



**Faculty of Manufacturing Engineering**

**ERGONOMIC DESIGN CHAIR FOR POSTPARTUM  
MOTHERS**

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**ERGONOMIC DESIGN CHAIR FOR POSTPARTUM MOTHERS**

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in fulfillment of the requirements for the degree of Master of  
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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).

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Supervisor Name : .....

Date : .....

## 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 :.....

## **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.

## 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<sup>th</sup>, 50<sup>th</sup> and 95<sup>th</sup> 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<sup>st</sup> percentile to 99<sup>th</sup> percentile for greater comfort.

## **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 kebolegunaan. 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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## TABLE OF CONTENTS

	PAGE
<b>ABSTRACT</b>	<b>i</b>
<b>ABSTRAK</b>	<b>ii</b>
<b>ACKNOWLEDGEMENTS</b>	<b>iii</b>
<b>TABLE OF CONTENTS</b>	<b>iv</b>
<b>LIST OF TABLES</b>	<b>vii</b>
<b>LIST OF FIGURES</b>	<b>ix</b>
<b>LIST OF APPENDICES</b>	<b>xi</b>
<b>CHAPTER</b>	
<b>1. INTRODUCTION</b>	<b>1</b>
1.1 Background of Study	1
1.2 Problem Statement	2
1.3 Objectives	3
1.4 Scope and Limitation of Project	4
1.5 Significance of Study	5
1.6 Project Outline	6
<b>2. LITERATURE REVIEW</b>	<b>7</b>
2.1 Episiotomy wound in Postpartum Period	7
2.1.1 Postpartum Care	9
2.2 Anthropometric Measurement	11
2.2.1 Body Mass Index (BMI)	15
2.3 Design of Postpartum Chairs	18
2.4 Pressure Mapping	21
2.5 Quality Function Deployment (QFD)	22
2.6 Analytical Hierarchy Process (AHP)	23
2.6.1 AHP Methodology in General	24
<b>3. METHODOLOGY</b>	<b>25</b>
3.1 Process Flow of the Project	25
3.1.1 Identify the Problem Statement, Objective and Scope	28
3.1.2 Planning of Literature Review	29
3.1.3 Planning of Research Methodology	29
3.2 Data Collection and Sample Size	30
3.2.1 Qualitative Data	32
3.2.1.1 Observation	32
3.2.1.2 Interview	32
3.2.2 Quantitative Data	33
3.2.2.1 Questionnaire Form (Technical Requirements)	34

3.2.2.2	Preliminary Study	34
3.2.2.3	Survey Form for Practicality and Usability of the Ergonomic Chair	35
3.2.2.4	Anthropometry Measurement	35
3.3	Data Analysis and Develop Design	37
3.3.1	Microsoft Excel	37
3.3.2	Minitab17	38
3.3.3	House of Quality (HOQ)	38
3.3.4	Design Concepts Generation	39
3.3.5	Design Selection Using Analytical Hierarchy Process (AHP)	39
3.3.5.1	Step 1: Define the Problem	40
3.3.5.2	Step 2: Develop a Hierarchical Structure	41
3.3.5.3	Step 3: Construct a Pairwise Comparison Matrix	42
3.3.5.4	Step 4: Perform Judgment of Pairwise Comparison	42
3.3.5.5	Step 5: Synthesizing the Pair-Wise Comparison	43
3.3.5.6	Step 6: Perform the Consistency Ratio	44
3.3.5.7	Step 7: Perform Step 3-6 Repeatedly	45
3.3.5.8	Step 8: Develop Overall Priority Ranking	45
3.3.5.9	Step 9: Choose the Best Decision	45
3.3.6	Materials Selection Process	45
3.3.6.1	Translation	46
3.3.6.2	Screening	47
3.3.6.3	Ranking	47
3.3.6.4	Documentation	47
3.3.7	Design Modelling	48
3.3.7.1	Parts Modelling	48
3.3.7.2	Detailed Drawing	48
3.3.7.3	Assembly Modelling	49
3.3.8	Process of Fabrication	50
3.4	Data Validation	50
3.4.1	Tekscan CONFORMat Pressure Mapping	51
3.4.1.1	Guideline Pressure Mapping Process	52
3.5	Conclusion and Recommendation	52
<b>4.</b>	<b>RESULT AND DISCUSSION</b>	<b>54</b>
4.1	Preliminary Study	54
4.4.1	Interview with Experts	58
4.4.2	Summary from Preliminary Study	59
4.2	Result Obtaining Objective One	60
4.2.1	Analysis of Questionnaire (Technical Requirements) Using SPSS	60
4.2.1.1	Demographic Data	61
4.2.1.2	Technical requirements	64
4.2.2	Analysis of Anthropometry Measurement Using Minitab17	69
4.3	Result Obtaining Objective Two	71
4.3.1	Analysis of Technical Requirements by Using House of Quality (HOQ)	71
4.3.1.1	Customer Requirement	72
4.3.1.2	Planning Matrix	73
4.3.1.3	Technical Requirement	74

4.3.1.4	Interrelationship Matrix	75
4.3.2	Conceptual Design	78
4.3.3	Concept Design Selection using Analytical Hierarchy Process Analysis	80
4.3.3.1	Define a problem	80
4.3.3.2	Developing the Hierarchy Structure	80
4.3.3.3	Pairwise Comparison for Alternatives	85
4.3.3.4	Pairwise Comparison of Sub-Criteria	89
4.3.3.5	Pairwise Comparison of Main Criteria	91
4.3.3.6	Priority Vector Analysis	92
4.3.3.7	Overall Priority Ranking	95
4.3.4	Detail Design Using SolidWorks Software	96
4.3.5	Material Selection Using CES Edupack	97
4.3.5.1	Material Selection for Fabric	97
4.3.5.2	Materials Selection for the Framework	101
4.3.6	Bill of Material	105
4.4	Result Obtaining Objective Three	107
4.4.1	Validation Using Tekscan CONFORMat Pressure Mapping	108
4.4.2	Summary of Pressure Mapping	115
4.4.3	Validation Using Survey	116
<b>5.</b>	<b>CONCLUSION AND FUTURE WORK</b>	<b>118</b>
5.1	Conclusion	118
5.2	Future Work	120
	<b>REFERENCES</b>	<b>122</b>
	<b>APPENDICES</b>	<b>130</b>

## LIST OF TABLES

<b>TABLE</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	Statistic of perineal trauma in 2010, 2011 and 2012	8
2.2	Anthropometric data for female Malaysian citizen, all units are in mm	14
2.3	The mean, SD, and 5th and 95th percentile anthropometric data for Malaysian male and female youth	14
2.4	Standard BMI	15
2.5	Summary past studies of BMI in postpartum mothers	17
2.6	Summary of chair for postpartum mothers	19
3.1	Relationship between methodologies and objectives	28
3.2	Dimension of anthropometry measurement	36
3.3	Scale for pair-wise comparisons	43
3.4	Random Index (RI)	44
3.5	Rank score for material selection	47
4.1	Anthropometric data	67
4.2	Importance rating scale	71
4.3	Postpartum mothers' requirement and importance rating	71
4.4	Rating for benchmark	72
4.5	Direction of improvement	72
4.6	Relationship matrix	73
4.7	Correlation matrix	74
4.8	Data on the conceptual design of chair	81
4.9	Pairwise comparison for alternatives towards waterproof	82
4.10	Pairwise comparison for alternatives towards lightweight	82

4.11	Pairwise comparison for alternatives towards strong framework	83
4.12	Pairwise comparison for alternatives towards padding thickness	83
4.13	Pairwise comparison for alternatives towards stability	84
4.14	Pairwise comparison for alternatives towards contouring	84
4.15	Pairwise comparison for alternatives towards materials	84
4.16	Pairwise comparison for alternatives towards manufacturing process	85
4.17	Pairwise comparison for alternatives towards adjustable armrest	85
4.18	Pairwise comparison for alternatives towards adjustable height	86
4.19	Pairwise comparison for sub criteria towards cost	86
4.20	Pairwise comparison for sub criteria towards ergonomic	87
4.21	Pairwise comparison for sub criteria towards safety	87
4.22	Pairwise comparison for sub criteria towards performance	88
4.23	Pairwise comparison for criterion	89
4.24	Pairwise comparison alternatives	89
4.25	CR for alternatives sub criteria	90
4.26	Synthesized the pairwise comparison	90
4.27	Priority Vector Analysis	91
4.28	Overall Priority Ranking	92
4.29	Translation on fabric	94
4.30	Properties each materials for fabric	96
4.31	Ranking of materials for fabric	96
4.32	Translation for framework	98
4.33	Properties of materials for frame	100
4.34	Ranking of materials for framework	100
4.35	BOM of ergonomic chair	103
4.36	Comparison pressure and time on pressure mapping	111

## LIST OF FIGURES

<b>FIGURE</b>	<b>TITLE</b>	<b>PAGE</b>
1.1	Current chair in Maternal and Child Health Clinics	3
2.1	The incision of episiotomy	8
2.2	Anthropometric (body) measurements	12
2.3	BMI	15
2.4	Pressure map	22
3.1	Flowchart of planning study	27
3.2	Anthropometer	36
3.3	House of Quality	39
3.4	Overall process flow chart for AHP step	40
3.5	A four level hierarchy model	41
3.6	Materials selection strategy	46
3.7	CONFORMat sensor	51
4.1	Mothers' age in preliminary study	54
4.2	Maternity of respondents	55
4.3	Responded on episiotomy wound	55
4.4	The episiotomy wound is disturbing or not	56
4.5	Responded on current chair	56
4.6	Sample size calculation	59
4.7	Postpartum mothers' age	60
4.8	BMI of postpartum mothers	61
4.9	Delivery times of postpartum mothers	61
4.10	Postpartum mothers' activities	62
4.11	Usability and range of armrest adjustment	63

4.12	Usability and range of back height adjustment	63
4.13	Frequency of postpartum mothers on cushion comfort	64
4.14	Contouring while sitting	64
4.15	Ease of cleaning the chair	65
4.16	Ease of seat height adjustment	66
4.17	Ease of armrest height adjustment	66
4.18	HOQ	69
4.19	Result of HOQ	75
4.20	Design A	76
4.21	Design B	77
4.22	Design C	78
4.23	Hierarchy structure of ergonomic chair	79
4.24	Design C in SolidWork	93
4.25	Price per unit volume of materials	95
4.26	The processability of some metal groups.	99
4.27	Tree structure of ergonomic chair	102
4.28	Pressure mapping of normal weight on current chair	104
4.29	Graph of normal weight on current chair	105
4.30	Pressure mapping of normal weight on prototype chair	105
4.31	Graph of normal weight on prototype chair	106
4.32	Pressure mapping of over weight on current chair	106
4.33	Graph of overweight on current chair	107
4.34	Pressure mapping of overweight on prototype chair	107
4.35	Graph of overweight on prototype chair	108
4.36	Pressure mapping of obese on current chair	109
4.37	Graph of obese on current chair	109
4.38	Pressure mapping of obese on prototype chair	110
4.39	Graph of obese on prototype chair	110
4.40	Survey result	112

## **LIST OF APPENDICES**

<b>APPENDIX</b>	<b>TITLE</b>	<b>PAGE</b>
A	NMRR letter	126
B	Gantt chart	127
C	Interview from with doctor	128
D	Questionnaire (technical requirements)	129
E	Preliminary study	133
F	Survey form	134
G	Anthropometry form	136
H	Reports from doctor	138
I	AHP	139
J	Feedbacks on prototype chair	150
K	Copyright letter	151



# **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

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

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.

- 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<sup>th</sup>, 50<sup>th</sup> and 95<sup>th</sup> 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

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

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.

## **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.

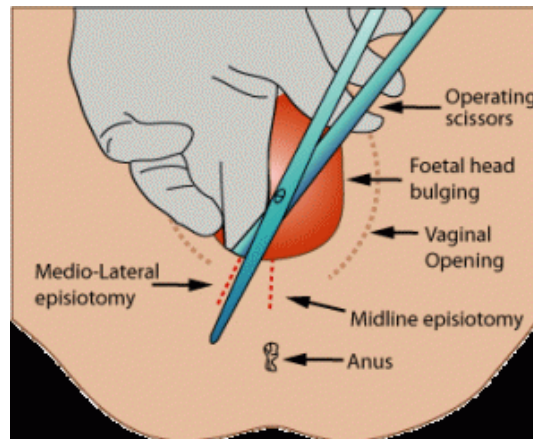


Figure 2.1: The incision of episiotomy. Note: the scissors used should blunt on the tips to prevent injury to the mother or baby. (Sources: Schmidler, 2016)

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	1 <sup>st</sup> degree	2 <sup>nd</sup> degree	3 <sup>rd</sup> & 4 <sup>th</sup> 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