is based on information gathered.

The last chapter is methodology to conduct the case study will be explained. All relevant data collection method analysis will be outlined.

CHAPTER 2
LITERATURE REVIEW

This chapter contains the literature review of the study which related to scope of the study. It covers the important elements in this case study such as definition and work study that can be use in this study. The sources of information are obtained from articles, journal, case study, report and also electronics resources. At the end of this chapter, the entire element will be narrowed down to the scope of study.

2.1 Introduction

Integration of human aspects into the technological planning processes in a company is a major strategy for the prevention of work-related injuries and illnesses among employees in manufacturing facilities (Ole Broberg, 1997). The method that used to relate human and work related injuries is by ergonomics. Ergonomics is the theoretical and fundamental understanding of human behavior and performance in purposeful interacting socio technical systems, and the application of that understanding to design of interactions in the context of real settings (John R. Wilson, 2000).Ergonomics includes information from engineering, biomechanics, environmental psychology, physiology and other fields about how human beings are affected by their environment, especially in the workplace. The main focus of ergonomic is to improve safety, productivity, and quality of life.

The term ergonomics is derived from the Greek word ergos meaning "work" and nomos meaning "natural laws of" or "study of". According to Jeffrey E. Fernandez (1995), ergonomics is defined as the design of the workplace, equipment, machine, tool, product, environment, and system, taking into consideration the human's

physical, physiological, biomechanical, and psychological capabilities, and optimizing the effectiveness and productivity of work systems while assuring the safety, health, and wellbeing of the workers. In general, the aim in ergonomics is to fit the task to the individual, not the individual to the task.

In ergonomics, there are two categories which are referred to as industrial ergonomics and human factor. Industrial ergonomics focus on physical aspects of work and human capabilities such as force, posture and repetition work. Human factor is focus to the psychological aspects of work such as mental loading and decision making.
Based on the definition, an ergonomist evaluates the demands of a specific task with reference to the capacity of workers to perform the task over a certain time period.The necessity of understanding physiological causes of occupational injuries is growing now that more safety issues and ergonomics intervention programs are imposed by work regulations (Issachar Gilad, 1994). So that, Ergonomic study and research doing for:

(a) Select tools for ergonomic reasons as well as vibration and other factors
(b) Create guidelines for correct tool selection and use on each type of operation
(c) Ensure operators are properly trained and understand the reasons for correct use

2.2 Overview of Grinding Task

Grinding task is a one of process in finishing process. This task is for removing excess material from the part. Besides that, grinding task also can used in cutting material. Hand grinding tools is one of the popular tools always used. When operate, this tools will generate vibration because using rotation wheel that produce by motor. Since sometimes grinding task take long time to operate, this vibration will affect the operator health. As the sequence, operator also exposed to health problem caused by their working posture.

Figure 2.1: Example of grinding task

Sources: http://images.toolstop.co.uk/product/BOS-GWS18v-li-1.jpg

2.3 Grinding Task Effect on Human

Physical exposure has three main dimensions to human body by amplitude (load level), repetition and duration. Human can get health problem cause by two conditions which are vibration and awkward posture.

(a) Vibration

Vibration is the mechanical oscillations of an object about an equilibrium point. The oscillations may be regular such as the motion of a pendulum or random. The study of health effects of vibration require measures of the overall "pressure waves" that are generated by vibrating equipment or structure. Vibration can be transmitted to the human body by vibrating surfaces of vehicles, machines, structures in contact with the human body.

Vibration induced effects on human bodies are related to the preservation of working efficiency, the preservation of health or safety and the preservation of comfort. High levels of vibrations or long duration of exposure have negative effects on human health and can cause diseases, from skeleton damage, to alteration of visual acuity, to manual control handicaps (G.L. Rossi et al, 1995).

When a worker operates hand tool such as a grinder or jackhammer, vibration affects hands and arms. Clinical and epidemiological studies have shown that operators of hand held power tools are prone to develop various vibration induced disorders of the hand and arm, which are collectively referred as hand arm vibration syndrome(HAVS) (S.Rakheja et al, 2010) The level of hand arm vibration is determined by measuring the acceleration of the tools or object grasped by worker.

Table 2.1: Hand tools vibration level

Sources: www.hse.gov.uk/pubns/misc112.pdf

Tool type	Typical vibration magnitude (ms^{-2})	Time limit before action recommended
Chipping hammer	10-40	2-40 minutes
Sand rammers	25-40	2-6 minutes
Hand tool grinder	2-35	3-16 hours
Disc cutter	4-10	40 minutes-4 hours
Disc sanders	10-15	16-40 minutes
Rock drills	15-35	3-16 minutes

(b) Awkward posture

Awkward postures refer to positions of the body (limbs, joints, back) that contrast from the neutral position while job tasks are being performed. Awkward postures occur when joints are not in neutral positions. Awkward postures often are contributors to musculoskeletal disorders (MSDs) because they increase the work and the muscle force that is required. When working in awkward postures, it will increase the amount of force need to accomplish the task.

Awkward postures create conditions where the transfer of power from the muscles to the skeletal system is inefficient. If use neutral body position, the amount of used for doing work is less and work with maximum efficiency. Operators must apply more force both to initiate and complete the motion or exertion to overcome muscle inefficiency. In general, the more extreme the postures (the greater the postures deviate from neutral positions), the more inefficiently the muscles operate and, in

turn, the more force is needed to complete the task. Thus, awkward postures make forceful exertions even more forceful, from the standpoint of the muscle, and increase the amount of recovery time that is needed.

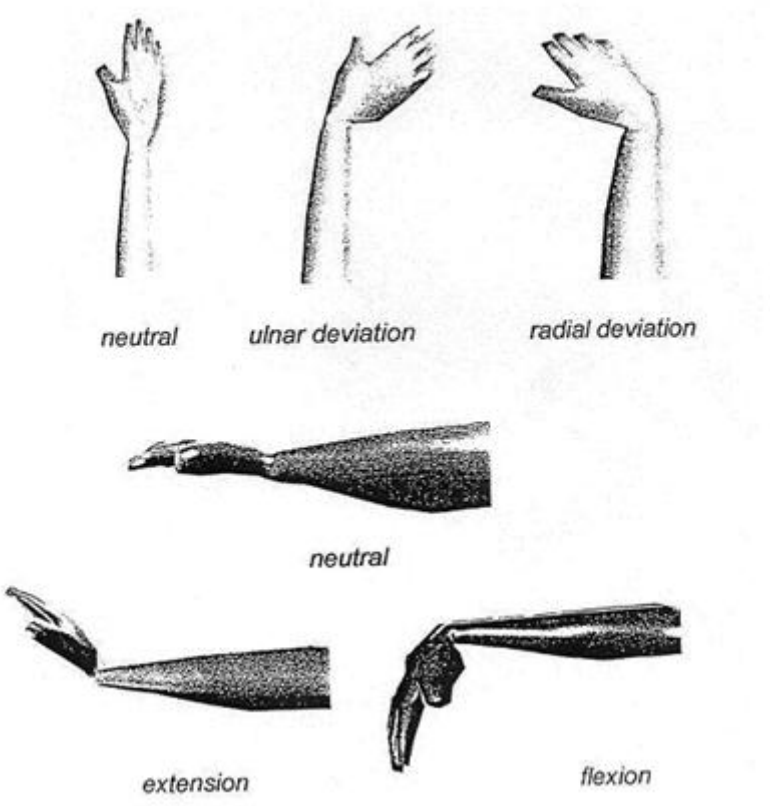

Figure 2.2: Neutral vs. Awkward Wrist Postures
Source: http://www.goer.state.ny.us/ergo/wrist-postures.cfm

2.3.1 Hand Arm Vibration Syndrome (HAVS)

Hand–arm vibration syndrome (HAVS) is the term often used for the symptoms associated with prolonged occupational exposure to hand–arm vibration arising from operation of hand-held power tools (Y. Aldien et al, 2006).Hand-arm vibration syndrome is often reported by workers that are exposed to Hand-arm vibration (HAV) generated from using handheld tools (Barregard et al., 2003).

From the symptoms, there are several effects that workers faced. This effect can influences worker life and working performance. The effects cause by vibration is like