Faculty of Manufacturing Engineering

ERGONOMIC DESIGN CHAIR FOR POSTPARTUM MOTHERS

Eliyana Sari Binti Sumaidy

Master of Manufacturing Engineering (Industrial Engineering)

2016

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ERGONOMIC DESIGN CHAIR FOR POSTPARTUM MOTHERS

ELIYANA SARI BINTI SUMAIDY

A thesis submitted
in fulfillment of the requirements for the degree of Master of Manufacturing Engineering (Industrial Engineering)

Faculty of Manufacturing Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2016

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APPROVAL

I hereby declare that I have read this dissertation and in my opinion this dissertation is sufficient in terms of scope and quality as a partial fulfillment of Master of Manufacturing Engineering (Industrial Engineering).

Signature :……

Supervisor Name :……...……

Date :……

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DECLARATION

I declare that this thesis entitled “Ergonomic Design Chair for Postpartum Mothers” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :…….

Name :…….

Date :…….

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DEDICATION

In the name of Allah S.W.T, Most Gracious, Most Merciful.

Special big dedicated to my beloved parents, En Sumaidy bin Jangin and Pn Kiptiah binti Rejam, whose never stop giving me so much support and all the sacrificed that makes me who I am today. May Allah bless them always.

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ABSTRACT

This study was carried out in the Ayer Keroh Health Clinic following registration with the National Medical Research Register (NMRR). Its objective is to address the concerns faced by postpartum mothers while being seated in the waiting area of the clinic because of pain at in their episiotomy wound. The problem areas were identified, which included the technical requirements needed by postpartum mothers in designing an ergonomic chair. A new design feature(s) was included in the chair, and then corroborated with regards to feasibility and usability. Considering the technical requirements, a questionnaire is conducted and data analysis is done utilising AHP and HOQ. The chosen design from the three conceptual designs was conceived in the Solidworks software. For chair dimensions, the 5^{th}, 50^{th} and 95^{th} percentile is computed using Minitab17 from the anthropometry measurements of postpartum mothers. The CES edupack is utilised for choosing material for specific parts of the chair. Attributes of an ergonomic chair include simple to use and adjustable armrest, comfort and ease of cleaning. The corroboration was done with respect to the technical method by utilising pressure mapping and subjective methodology from the survey. The comparison of respondents' contact pressure is done using the present chair in the clinic's waiting area and the model of the ergonomic chair. It was noted that the contact pressure decreased at the perineal area. The projected outcome from the chair design is able to scrutinise the postpartum mothers' technical requirements and the ergonomic chair's designs will decrease the episiotomy wound. This research could undergo further scrutiny in terms of designing an ergonomic chair which is apt for postpartum mothers and offers comfort to 95 percent of users. Going forward, the chair should be designed with an adjustable height and in accordance with body dimensions of postpartum mothers, from 1^{st} percentile to 99^{th} percentile for greater comfort.

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ABSTRAK

Kajian ini telah dijalankan di Klinik Kesihatan Ayer Keroh selepas didaftarkan dengan Pendaftaran Penyelidikan Perubatan Kebangsaan (NMRR). Tujuan kajian ini adalah untuk mengatasi masalah yang dialami oleh ibu-ibu selepas bersalin sambil duduk di klinik ruang menunggu kerana sakit pada luka episiotomi yang dilalui ibu-ibu selepas bersalin. Masalah ini telah dianalisis termasuk spesifikasi teknikal yang diperlukan oleh ibu-ibu selepas bersalin dalam reka bentuk kerusi ergonomik. Satu ciri reka bentuk baru telah diperbadankan di kerusi ergonomik yang kemudiannya disahkan dari segi praktikal dan kebolehgunaan. Satu soal selidik untuk keperluan teknikal dijalankan dan data dianalisis menggunakan HOQ dan AHP. Reka bentuk yang dipilih dari 3 reka bentuk konsep direka dalam perisian Solidworks. The persentil ke-5, ke-50 dan ke-95 dikira menggunakan Minitab17 untuk ukuran kerusi daripada pengukuran antropometri ibu selepas bersalin. CES edupack digunakan untuk pemilihan bahan untuk bahagian-bahagian tertentu kerusi ergonomik. Kerusi ergonomik direka dengan ciri-ciri tempat letak tangan boleh laras, mudah untuk menggunakan tempat letak tangan yang selesa dan mudah untuk membersihkan. Pengesahan adalah dari segi kaedah teknikal dengan menggunakan pemetaan tekanan dan kaedah subjektif daripada kajian. Tekanan sentuhan responden dibandingkan menggunakan kerusi semasa di kawasan klinik dan prototaip kerusi ergonomik menunggu. Keputusan adalah tekanan sentuhan dikurangkan pada kawasan perineal. hasil yang diharapkan dari reka bentuk kerusi itu berupaya untuk menganalisis keperluan teknikal bagi ibu-ibu selepas bersalin dan reka bentuk kerusi ergonomik akan mengurangkan luka episiotomi selepas duduk di kerusi prototaip ergonomik. Sebagai cadangan, kajian ini dapat diteliti lebih lanjut mengenai mereka bentuk kerusi ergonomik yang sesuai dan memberi keselesaan kepada ibu-ibu selepas bersalin untuk berpuas hati 95% daripada populasi pengguna. Pada masa depan adalah mereka bentuk kerusi di ketinggian boleh laras dan sesuai dengan badan dimensi ibu-ibu selepas bersalin dari persentil 1 hingga persentil ke-99 untuk keselesaan yang lebih.

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ACKNOWLEDGEMENTS

Alhamdulillah, thanks to the almighty Allah, my first and most heartily gratitude who blesses to all for his divine throughout my life and my final year project.

At this juncture, when I am submitting my final year project, I honestly feel that this report of study would not have been possible without the support guidance, critique and direction of those who are associated with my academic and personal life.
Foremost, I would like to extent my respect and gratitude to Dr. Effendi bin Mohamad, my supervisor whose advises are very helpful for my report and his concern for the students has always made me perform better confidentially. Thanks for guiding me in a very well to finish my report.

I acknowledge my deep indebtedness to my family who always pray the best for me and understand on my journey to complete this report.
My special thanks to my seniors who also master student that always had a time to teach me on using software Solidwork and Pressure Mapping and advise me to perform well in this my master project.

I deeply thanks to all my classmates and thanks to all my friends whom unforgettable support and motivation. Last but not least I thank to all my respondents whose postpartum mothers, doctors and nurses in the clinic as this project conducted without them this study can't be possible.

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CHAPTER 1

INTRODUCTION

This chapter explains the background of study, the problem statement, objective of the study, and lastly scope as well as limitation in completing this study. The basic fundamental of ergonomics and design of ergonomic chair towards postpartum mothers will be discussed in the background study. Then, from the objective, the limitation and the scope will be identified. This study is mainly about an ergonomic chair for postpartum mothers.

1.1 Background of Study

Postpartum is a very special period for a women and her family. Despite the pain and discomfort to do daily activities, the present of the new baby after waited for a long time and start a new life as a mother is the beginning of new chapter in human life (Zainur and Loh, 2006). However, in the postpartum period, the mothers will face a pain full perineum associated with child birth through vaginal delivery. The mother undergoing episiotomy is characterised by great blood loss during delivery and there is a high risk of improper wound healing during early puerperium (Kakade, 2015). The smallness of episiotomy cut brings us assume that this operation will not cause problem to the mothers, though this area participates in more ordinary activities such as sitting, walking, standing, squatting and urinating due to the availability of many muscles in the pelvic floor and

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causes discomfort for postpartum women (Rowland et al., 2005). According to the report issues from the doctors and pilot study that had been done, the current chair in the waiting area of mothers and child clinic are not ergonomically enough. After been registered with National Medical Research Register (NMRR) this project is carried out in Ayer Keroh Health Clinic. These issues are focussed on postpartum mothers. The effect from the episiotomy wound limits the postpartum mothers to stay in prolonged sitting. Hence, an ergonomic chair for the postpartum mothers is developed to release their pains. The chair is developed based on postpartum mother's requirements. It will be design fit according to the postpartum mother's anthropometry data. The design of the chair focuses on to reduce the contact pressure between episiotomy wound area and the cushion of the chair. In addition, to provide comfortableness of cushion for the postpartum mothers stay in prolonged sitting in a longer period. Besides, the technically of the chair such as adjustability and armrest are add up according to postpartum mothers requirements. Hence, the new develop of ergonomic chair are required to release the episiotomy wound pain faced by postpartum mothers due to prolonged sitting.

1.2 Problem Statement

Postpartum mothers who delivered vaginally and underwent episiotomy experience pain at their perineal area while sitting because of episiotomy wound. The probability of problems with episiotomy wound healing and experience pain were approximately two times higher in the earlier postpartum weeks (Karacam et al., 2013). A questionnaire distributed to 56 of postpartum mothers and 26 of postpartum mothers had underwent episiotomy wound. 23 of postpartum mothers at the Maternal and Child Health unit at

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Ayer Keroh Health Clinic showed that episiotomy wound reduce their comfort while sitting at the waiting area. This raised the concerns of doctors at the Maternal and Child Health Clinic at Ayer Keroh Health Clinic especially for postpartum mothers who have to come to clinic repetitively to bring their jaundiced babies for treatment. During each clinic visits, mothers will have to wait and average of 45 minutes to an hour before being called to doctor's consultation room. Due to long waiting time and the discomforts pain caused by the episiotomy wound, postpartum mothers and doctors want the current chair to be improved. Figure 1.1 showed the current chair at the waiting area of Maternal and Child Health unit at Ayer Keroh Health Clinic.

Figure 1.1: Current chair in Maternal and Child Health Clinics

1.3 Objectives

1) To analyse the technical requirements required by the postpartum mothers in the design of an ergonomic chair.
2) To develop a new design feature(s) in the ergonomic chair to ease postpartum mothers.

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3) To validate the new design features of ergonomic chair in terms of practicality and usability.

1.4 Scope and Limitation of Project

The important of this project is on reducing the pain of postpartum mothers while sitting due to the episiotomy wound by suggesting the ergonomic chair. The ergonomic chair will be included the characteristic of ergonomic while designing the chair. For instance, have an armrest, comfort, easy to use, followed the measurement body of postpartum mothers and reducing the back pain due to longer time in sitting posture. However, these characteristics are based on the postpartum mothers' requirements. The questionnaire on technical requirements and open interview will be conducted to collect the data of postpartum mothers' requirements. At the same time, the measurement of postpartum mothers will also be collected. The scopes of this project are the respondent only focus on postpartum mothers at early weeks of postpartum period because after 6 weeks postpartum period they will gain weight or lose weight (Gunderson et al., 2001). The aim of this study is to overcome the problem experienced by postpartum mothers while sitting at the clinic waiting area for treatment of baby due to the pain at their episiotomy wound. The anthropometry measurements will be collect and percentile for the measurements is 5^{th}, 50^{th} and 95^{th} percentile. The Minitab17 will be used to calculate the percentile. The limitation of this project is the data are taken only in Ayer Keroh Health Clinic in 2 months of period. This permission is after received approval and been assigned from District Health Officer Melaka Tengah to take data in Maternal and Child Health Clinics in Ayer Keroh Health Clinic. There are time constraints while taking data due to

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started taking data on March 2016 to April 2016 only while in that period need to attend class and do class projects. Besides, data of questionnaire and anthropometry measurements will be collect once the postpartum mothers want to give cooperation. The ergonomic chair will be prototype after undergoing methods of House of Quality (HOQ) to select the highest criteria from postpartum mothers and Analytical Hierarchy Process (AHP) to select the best design based on the criteria. The design will be transfer into Solidwork Software. The prototyped chair will undergoes validation by conducting survey in Ayer Keroh Health Clinic and pressure mapping. The pressure mapping will be test on the contact pressure between the episiotomy wound and the seat pan of current chair and the prototyped chair. The difference on the pressure is used to validate the ergonomic chair for postpartum mothers. This is because, the decreasing of pressure on seat showed that the episiotomy wound faced by postpartum mothers while sitting can be reduced.

1.5 Significance of Study

This study brings many benefits to all especially postpartum mothers. The root cause of pain faced by postpartum mothers while sitting is identified. During the first few postpartum days, one of the common causes of discomfort is episiotomy. This pain often interferes with basic daily activities for the woman such as walking, sitting and passing urine and also negatively impacts on motherhood experiences (Hedayati et al., 2005). Besides, based on the anthropometry data and the BMI of postpartum mothers, the ergonomic chair is developed to provide comfort and fit with their body measurement. Furthermore, this study will compare the pressure contact between the current chair and the ergonomic chair by using pressure mapping. Moreover, methods of design that has been

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applied to produce the ergonomic chair such as House of Quality, AHP, Solidwork Software and Bill of Material will be discussed. The overall significance of this study are developing new ergonomic chair for postpartum mothers that will bring comfort for them even when sitting for a long period of time.

1.6 Project Outline

This study was divided into five chapters. The first chapter is describing about the introduction of the study. This including the overview of the project, objectives, scope of the study, problem statement and also the outline of the project.

The second chapter will describe about the literature reviews which focus on the past studies that relates to the title of this study. The references of this study are based from the books, journals, past research, review article and website. This chapter also discussed about the method used to gain the information based from the researchers.

The next chapter, which is the third chapter, is discussing about methodology. This chapter describes on how the study is conduct using several tools that was divided into two phases in order to finish this study. Gantt chart will be developed according to the time provided to see whether this study is following the time or not.

Meanwhile for the chapter four, it express about the result and discussion. The result and analysis will determine whether the project achieves the objectives of the study. Then, a survey will be conducted to validate the ergonomic chair. While the data collected, discussions are made to describe the entire result finding.

Lastly, the final chapter that is chapter five is discuss about the conclusion and future work of the study.

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CHAPTER 2

LITERATURE REVIEW

This chapter consist of review regarding project according objectives and scope of the project. This review contains the episiotomy wound effect on daily activities, anthropometric measurement, BMI, current design on postpartum chairs and software used. All these information obtained from articles, journals, and some books related to this project. Each sources and information were selected based on the relation with scope of this study.

2.1 Episiotomy wound in Postpartum Period

Definition of episiotomy is a surgical incision on perineum. It is vaginal cut to increase outlet diameter for smoothen baby's birth (Kettle et al., 2002). The incision, performed with a scalpel or surgical scissors, which being made in mediolateral position or along the midline of the perineum as in Figure 2.1. The scissors shown are incorrect; the scissors actually used are blunt on the tips to prevent injury to the mother or baby.

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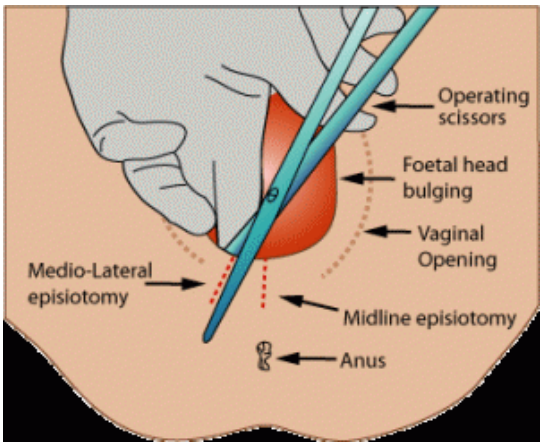

Figure 2.1: The incision of episiotomy. Note: the scissors used should blunt on the tips to prevent injury to the mother or baby. (Sources: Schmidler, 2016)

High episiotomy rates close to 100%, in North America and Asia (Goldberg et al., 2002; Lam et al., 2006) whereas in Taiwan the episiotomy pain increased in weeks 1, 2 and 6 postpartum (Chang et al., 2011). Meanwhile, past study by Muda (2014) in Kuala Lumpur Maternity Hospital resulted in Table 2.1.

Table 2.1: Statistic of perineal trauma in 2010, 2011 and 2012 (Muda, 2014)

Year	Total of birth	Perineal trauma					Total (%)
		Episiotomy	1st degree	2nd degree	3rd & 4th degree	Others*	
2010	11,916	3016 (25%)	1561 (13%)	1943 (16.3%)	12 (0.2%)	198 (1.7%)	56.5
2011	12,660	3292 (26%)	1514 (12%)	2322 (18.3%)	12 (0.1%)	134 (1.1%)	57.5
2012	12,463	2587 (21%)	950 (7.6%)	2858 (23%)	9 (0.07%)	359 (2.9%)	53.45

According to study done, the episiotomy rate declined by 4% without any increase in the rate of severe perineal trauma and with a 0.03% decrease in the rate of perineal

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