UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND SIMULATE BED CHAIR WITH FRONT REST FOR CHRONIC PATIENT

This report is submitted in accordance with the requirement of the UniversitiTeknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Maintenance) with Honours.

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ABSTRACT

In this revolution of technologist, many product and innovations are created to easier the human activities and demand. All the product are easier to get and reaches with different brand and price starting from furniture, gadgets, transportations, foods and others. However, the consciousness to the patient demanding are still weak in this industry. Most of them are focuses only on healthy people rather than this group of people who suffer with their illness. High cost are needed to get the basic needs for patient since the development for this group are only a few in this world. In everyday, many people are diagnoses with chronic disease due to unhealthy lifestyle and genetic factor. Statistics shows that 70% of them are having a problem with sleeping and suffer with Sleep Apnea problem. One of the symptom is when the patient is unable to sleep in lying position. Thus to overcome this problem, the bed chairs with front rest are created and analyse to investigate the applicable for this group in order to helping them with easier their sleeping on chairs in sitting condition. CATIA V5 are used as tools of software for design the bed chair with front rest. The front rest are important point in this design where it is used as front support for chronic patient to sleep forward position. The front support are consists with head rest, chest rest and arm rest. The complete design then been analyse with RULA analysis which it is used to determine the ergonomic posture of human to prevent any risk of posture when it apply to patient. Structural analysis also used to investigate the strength of structure in design to determine in factor of safety.

ABSTRAK

Dalamrevolusiteknologi yang kianpesatini, banyakprodukdaninovasi yang dihasilkanbagimemudahkandanmemenuhikeperluanmanusia. Hampirkesemuaprodukmudahdiperolehidenganberlainanhargadanjenama. Bagaimanapun, kesedaran orang ramaitentangkeperluanpesakitkronik di duniamasih lag kurangdiberitumpuan. Kebanyakanindustrihanyamenumpukanpenghasilanbarangkeperluanuntukmanusia normal daripadagolonganpesakitini. Kos yang tinggidiperlukanbagimemperolehikeperluanasaskeranahanyabeberapapihakpengeluar yang menyediakanbarangankeperluankepadapesakit. Setiaphari, ramai orang disahkanmenghidapipenyakitkronikdisebabkanpengamalgayahidup yang tidaksihatdanfaktorgenetik yang lemah. Statistikmenunjukkanbahawa 70% daripadapesakitkronikmengalamimasalahgangguantidursepertiApnea. Antarasimptom yang dapatdikenalpastiadalahpesakitmengalamikesukaranuntuktidurdalamkeadaan baring. Olehitu, bagimenyelesaikanmasalahini, kerusitidur yang direkabersamasokonganhadapantelahdiujibagimengenalpastikesesuaiandanmembantudalamkeselesaantidurpesakit. Rekaankerusiinimenggunakan CATIA V5 sebagai medium penghasilanrekaan. Sokonganhadapanmerupakanaspek yang pentingdalamrekaaninibagimembantupesakitkronikuntuktidursecarakehadapandalamkeadaanduduk. Sokonganhadapaninidirekamerangkumisokongankepala, dada dantangan. Rekaankemudiandiujimenggunakanujian RULA bagimengenalpastikedudukanergonomik

yang sesuaisertamencegahdaririsikokedudukanmerbahayakepadapesakit. Ujianstrukturjugadigunakanbagimengujiketahananrekaandalammenampungberatmaksimumpesakit.

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First and foremost I thank ALLAH (my Lord) the all great and merciful who made it possible for me to conduct this study and complete this thesis.

I would like to take this opportunity to express my sincere acknowledgement to my supervisor Mr Mohammad Rafi bin Omar from the Faculty of Mechanical and Manufacturing Engineering Technology University Technical Malaysia Melaka (UTEM) for his supervision, support and encouragement towards the completion of this thesis. This thesis dedicate for his late mother who suffer with chronic disease which unable to sleep in lying position due to womb cancer.

Special thanks to all my peers, my parents and siblings for their moral support in completing this degree. Lastly, thank you to everyone who had been a crucial parts of realization of this project.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In this century, the production in manufacturing process is growing widely in the entire world. It is made with different type of based material which is polymer, steel, rubber and wood. Due to this growth, the development of chairs also rises. Chairs are use as tool for resting their body other than bed. Usually, chairs are developed with these characteristics which are armrest, seat pan and backrest, thoracic and lumbar contouring (Figure 1.1).

There are many chairs that can be found in our daily life such as house, cafeteria, hospital, hotel and office. It was created in different shape and design due to their function and needed. Also, the variety of chairs is easily to be found in hospital. Workers such as nurses, doctors or pharmacists are using a common chair that are different with a patient. Besides a resting the body, chairs also used to help a disability patient to move their body from one place to other place that called as wheelchairs. Sitting is something that human being do repeatedly in a day, yet the effect of poor seat configuration can be striking since it can cause dysfunction, pain, and disability in a long term. It can block the sitter's execution or task, and it can restrain the ecstatic claim and desirability of the seat to buyers and clients. In order to prevent this undesired occurrence from happening, peoples need to

familiarize themselves with proper sitting position as shown in the Figure 1.2. Seat design has been affected by numerous factor concurring clients requests.

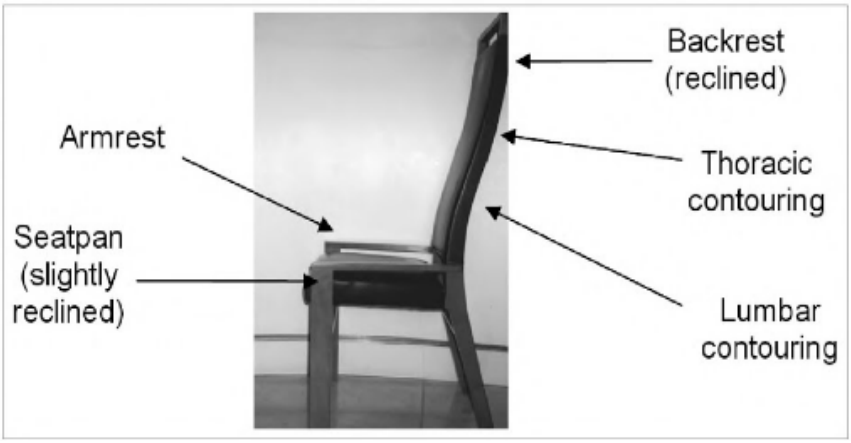

Figure 1.1: Basic Design Features in Chairs Development.

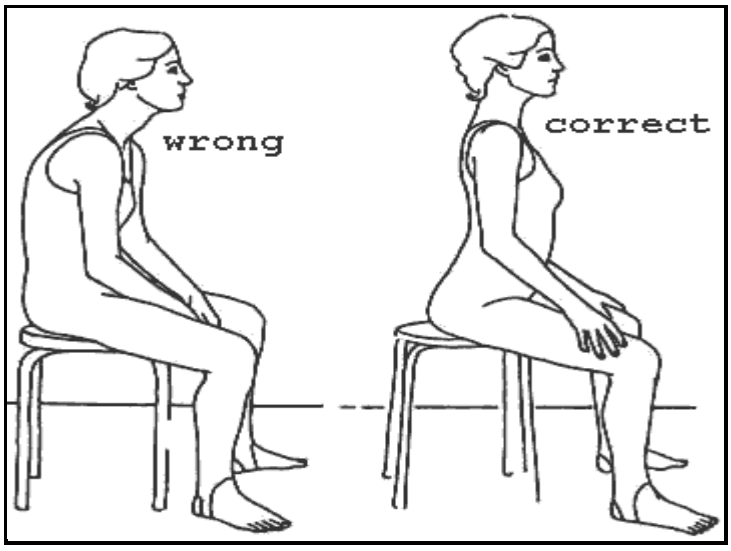

Figure 1.2: An Example for Correct Position in Sitting.

1.2 Background Study

This research was focusing on the development process of chairs that can be used for chronic patient where they can't sleep while lying down position due their physical health condition. The design consists of a few criteria that suitable and comfort for the users which is it have a front rest in addition. Therefore, the patient can use the front support to sleep where they can adjust it according to their comfort. This design is using a

CATIA V5 as design software. This chair will have basic features which is backrest (with thoracic and lumbar contouring), arm rest and seat pan. By referring an ergonomically concept, the design need this basic part to prevent a back pain when the user on it. In additional, to create a design that can solve a main problem which is patient that have a chronic disease which make them unable to sleep due to the pain of disease, this design will add an additional features to the design which is a front support. Front support are important part where it function as supported to front body of patient where they will have a better sleep when lean on this supported. Before this design created, a little some o research and study are going through to learn about the chronic disease and the characteristics about the patient that will need this chair.

Chronic disease is a large term of disease which is consist of complication of health problem such as heart disease, lungs problems, stroke, cancer, and diabetes. Besides Malaysia, other country also faced with this chronic disease such as India and Nigeria. In World Health Organization journal state that chronic disease have a big impact on their country besides HIV, malaria and tuberculosis (World Health Organization, 2005). The main factor that can cause chronic disease is smokers and their people surrounding. Also, this journal state that 80% of chronic disease death occurs in equal numbers among men and women (Figure 1.3). This chronic disease can be overcome using existing knowledge such as people stop or avoid smoking a cigarette or smokers. It occurs when the smoke enters the lung during breathing. Smoke contains a contaminant such as tar which is affected the lung and other organ through the blood. Other than smokers, people who don't have a better health activities life such as exercising and good nutrition also can have a chronic disease such as diabetes and heart problem. To prevent it, they need to change into a better life style such doing exercising and take a nutritious food a health portion. It is

better to prevent than a cure. In United State, their government are spending a high cost in order to prevent a chronic disease (CDC, 2009).

In explanation, some of this diagnosed of chronic disease, they have a problem with sleeping. In example, patients who have a lung and breathing problem were not comfortable to sleep by lying down on mattress or vertical position. The breathing structure have some problem such as blocking airways which make difficulties while breathing. To have a better sleep, they only can sleep with the body in sitting condition. Some of them need to bow or nod their front body in angle 30-120 degree. Therefore, this chairs are being created with front supported. in order to validate this chair, the design will go through an analysis which is RULA analysis and Structure analysis. Both of analyses were function as to test the comfortness of users and the strength of structure for the design.

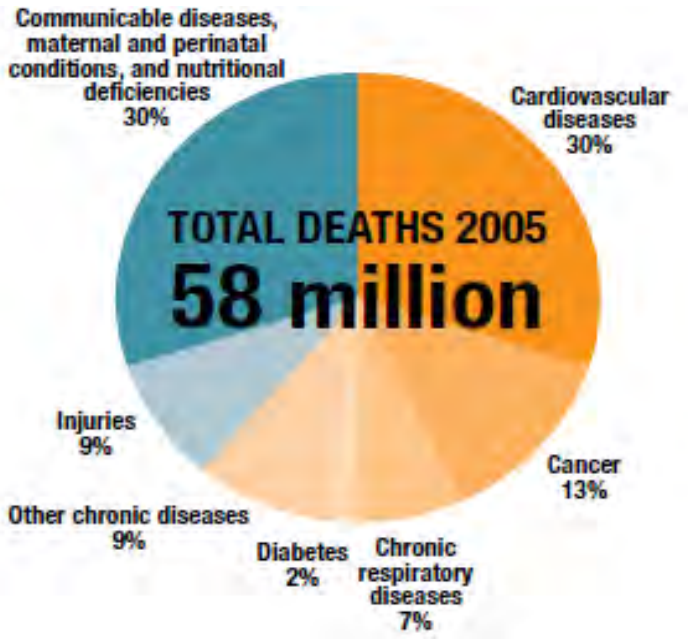

Figure 1.3: The number and rates of projected chronic disease deaths in males and females for four age groups are shown in the table on the facing page. The number of deaths is similar in males and females

1.3 Problem Statement

Some of the patients that have chronic disease really need to bowed or lift their upright during sleeping due to their physical condition of health. The current product for this patient is only bed for lying their body as a normal person. Some of this patient are sleep in sitting position on their sofa or bed. This project was specified on the patient that has a chronic disease such as below:

i. Chronic Obstructive Pulmonary Disease (COPD)

ii. Sleep Disorder (SD)

iii. Congestive Heart Failure (CHF)

iv. Cancer (patient that have a pain after chemotherapy)

Therefore, to overcome this problem, a bed chair comes with a solution to help this patient to get a better sleep and rest. This chair comes with a feature which able to adjust the levels position of the bed. This bed chairs are created with comfortness and strength to prevent any injured for users.

1.4 Objectives

The objectives for this project are:

1) To analyze the strength of design by using Structure Analysis.
2) To analyze the product comfortness for chronic patient to have a better sleep by using RULA Analysis.

1.5 Work Scope

In this task, it covers several work scopes which will be followed to complete this project accordingly. The work scope of this project is:

i. Study the behavior of chronic disease that make a patient unable to sleep in lie position.
ii. Design the bed chair with front rest using CATIA V5.
iii. Simulate for comfortable user by using RULA Analysis.
iv. Simulate for stress of structure by using Structure Analysis.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction of Bed Chairs

Bed chair is a home product that combination of bed and chairs. A chair is a household item with a raised surface bolstered by legs, regularly used to situate by the individual. Besides called as chairs, it also can call as a seat. The word chairs originally are from the early 13th-century English word which*chaere*, stand for (chair, seat, and throne). Chairs have four legs and a backrest. It also may have three legs according to different of shape. Chairs are made of a wide assortment of materials, going from wood to metal to manufactured material such as plastic, and they might be cushioned or upholstered in different colors and textures, either just on the seat like dining chairs or plastic chairs (e.g. restaurant, cafeteria area). While, a bed is a household item which is utilized as a place to rest and relax the body. Most present day beds comprise of a soft, mattress cushion on a frame of bed, the mattress structure either on a strong base, regularly wood supports, or a sprung base. Numerous beds incorporate a container spring internal sprung base, which is a huge sleeping cushion measured box containing wood and springs that give extra help and suspension to the bedding. Figure 2.1 are shows the example of minimalist chairs and bed that easily found in this industry with different price and brand.

In this era globalization, even though the manufacturing's of chairs are widely around the world, there still have a chair that is not good for a people. This is happen when a designer produce a design of seats by un-follow the rules and principle of ergonomics structure. Most of them create a design to attract the customers based on the minimalist of its design. Ergonomic structure are important for every designer of furniture particularly for bed and chairs due to it can effects on the consumer health. Every movement of body is important because it will affect the structure of bone and muscle strictly especially for a specific duration. Comfort and ergonomics, safety and functionality, and durability and clean ability all play a role (Miller, 2009).

Figure 2.1: An office chairs with arm-rest manufacturer by Arlington Executive (UK, 2016) and Minimalist latest design of king size of beds by Sofia Vergara

2.2 Contents of Literature Review

In this chapter, student will cover the topic below which a study of the concept of the product designs which chairs and the type of user that suitable for this product as figure 2.2:

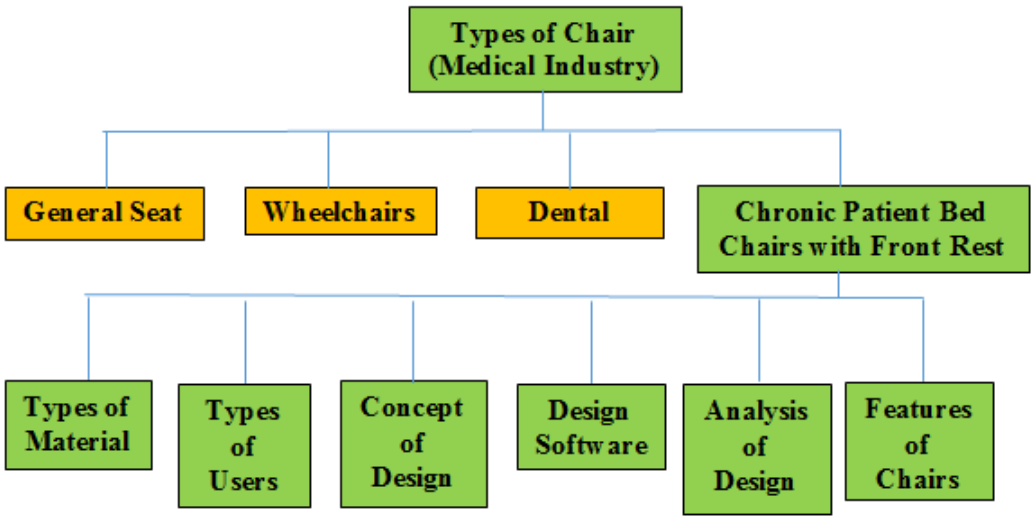

Figure 2.2: Overview of literature review section

2.3 Types of Chairs

In this study, we are focused on a chairs that been utilized in a hospital and clinical area. These chairs are separate into 4 categories which are general seats, wheelchairs, dental chairs and physician's surgical chairs. All of this category are important seats that been used around the world hospitalization. Most of countries have similar functions of seats but different kind of features according to their country technologies and manufacturing.

2.3.1 General Seat

General chair are used as a basic seats that be seen in the daily life. There are many type of general seat with different function, shape, material, design or colour. These chairs are used by the workers and the customer. Since the hospital is the place that has a big area, many different type of chair are easily to be found in this area. The table 2.1 shows the type of general chair that available in the hospital area:

Table 2.1: The type of general chair that available in the hospital area.

Type of Chairs	Diagram	Function
Office Chair (Officer)		Office chairs are used in the working area spaces. It is comfortable seats which is movable chairs and has a comfortable since the sit and backrest made with cushion and sponge.
Office Lobby Chair (Customer)		Normally this type of chair were able to see at the waiting area of the hospital and company spaces. It is used by customers or client while waiting their turn for services and treatment. These chairs were different from other seat because it joint together and become one long chain