UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPEMENT OF RICE TREATMENT METHOD TOWARDS ANKLE SPRAIN SYNDROME

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Manufacturing Engineering Technology (Product Design) with Honours.

by

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2019

DEVELOPEMENT OF RICE TREATMENT METHOD TOWARDS ANKLE SPRAIN SYNDROME

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A thesis submitted
in fulfillment of the requirements for the degree of Process Technology
in Mechanical and Manufacturing Engineering

Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2019

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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SESI PENGAJIAN: 2019/2020

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ABSTRAK

Terdapat banyak kelaziman dalam risiko tinggi terhadap sindrom pergelangan kaki yang boleh berlaku kepada kita. Ini berlaku kerana ligamen yang tertekan yang berlaku di buku lali kita. Namun, kaedah rawatan RICE adalah cara paling mudah untuk memulihkan kecederaan penting ini dan hanya memerlukan 2 minggu untuk fasa rawatan ini. Rehat, ais, mampatan dan ketinggian adalah rawatan awal untuk apa-apa tahap pergelangan kaki. Untuk membentangkan strategi pengurusan yang komprehensif, menilai data kesusasteraan yang terdiri daripada kajian terdahulu dan data internet mengenai rawatan RICE untuk kecederaan buku lali telah dilakukan. Setiap perkataan untuk rawatan ini mempunyai fungsi dan kriteria masing-masing yang diperlukan untuk produk itu yang boleh digunakan oleh pesakit. Walau bagaimanapun, produk RICE di pasaran kini dijual secara berasingan yang boleh kita dapati di farmasi dan kedai sukan. Tujuan projek ini adalah untuk membangunkan kaedah rawatan RICE ke arah sindrom pergelangan kaki dengan memudahcarakan produk pasaran semasa ini menjadi satu fungsi yang mudah. Pengumpulan data kesusasteraan dan data primer akan memberi idea konsep untuk perkembangan produk baru ini. Kaedah pemilihan PUGH adalah cara terbaik untuk memuktamadkan idea konsep yang diingini untuk produk ini. Fasa pembangunan menggunakan perisian SolidWorks dan pembuatan tambahan dilakukan untuk menghasilkan prototaip untuk menguji pesakit. Membandingkan keputusan menggunakan ujian pengimejan dan tekanan akan menjadi pendekatan dalam objektif untuk projek ini. Selain itu, ujian penggunaan produk baru ini juga akan dilakukan kepada pesakit yang terpilih. Produk baru ini akan memudahkan pesakit menggunakannya sebagai rawatan di rumah mereka dan mengurangkan masa pemulihan untuk sindrom pergelangan kaki lengan ini.

ABSTRACT

There is many prevalence in the high risk of ankle sprain syndrome to happen on us. This happen because of the overstretched ligament that occur in our ankle. Yet, RICE treatment method is the simplest way to recover this crucial injury and its only takes 2 weeks for this treatment phase. Rest, ice, compression and elevation is the initial treatment for any grades of ankle sprain. In order to present comprehensive management strategies, evaluating on literature data that consist of previous research and internet data on RICE treatment for ankle sprain had been done. Every word for this treatment have their own function and criteria that need to have in the product for the patient to use it. However, RICE product in the market now sold separately that we can find it at the pharmacy and sports store. The purpose of this project is to develop RICE treatment method towards ankle sprain syndrome by facilitate this current market product into a simple function. Collection of literature data and primary data will give conceptual ideas for this new product development. PUGH selection method is the best way to finalize the desired conceptual ideas for this product. Development phase using SolidWorks software and additive manufacturing is done to produce prototype to test on the patient. Comparing results using imaging test and hand press will be the approach in the objective for this project. Other than that, usability testing will use towards this product for selected patient. This new product will facilitate the patient to use it as their home treatment and reduce recovery time for this ankle sprain syndrome.

DEDICATION

To my beloved mother and father

ACKNOWLEDGEMENTS

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 Nurul Ain Binti Maidin from the Faculty of Mechanical and Manufacturing Engineering Technology Universiti Teknikal Malysia Melaka (UTeM) for his supervision, support and encouragement towards the completion of this thesis.

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

1.0 Introduction

Ankle is one of most important biomechanics part in human body. It helps us on doing our daily life activity. Ankle or the talocrucal region is the region where the foot and the leg meet. This joint allows humans to walk, run, jump, and perform a variety of other actions. Human ankle consist 3 types of bones that have their own function and benefit. In ankle also have 33 types of ligaments that can separate into 3 regions of our ankle that are lateral, deltoid and tibiofibular area. Ligaments in the ankle act as a joint system that connect 3 types of bones in our ankle. Ligaments are strong, fibrous tissues that connect bones to other bones. The ligaments in the ankle help to keep the bones in proper position and stabilize the joint. There are 6 axis of rotation in our ankle that helps our movement between the leg and foot to perform our daily basic activity.

Human ankle is 1 of the crucial part in human body that we need to take serious care in our daily life. As we know, most of daily activity that we done in our life needs our leg and foot to perform our work or task. In sports world, 97% need the movement of human ankle to perform in their games. If the movement of the ankle reach at their own maximum angle, sprain or injury can happen. There are 3 main types of ankle injuries that are sprain, strain and fracture that may occur in our ankle. The most frequent injury that happen in human life is the sprain syndrome and it can be worst if the sprain repeated over and over again. We should aware that ankle sprain syndrome can be happened on various type of age and even male or female.

Ankle sprain syndrome is 1 of the head injury that that always happen in our leg even we do a simple task in our daily life and usually it happened in the lateral area. An ankle sprain occurs when the strong ligaments supporting the ankle extend beyond their boundaries and tears. It can be from mild to serve of pain depending on the tear of the ligaments in human ankle. There are 4 symptoms to identify if we had an ankle sprain injury and probably the 'pop' sound can be heard in our ankle. We have to see the doctor to analyze using press and imaging test on what grades that the patient suffers from the ankle sprain. Every sprain has their own method of treatment to perform back fit to do their daily life activity. There are 3 types of method that the doctor will pursue us for the treatment that are RICE, physical and surgical treatment. Higher the grades of ankle sprain require longer time for the ankle to recover back.

For the early treatment will be the RICE method that are rest, ice, compression and elevation. This method can implement in every ligament injury in the human body especially in human ankle. This treatment is the early treatment for any grades of ankle sprain. RICE method should be applied immediately following an injury. Average within 2 weeks if we implement this method will recover our early ankle sprain syndrome. RICE method is 1 of the home treatment that we can apply by our own self at home and required several products to do it. Mainly every words on the 'RICE' have their own product that the patient has to use for the home treatment. The combination of the 'RICE' method in 1 product that can make it portable and easier for the patient can use at their home.

1.1 Problem Statement

Relationship between human ankle and daily life routine in their life has the biggest concern among people this day. Every activity that use our foot and leg need the movement of ankle to permits movement and contributes to lower limb stability. The ankle sprain syndrome is one of the injury that always occur on us and this injury can be occur over and over again. For 1st grade of ankle sprain syndrome can be identify using hand press method and the easiest recovery method by using RICE method. RICE treatment is the initial treatment that we can do at home and it easy to do. However, this treatment need several products that need to carry out this treatment technique and in the market now only sell separately. Some of the product on the market right now did not suit to use it in our daily life routine at home. To facilitate this problem, combining this RICE treatment product into simple device and maintain the recovery phase for ankle sprain syndrome is the objective for this project.

1.2 Objective

i. Identify ankle sprain syndrome using hand press method.

ii. To develop the RICE treatment method into product.

iii. To test the RICE treatment method.

1.3 Scope of Work

Scopes for this study is based on objectives that have been stated and these are the several scopes that will be carrying out:

i. Investigate human ankle towards the sprain syndrome by using hand press method.

ii. Explore the RICE treatment method in ankle sprain syndrome.

iii. Analyze quantitative data from the respondent for this RICE treatment method.

iv. Implementation of Morphological Chart and PUGH method for the design and development of the RICE treatment product.

v. Make a 3d modelling using SolidWorks Software.

vi. Fabricate, test and analyze the result of the ankle sprain syndrome via usability testing.

1.4 Significant of Study

The direct beneficiaries of the project will be known which muscle or ligaments that effect towards the ankle sprain syndrome. The scientific community will gain a better understanding in terms of the fundamental scientific knowledge of the ankle sprain syndrome. Focus on the 1st grade of ankle sprain syndrome, 2 weeks needed for recovery from this injury. Implementation of RICE treatment is the initial method to pick it as a home treatment to shoot out this painful syndrome. This new development product will facilitate product use for the community with maintaining the initial recovery phase for this ankle sprain syndrome.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Literature review is an evaluative report of data found in the writing that relates to the field of study. The purpose of a literature review is to describe or set up the field of studies in the chosen point. Literature review may consist of books, journal, article, thesis, website or some other resources. Particularly, this study is strongly assigned to develop of RICE treatment method towards ankle sprain syndrome and in order to compose this literature review, the journal needs to be interpreted along with all of the references that relates to the project. In addition, this section will clarify all the theory and execution of the parts in regards to the project to accomplish the project objective in detail.

2.1 Bones On Ankle

Ankle is one of the most important mechanisms part in the human body. It helps us to allow movement and lower the stability of the limbs. This foot and leg joint allows people to walk, run, kick, and perform a variety of other actions in their daily life. There are 3 types of bone that are connected to each other that are tibia, fibula and talus. It also has 3 main part that consist 30 types of ligaments that connect bone to bone. Ankle is one of the important biomechanics part in human body that help us perform our life better. Bones is a main structure of our body that have strength in it.

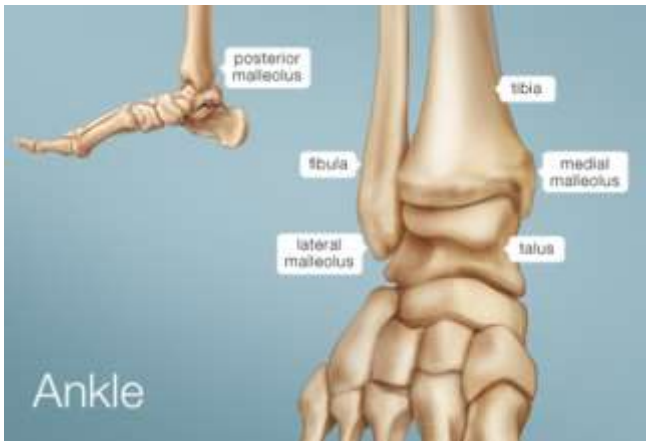

Figure 2.1 Bones and Area of the Ankle (web.md.com)

According to (Brockett & Chapman, 2016) all bones that joint with ligaments have their own section in our ankle. For medial and posterior area, we can observe the joint system between tibia and talus bone. While, lateral area we observe the joint system between fibula and talus bone. Most of the injuries that occur in our ankle are in medial and lateral area. This area is the most frequent are to have injury.

i. The subtalar joint (Tibia)

Tibia bone connected to the Achilles tendon. It is the largest, strongest and most rear bone of the foot. It is located below the talus and forms a uniaxial triplanar joint with the talus. The talus joint rests on the calcaneus ' anterior portion. This bone is the vertical bone that cover our leg in human body.

ii. The tibiotalar joint (Talus)

The tibiotalar joint forms the junction between tibia and fibula. The tibiotalar interface is the load bearing aspect of this joint. The talus bone includes head, neck and body and does not have a direct connection to the muscle. This medial bone is the middle between leg and the foot.

iii. The tibiofibular joint (Fibula)

This joint refer to the fibula bone that the joint primary function is a static blazing role, which adds stability to the foot and ankle rather than additional motion. The ligamentous constraint makes it highly susceptible to injury, often involving injuries to ankle fracture and eversion. The bone covers the lateral area of the human ankle.

2.2 Ligaments On Ankle

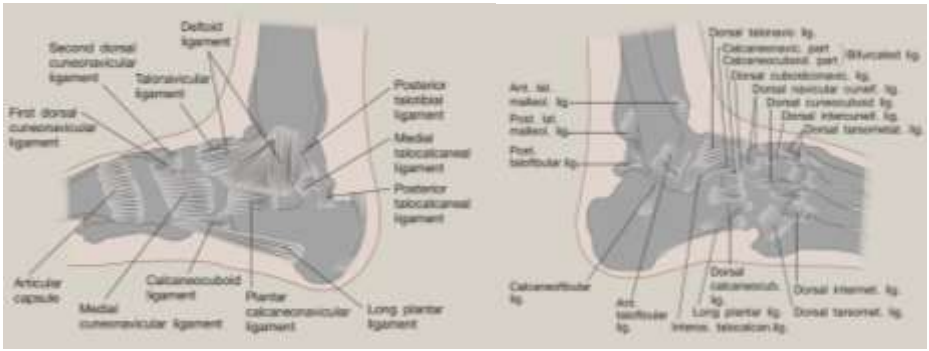

Figure 2.2 Types Of Ligaments In Our Ankle (Brockett & Chapman, 2016)

There are 30 types of ligaments that consist in our ankle. Ligament is a tough fibrous band of connective tissue that supports the internal organs and holds bones together at the joints properly. A ligament consists of dense fibrous bundles of collagen fibers and spindle-shaped cells known as fibrocytes with little ground substance (a gel-like component of the different connective tissues). Refer to (Golanó et al., 2016), the ligaments around the ankle can be divided into three groups, depending on their anatomical position. The lateral ligaments, the medial deltoid ligament, and the tibiofibular syndesmosis ligaments that join the distal epiphysis of the leg bones (tibia and fibula).

2.2.1 Area of Ligaments

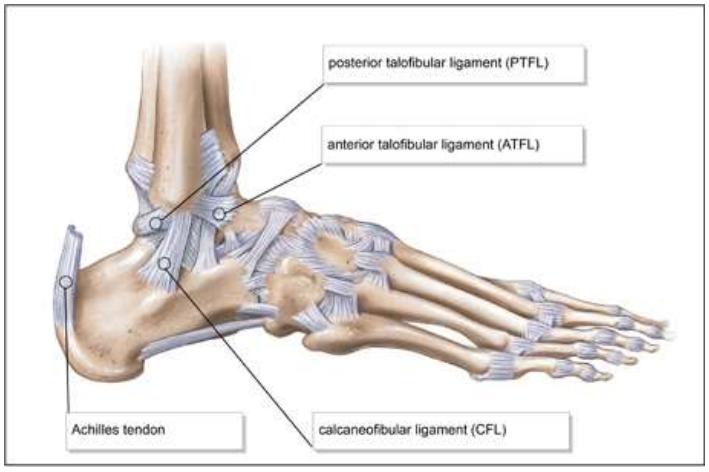

Figure 2.3 Lateral Ligaments (physio-pedia.com)

This area of ligament is the most frequently injured ligament of the ankle and is the most frequently observed injury in the emergency room. This ligament plays an important role in limiting anterior displacement of the talus and plantar flexion of the ankle. This is what we call it as the outer part on our ankle.

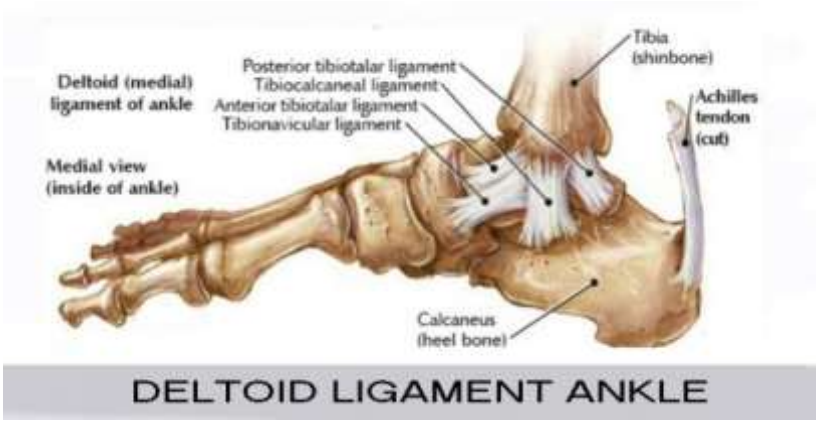

Figure 2.4 Deltoid ligaments (worldwidelifestyle.com)