Faculty of Mechanical and Manufacturing Engineering Technology

THE EFFECT OF SITTING POSTURE IN CAD DESIGNER WORKPLACE

Lau Sin Hong

Degree in Manufacturing Engineering Technology

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THE EFFECT OF SITTING POSTURE IN CAD DESIGNER WORKPLACE

LAU SIN HONG

A thesis is submitted in fulfilment of the requirement for the Bachelor Degree of Mechanical & Manufacturing Engineering Technology (Product Design) with Honours

Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DEDICATION

This project is dedicates to my beloved parents, Lau Kian Peng and Tey Koay Pheng who gave me caring and a lot of love around me. They always been there and give fully support to me. This make me become brave when I faced problem in my life. Thank you for everything you do.

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ABSTRACT

There are many people are prevalence in the high risk of musculoskeletal disorder especially computer users. They are exposed to this disorders due to their prolonged sitting. A good or poor sitting posture can be contributed to a high or low seating pressure. In this study, the feedback for the effect of poor seating posture to the people is identified by using questionnaires. The experiment are conducted two times to compare the seating pressure of the respondents which is according to the sitting posture before and after adjusted. The seating pressure of the respondents who sit on the ergonomic chairs in the lab is determined by using CONFORMat Research 7.60 software. Therefore, the shape, contour, dimensions, firmness and padding of the surface design are shown through the real-time display of sensor data and be graphing with data analysis. Most of the respondents recorded the lower sitting pressure for after adjusted sitting posture while compared with the sitting pressure before adjusted posture. Furthermore, the sitting posture would be adjusted by using RULA analysis. Lastly, the sitting posture after adjusted is considered as a proper sitting posture which can be proposed to the people such as CAD designer according to the comparison of sitting pressure. There are some of the recommendations for future improvement of this study.

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ABSTRAK

Terdapat ramai orang yang mempunyai kelaziman berisiko tinggi gangguan otot terutama pengguna komputer. Mereka terdedah kepada gangguan ini kerana mereka berpanjangan di depan komputer. Posisi duduk yang baik atau miskin boleh disumbangkan kepada tekanan tempat duduk yang tinggi atau rendah. Dalam kajian ini, maklum balas untuk kesan postur tempat duduk yang lemah kepada orang ramai dikenal pasti dengan menggunakan soal selidik. Eksperimen dilakukan dua kali untuk membandingkan tekanan tempat duduk responden yang mengikut postur duduk sebelum dan selepas diselaraskan. Tekanan duduk responden yang duduk di atas kerusi ergonomik di makmal ditentukan dengan menggunakan perisian CONFORMat Research 7.60. Oleh itu, bentuk, kontur, dimensi, tegasan dan padding reka bentuk permukaan ditunjukkan melalui paparan masa sebenar data sensor dan grafik dengan analisa data. Kebanyakkan responden mencatatkan tekanan duduk yang rendah untuk selepas posture duduk yang diselaraskan berbanding dengan tekanan duduk sebelum postur laras. Tambahan pula, kedudukan duduk akan diselaraskan dengan menggunakan analisis RULA. Akhir sekali, postur duduk selepas dilaraskan dianggap sebagai kedudukan duduk yang betul yang boleh dicadangkan kepada orang-orang seperti pereka CAD mengikut perbandingan tekanan duduk. Terdapat beberapa cadangan untuk penambahbaikan masa depan kajian ini.

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TABLE OF CONTENTS

	PAGE
DECLARATION	
APPROVAL	
DEDICATION	
ABSTRACT	**i**
ABSTRAK	**ii**
ACKNOWLEDGEMENTS	**iii**
TABLE OF CONTENTS	**iv**
LIST OF TABLES	**vi**
LIST OF FIGURES	**viii**
LIST OF APPENDICES	**xi**
CHAPTER	
1. INTRODUCTION	**1**
1.1 Research background	1
1.2 Problem statement	2
1.3 Objectives	3
1.4 Scopes	3
1.5 Expected result	4
1.6 Organization of the project	5
1.7 Significance of study	5
2. LITERATURE REVIEW	**6**
2.1 Workstation	6
2.2 Design of chair	9
2.3 Posture	13
2.4 Risk factor	14
2.4.1 Repetitive motion disorder	14
2.4.2 Awkward posture	15
2.4.3 Contact stress	16
2.4.4 Temperature	16
2.5 Work- related musculoskeletal disorder (WMSD)	17
2.5.1 Low Back Pain	20
2.5.2 Carpal Tunnel Syndrome	24
2.5.3 Tendonitis	26
2.6 Tekscan ConforMAT system	26
3. METHODOLOGY	**29**
3.1 Planning of study	30
3.2 Research methodology	31
3.2.1 Experiment Execution	32
3.2.2 Conducted of survey	36
3.2.3 Setup of equipment	36
3.2.4 Experiment	37

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3.2.5 Data collection 38
3.2.6 Adjustment of sitting posture by RULA analysis 38
3.2.7 Comparison of results 39

4. RESULT & DISCUSSION 40
4.1 The result of survey 40
4.1.1 Demographic profile 40
4.1.2 Questions related to the effect of sitting posture 43
4.2 Result of experiment 50
4.2.1 The characteristics of the respondents 50
4.2.2 Result of analysis 52
4.2.3 The overall result of sitting pressure with discussion 67
4.3 RULA analysis 69
4.3.1 The adjusted sitting posture of male manikin 70
4.3.2 The adjusted sitting posture of female manikin 70

5. CONCLUSION & RECOMMENDATION FOR FUTURE RESEARCH 72
5.1 Conclusion 72
5.2 Recommendation 74

REFERENCES 75
APPENDIX 80

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LIST OF TABLES

TABLE	TITLE	PAGES
2.1	Five common type of workstation	7
2.2	Different kinds of chairs in the market	10
2.3	Common spinal causes of back pain with physical examination findings, recommended imaging modalities, and any additional diagnostic testing	23
2.4	The examples of work exposures and the probability of work-relatedness	26
3.1	The final score in the form of a number between 1 and 7	34
4.1	The characteristics for each of the respondent	51
4.2	The sitting posture of Respondent 1	53
4.3	The comparison of result for Respondent 1	53
4.4	The sitting posture of Respondent 2	54
4.5	The comparison of result for Respondent 2	54
4.6	The sitting posture of Respondent 3	55
4.7	The comparison of result for Respondent 3	55
4.8	The sitting posture of Respondent 4	56
4.9	The comparison of result for Respondent 4	56

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4.10	The sitting posture of Respondent 5	57
4.11	The comparison of result for Respondent 5	57
4.12	The sitting posture of Respondent 6	58
4.13	The comparison of result for Respondent 6	58
4.14	The sitting posture of Respondent 7	59
4.15	The comparison of result for Respondent 7	59
4.16	The sitting posture of Respondent 8	60
4.17	The comparison of result for Respondent 8	60
4.18	The sitting posture of Respondent 9	61
4.19	The comparison of result for Respondent 9	61
4.20	The sitting posture of Respondent 10	62
4.21	The comparison of result for Respondent 10	62
4.22	The sitting posture of Respondent 11	63
4.23	The comparison of result for Respondent 11	63
4.24	The sitting posture of Respondent 12	64
4.25	The comparison of result for Respondent 12	64
4.26	The sitting posture of Respondent 13	65
4.27	The comparison of result for Respondent 13	65
4.28	The sitting posture of Respondent 14	66
4.29	The comparison of result for Respondent 14	66
4.30	The overall result of fourteen respondents	67

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LIST OF FIGURES

FIGURE	TITLE	PAGES
2.1	Different kinds of sitting posture	13
2.2	People who sit with proper posture and poor posture in front of computer	14
2.3	Repetitive motion strain	15
2.4	The different posture of hand	15
2.5	The hand that contact with table directly and cause the pain of wrist	16
2.6	The heat illness which are temperature and humidity	17
2.7	The multifactorial nature that can cause musculoskeletal disorders	18
2.8	The ligaments and nerve in the elbow	20
2.9	Mechanical Back Pain	21
2.10	Dynatomal mapping of cervical of radicular pain from mechanical simulation of cervical nerve roots C4 (A), C5 (B), C6 (C) and C7 (D)	22
2.11	A schematic presentation for vascular mechanism of carpal tunnel syndrome and median nerve injury	25

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2.12	The photograph of the lumbar support pillow placed on the standard, split back office chair	27
2.13	Pressure distribution of the subject in different seating conditions (1) Bare floor with mat, (2) Office chair with mat and (3) Car seat with mat	28
3.1	Flow chart of planning of study for final year project stage 1 and stage 2	30
3.2	Flow chart to conduct experiment	31
3.3	The workstations which are with ergonomic chairs in Ergonomic & OSHE lab	32
3.4	Faculty Engineering Technology, UTeM	33
3.5	The measurement of weight for each of the respondent was done by using digital weight scale in the laboratory	33
3.6	The final score for each of the body part	34
3.7	The button of "start" is selected in the point calibration dialog	35
3.8	The average value is inserted into the column in the calibration pressure dialog	36
3.9	The timer in the handset is set in one hour	37
3.10	Real-time display from Tekscan ConforMAT system	38
4.1	The gender of the respondents	40
4.2	The age categories of the respondents	41
4.3	The ethnic of the respondents	42
4.4	The year of study of the respondents	42

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4.5	The duration of the respondents spend in lab session	43
4.6	The effect after prolonged sitting in front of computer	43
4.7	The comfort level of chairs in lab	44
4.8	The factors that caused changing of sitting posture	44
4.9	The effect to the sitting posture by the design of chairs	45
4.10	The correction to the proper sitting posture which is after adjusted	46
4.11	The support to change the sitting posture from the colleagues	46
4.12	The effect of musculoskeletal disorder to the musculoskeletal system in human's body	47
4.13	The activity that use computer for a long period	47
4.14	The people who prevalence in musculoskeletal disorders	48
4.15	The sitting pressure affected by the sitting posture	49
4.16	The ways to prevent people from exposed in the musculoskeletal disorders	49
4.17	The graph of weight for each of the respondent	52
4.18	The graph of overall result from fourteen respondents	68
4.19	The adjusted sitting posture of male manikin	70
4.20	The adjusted sitting posture of female manikin	70

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LIST OF APPENDICES

APPENDIX	TITLE	PAGE
1	Data collection	80
2	The step to set up Tekscan ConforMAT system	121
3	Gantt chat for final year project 1 & 2	122

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CHAPTER 1

INTRODUCTION

This chapter is the overview of the project. The background of this project is briefly explained in this chapter. The problem statement are the reason to conduct this project. Therefore, the objectives come out according to the problem statement. The purpose to conduct this project would be described by the objectives and scopes.

1.1 Research Background

An erect posture can decrease internal disc pressure during sitting. A prolonged upright sitting posture to maintain. This is because it requires balance and muscular endurance (Yu *et al.*, 2015). The design of workstation is important to the people especially computer users. This is because they have to spend a long time to sit in front of the computer during working time. The space of workstation which is big or small enough will affect the efficiency of the users. According to Hadgraft *et al.* (2016), the office workers who spends a long time of the sitting during working time may contribute to the high risk of chronic disease and premature mortality. There are different types of workstations in the market. This is to ensure that the workstations that choose by the consumer which are suitable for them. Besides that, the design of chairs which are one part of the workstation also related in affect the comfort of users. The chosen of design for the chairs have to follow the condition of the workplace. For examples, an adjustable chair that used in the workplace has to match with the table. Besides that, there are the different material used to produce different types of chairs. The materials can also ensure the lifespan of the chairs. The

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lifespan for the good quality of chairs can be used for a long time without change after a period. The material is important to ensure the comfort of users. For examples, a computer user will feel discomfort with the poor materials of the chair after a long time sitting although the chair consists of backrest, armrest and lumbar support. A good design of workstation can reduce the risk of musculoskeletal disorders such as low back pain which is commonly faced by the people.

In this project, the ergonomic chairs in the workstation was sitting by the respondents. The effect of poor sitting posture are identified first through the survey. This will followed by the sitting pressure of the respondents would be monitored during they prolonged their sitting on the chair which is in front of the computer. The comfort level of the respondents during they spend a long time sitting in the workplace would be identified. A good or poor sitting posture can be determined through the real time display figure. Therefore, the risk of musculoskeletal disorders among the respondents can be discovered early.

The weight of the respondents are collected before they sit on the chairs which is for calibration of force. The sitting pressure would be measured by using Tekscan ConforMAT system. With the using of this system, the sitting pressure can be identified and investigate clearly with the graphing data. Furthermore, the proper sitting posture for the respondents will be proposed by RULA analysis.

1.2 Problem Statement

The comfort level of sitting becomes the problem concerned by people. This is because musculoskeletal disorder was prevalence among the people in their activities of daily life. Computer users are the people who at the high risk of musculoskeletal disorder due to their poor sitting posture. A poor sitting posture would cause them to expose to the

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risk of low back pain due to their prolonged sitting. The people who sit in relax condition was consider as poor sitting posture. This is because they may sit on the chair with not properly posture. A poor sitting posture can cause the increasing of intradiscal pressure and flattening of lumbar curve (Cho *et al.*, 2015). According to the research of the previous journal, it still very less of related study about sitting posture of computer users by using Tekscan ConforMAT system.

1.3 Objectives

There are three objectives of this project which are:

1. To investigate the effect of poor posture during long duration sitting at CAD designer workplace.
2. To conduct an experiment in order to determine sitting pressure of the chair in the workstation by using Tekscan ConforMAT system.
3. To propose the suitable sitting posture for CAD workplace.

1.4 Scopes

The scopes of this project are to investigate the poor sitting posture of the CAD designer while sitting in front of the computer. The sitting pressure can be used to determine the comfort level of sitting. The experiment is carrying out in Faculty of Manufacturing Engineering in Universiti Teknikal Malaysia Melaka. The ergonomic chairs with a normal height of table would be the workstation chosen to carry out the experiment. There were seven females and seven males are participating in this experiment. The weight of the respondents would be recorded before going to experiment. There was a questionnaire would be conducted to the computer users. Therefore, the effect of poor sitting posture can be determined. Tekscan ConforMAT system is the device of pressure mapping use in this

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experiment which is to measure the sitting pressure of the respondents. Model 5330 (CER2) which is the model of device used in the experiment with a provided laptop. There is two separate pressure mapping in this system which is seat front and back top. This two pressure mapping is putting on the chair before the respondents sit on it. Therefore, all of the respondents have to sit on ergonomic chairs for one hour. ConforMAT Research 7.60 software is the software used to visualize the changes of the pressure distribution of the respondents along one hour of sitting. All of the respondents are required to sit on the chair and use the computer by following their own sitting posture along one hour of the experiment. The sitting posture are adjusted to become a proper sitting posture through RULA analysis. All of the respondents are required to sit on the chair again by according to the proper sitting posture from RULA analysis. The sitting pressure would be recorded again. The result of pressure distribution of sitting for before and after adjusted would be compared.

1.5 Expected Results

There are some of the expected result comes out at the end of this project. The effect of poor posture during long duration sitting at CAD designer workplace was investigated. A questionnaire is created to gain the feedback from the respondents. The result showed that there are many respondents give the feedback about the poor sitting posture can cause the musculoskeletal disorder. Besides that, the sitting pressure of the chair in the workstation was identified by using Tekscan ConforMAT system. The shape, contour, dimensions, firmness and padding of the surface design will be shown through the real-time display of sensor data and be graphing with data analysis. Furthermore, the suitable sitting posture for CAD workplace was being proposed. The poor sitting posture is adjusted until the posture become proper by using RULA analysis.

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1.6 Organization of the project

Chapter 1: Introduction

This chapter will explained about the background, objectives, problem statement, scopes and the expected result of the project.

Chapter 2: Literature review

This chapter will study about the previous journal and research that related to the project.

Chapter 3: Methodology

This chapter will states about the method to conduct this project.

Chapter 4: Results & discussion

This chapter will state the result obtained from experiment and discussed.

Chapter 5: Conclusion & recommendation for future research

This chapter will conclude the project and come out with suggestions.

1.7 Significance of Study

The effect of poor sitting posture would be investigated among the respondents. This can help to create awareness among the people who prolonged their sitting in front of computer with poor sitting posture that may cause them to expose in the risk of musculoskeletal disorder. The sitting posture of respondents can be identified whether it is poor or good by referred to the result of pressure distribution that display from the Tekscan ConforMAT system. The proper sitting posture from RULA analysis is hope can be avoid the low back pain for people who prolonged their sitting on chair.

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CHAPTER 2

LITERATURE REVIEW

This chapter is explained about the workstation, design of the chair, sitting posture, risk factors, work-related musculoskeletal disorders (WMSD) and pressure ulcers. Besides that, this chapter also explained about how the seating pressure measured by using Tekscan ConforMAT system which is according to the sitting posture of the students. All of the related information in literature review are come from journals, the articles, the books and also from the website.

2.1 Workstation

The workstation is a special of the space which is designed or developed for the technical application. The workstation which is in good design was performed well in its duties. Therefore, the efficiency of the working will become more accurately as compared to the other desktop computers. The worksite based sitting time can be reduced with the use of height-adjustable desks whereas single-desk sit-to-stand workplaces will reduce the potential and easy to loss in performance (Schwartz *et al.*, 2016). There are different types of workstations in the market. The workstation was important in maintaining the professionalism.

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