



**Faculty of Mechanical and Manufacturing Engineering
Technology**

**EFFECT OF DRIVING POSTURE AND HAND GRIP FOR HAND
ARM VIBRATION SYNDROME AMONG CAR DRIVERS**

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Tajuk: EFFECT OF DRIVING POSTURE AND HAND GRIP FOR HAND ARM
VIBRATION SYNDROME AMONG CAR DRIVERS

Sesi Pengajian: 2019

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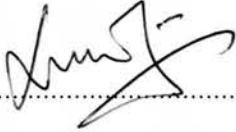


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DEDICATION

This project dedicates to my beloved parents; Lee Swee Yong and Chong Lee Lian, who gives me unconditional love and raise me to become the person I am today. They always be there for me and give mental support which allow me to achieve my goal without fear. Next, thanks to my friends who lend a hand to me when I need help. Lastly, very appreciation to the consultation of my supervisor, Pn. Nurul Ain Binti Maidin who always guide me with patience when I am lost. Thank you for everything.

ABSTRACT

Hand position on the steering wheel is important in providing an optimum comfort grip experience to drivers especially for the drivers who always drive in long journey. In this study, two type of hand position on the steering which is hand position 3 & 9 o'clock and 2 & 10 o'clock are used to compare the hand grip force before and after driving 30 minutes for both hand position. The route selection for this study is from the toll Ayer Keroh to toll Tangkak with total of 32.1 km and the speed limit will be 80km/hr. The grip force is collected before and driving session by using Hand Grip Dynamometer. Furthermore, the data collected for the grip force will be analysed and compared. Besides that, the ergonomics risk factor for both hand position also will be analysed by RULA analysis in Catia software. Lastly, limitation of the study faced and suggestion for the future study will be listed at the end of this report.

ABSTRAK

Kedudukan tangan pada stereng adalah penting dalam menyediakan pengalaman cengkaman keselesaan yang optimum kepada pemandu terutamanya bagi pemandu yang sentiasa memandu dalam perjalanan yang panjang. Dalam kajian ini, terdapat dua jenis kedudukan tangan pada kemudi yang kedudukan tangan 3 & 9 jam dan 2 & 10 jam digunakan untuk membandingkan daya pegangan tangan sebelum dan selepas memandu 30 minit di kalangan responden. Pemilihan laluan untuk kajian ini adalah dari tol Ayer Keroh tol ke tol Tangkak dengan jumlah 32.1 km dan had kelajuan 80km / jam. Daya cengkaman dikumpulkan sebelum dan memandu sesi dengan menggunakan alat Tangan Dynamometer. Selain itu, data yang dikumpul untuk daya cengkaman akan dianalisis dan dibandingkan. Di samping itu, skor faktor risiko ergonomik bagi kedua-dua kedudukan tangan juga akan dianalisis dengan analisis RULA dalam perisian CATIA. Akhirnya, had kajian dan cadangan untuk masa depan akan disenaraikan pada akhir laporan ini.

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LIST OF SYMBOLS

cm	-	centimeters
lbs	-	Pounds
kg	-	Kilograms
Kgf	-	Kilogram-force

LIST OF ABBREVIATIONS

CTS	Carpal tunnel syndrome
CATIA	Computer-Aided Three-Dimensional Interactive Application
DELMIA	Digital Enterprise Lean Manufacturing Interactive Application
EDC	Extensor digitorum communis
EGA	DELMIA Ergonomic Analysis
EPS	Electric power steering
EVE	DELMIA Ergonomics Evaluation
HAVS	Hand-Arm Vibration syndrome
HPS	Hydraulic power steering
FDS	Flexor digitorum superficialis
HGS	Hand grip strength
LCD	Liquid crystal display
MSD	Musculoskeletal disorder
MSDs	Musculoskeletal disorders system
RULA	Rapid Upper Limb Assessment
d.o.f	Degree of Freedom
PCA	Principal Component Analysis

CHAPTER 1

INTRODUCTION

This chapter introduce the background of the study research. Moreover, problem statement, objective, project scope and organization will be presented. The project background will cover the research overview while the problem statement will state the purpose to conduct this study. The objective in this chapter will introduce the goal of project and scope of project will state the limitation of project implementation. Lastly, the organization will include the detail of the system plan.

1.1 Background

Grip strength is important in applying forces to hold or undergo pull and push activities. It is also can be defined as the strength of hand. Thus, in activity of driving, strong grip strength is essential to grasp the steering which the steering is actuator of the car. It will help in changing the direction of the car. Poor grip strength also may lead to lose control of the car direction.

Malaysia's car accident case increases significantly in recent few years. Unsafe and dangerous driving causes had contributed to the serious traffic injuries each year. Therefore, finding the causes and solution is the main precedence for the government institution and automobile manufacturers alike. The main reasons of the car accident is the car driver's behavior and the driving posture. Besides that, uncomfortable driving posture and hand position also has causes the muscle fatigue of the driver and directly affected the driving skill.

Driving posture and hand position located on the steering wheel is the top concern for the driver to prevent the muscle fatigue while driving. As the steering wheel is the actuator of the of the steering system and its function is guiding the car's direction on the road. Therefore, a comfortable and proper hand position on the steering wheel is important to control the steering wheel become more stable. This can avoid the driver's wrist and hand muscle fatigue and indirectly can allow the drivers to concentrate in driving.

Commonly, driver weariness and lack of attention have long been recognized as the primary dedicate factors in car accidents which the muscle fatigue occur due to incorrect driving posture. Moreover, the dangerous and unsafe posture of driver also lead to the car accident. The driving actions including operating the shift lever, talking on a cell phone, eating, and smoking are first decomposed into a number of predefined action primitives. Therefore, the dangerous driving posture must be prevented to achieve less car accident goal.

1.2 Statement of the Purpose

The objectives of the research are:

1. Conduct a study to determine the hand grip strength of the subjects before and after driving 30 minutes with hand position 3 & 9 o'clock and 2 & 10 o'clock.
2. To analyse the data of the hand grip strength for hand position on the steering wheel among the subjects.
3. To obtain the RULA analysis score and propose the best posture design of hand position on the steering during driving by using DELMIA V6 RULA.

1.3 Problem Statement

Nowadays, the percentage of car on the road in Malaysia is getting higher compare to past few years. For the long journey driver, a comfortable driving posture design is playing an important role especially. As uncomfortable and awkward driving posture in long period will causes some chronic health problem such as Musculoskeletal Disorder (MSDs). Besides that, the vibration also will be transmitted from the road to the driver though the wheel steering. The muscle fatigue around the hand, arm and finger of driver appear if expose to long term vibration. The ergonomics effect on the drivers normally can be seen in term of carpal tunnel syndrome and Hand Arm Vibration Syndrome. Moreover, the driver may suffer all the disease due to the repetitive motion of turning steering wheel, awkward and static posture on arm and wrist. Therefore, with all the problem faced, the chronic health problem must be concern among the Malaysian drivers and need a good solution to solve all the problems.

1.4 Scopes

The scopes of the study are focus on the relationship between the hand position on the steering wheel and the hand grip force. The hand grip force will be measured by the hydraulic Hand Dynamometer. The hand grip force will be taken based on the before and after driving session.

Before the experiment, the hand grip force is measured by using the hand dynamometer. After that, participants are required to drive for 30 minutes journey with speed limitation of 80 km/hr. Throughout the driving session, participants are required to use the specific driving position on steering wheel while driving. After driving, hand grip force of driver will be taken again. Furthermore, the best driving posture design will be

construct out and analyzed by using Delmia V6 RULA posture to determine the Musculoskeletal disorder (MSD) for the both hand position on steering wheel.

In this research, the total of 14 participants with 7 females and 7 males are required to use the specific steering wheel position which is at 2 o'clock and 10 o'clock for driving round 1 while round 2 the hand position will need to positioned at 3 o'clock and 9 o'clock on steering wheel. This used to study the relationship between different position on the steering wheel and the hand grip force.

1.5 Project Significant

Nowadays, car accidents are increased years by years therefore the finding of this research will rebound to the benefit of the society who driving on the road. The research will create the awareness of the driver's hand position on the steering wheel which will directly contribute to the chronic health. As the awkward posture of the hand position on the steering within a long period causes the Musculoskeletal Disorder (MSD). Besides that, the vibration of the tire transmitted through the steering system to a driver also affect the MSD of the driver.

In the discussion and result, the comparison between two hand position on the steering wheel will be discussed in the discussion and the best design of hand position will proposed to the society and the MSD analysis obtain to suggest the drivers drive with hand posture to protect the wrist and hand.

1.6 Organization

In the final year project, there are total of six chapters. Details of the system plan will be discovered in this research. Below is the summary of the six chapters for the final year report.

Chapter 1.0 Introduction

In this chapter will consist the introduction of the relationship of thee driving posture and hand grip pressure among the drivers. Moreover, problem statement, objective, report scope and organization would be included within this chapter.

Chapter 2.0 Literature Review

In this chapter consists of the review study regarding to the existing research. This chapter include the knowledge of other author and their substantive findings such as theoretical and methodological contributions to a particular topic. Besides that, literature review also a summary of the resource to recap the important information of the source and synthesis it to reshuffling the information. This chapter will cover the knowledge of the others author based on the project purpose.

Chapter 3.0 Methodology

This section will cover the detail procedure for the experiment carry out for the research. A complete description of the equipment and techniques used for gathering the data would include in this chapter. This chapter will cover the research questions, participant and method used throughout the experiment.

Chapter 4.0 Result and Discussions

In this chapter, the result raw data would be gathered and analyzed. The hand grip pressure of the participant before driving and after driving will be measured by using hand Dynamometer. The data is collected for future discussion and interpretation and

explanation the finding of the result. This chapter is about the implications and assesses importance of the finding. Besides that, it also acknowledges limitations of methods and identifies new area for explorations.

Chapter 6.0 Conclusions and recommendations

This chapter consists of the research summary. It would include the main point of the overall research. Besides that, this section will determine whether all the objectives and scope have been achieved and covered. Moreover, future suggestion will be introduced for future research.

1.7 Expected Result

The research aim is to study the effect of driving posture and hand grip among for Hand Arm Vibration Syndrome among car drivers. The hand grip force will be measured by using the dynamometer hand grip, the measurement will be taken before and after driving activities depend on the hand position on the steering wheel. Furthermore, the result of the measurement is will compared. The hand grip force after driving in expected will be lower than before driving because the hand had experienced vibration and causes the vibration transmitted to the hand arm of the user. The position on steering wheel also will compared in term of grip force. Next, there will be an outcome of posture design in CATIA software by using RULA analysis.