UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ELECTROMYOGRAPHY SENSING ON TIBIALIS AND PERONEUS MUSCLE AGAINST IMPROVISED FLAT FEET ORTHOTIC INSOLE

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

NURATIFAH BINTI ABDUL KUDUS

B071510362

960311055614

FACULTY OF MECHANICAL AND MANUFACTURING ENGINEERING TECHNOLOGY

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Product Design) with Honours. The member of the supervisory is as follow:

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Co-supervisor: Encik Mohd. Hidayat Bin Abdul Rahman

ABSTRAK

Sukan memainkan peranan penting dalam kehidupan manusia kerana ia mengekalkan kesihatan badan. Golongan muda mahupun tua banyak terlibat dalam aktiviti sukan.Lapik kaki yang mempunyai serapan yang baik adalah penting untuk mengurangkan kesakitan kaki semasa melakukan sebarang aktiviti sukan. Bagi individu yang mempunyai bentuk kaki yang normal, ini bukan masalah besar apabila melakukan aktiviti sukan, tetapi untuk individu yang mempunyai bentuk kaki yang rata, mereka menghadapi pelbagai risiko semasa melakukan aktiviti sukan seperti sakit di bahagian lekuk kaki dan lenguh. Kepentingan projek ini dijalankan adalah untuk mengesan elektromilografi pada otot tibial dan peroneal terhadap pelapik kaki ortotik. Ciri-ciri utama reka bentuk pelapik kaki ortotik adalah mempunyai sokongan lengkungan yang cukup, pad tumit, pad metatarsal dan cawan tumit yang mendalam. Analisis tekanan plantar kaki diambil untuk meneliti bahagian tekanan tertinggi pada tapak kaki. Proses pembuatan bagi pelapik kaki ortotik ini terbahagi kepada dua iaitu proses acuan kayu dan proses pemutus vakum. Bahan yang digunakan dalam pembuatan pelapik kaki ortotik bagi telapak kaki rata adalah Flexifoam X. Kedua-dua pelapik kaki ortotik dinilai dan dibandingkan oleh electromyography (EMG) pada otot tibial dan peroneal yang dihasilkan oleh kekuatan otot semasa pergerakan kaki.

ABSTRACT

Sports play a great role in human life as it keeps body healthy and active. Youngest and adults involved in sports. The great shock absorber of the insole for the foot is important to reduce the foot pain while doing sports. For normal feet, it is not the big issue when doing sports, but for flat feet person, they undergo high-risk associate on foot pain, foot problems while doing sports activities such as running.This project presents electromyography sensing on tibialis and peroneus muscle against improvised flat feet orthotic insole .The main characteristics of orthotics insole design are sufficient arch support, heel pad, metatarsal pads and deep heel cup. Ergonomics length, width and thickness of orthotics insole are based on the survey questionnaire of Malaysian standards foot size that has been distributed online. The foot plantar pressure analysis is obtained to research the highest pressure on plantar foot area. The process fabricating the orthotics insole is divided into two which are wood moulding process.Flexifoam X is used in fabricating the improvised orthotic insole for flat feet. The comparison was made on fabricated orthotics insole with the existing orthotics insole that comes from the different material. Both of the orthotics insoles are evaluated and compared against the measured data of electromyography (EMG) at tibialis anterior and peroneus longus that generated by the muscle strength responsible for the lower limb movement. The sult shown that fabricated insole showed a bit of improvement based on the electromyography sensing testing on muscle fatique compare to the existing insole.

DEDICATION

To my beloved parents and siblings

Abdul Kudus bin Mahat
Norhayati binti Hasim
Nurhanisah binti Abdul Kudus
Nurhidayah binti Abdul Kudus
Nur Arif Aiman bin Abdul Kudus
Nur Ain Safiah binti Abdul Kudus

Thank you for all supports, sacrifices and patients that have been shared with me.

To my honoured supervisor and co-supervisor

Puan Umi Hayati binti Ahmad & Encik Mohd. Hidayat Bin Abdul Rahman

Thank you for always giving me guidance to complete this thesis project.

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LIST OF ABBREVIATIONS

EMG	Electromyography
MLA	Medial longitudinal arch
FFF	Flexible Flat Foot
FFF-STA	Flexible Flat Foot with Short Tendo-Achilles
LFM	Linear Fit Method
RMS	Root Mean Square
CGA	Clinical Gait Analysis
CAD	Computer-Aided - Design
CNC	Computer Numerical Control
MDF	Median Frequency
TD	Time Domain Analysis
MSD	Musculoskeletal disorders
FD	Frequency Domain Analysis

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter will focus on researchers according to the project. Firstly, it will focus on the background and objectives of the project, Then, will proceed with the description of the problem statement for the project and briefing about the overall project. From that, the scope will be elaborate in order to achieve the expected result of this project.

1.1 Research Background

Sports play a great role in human life as it keeps body healthy and active. A healthy body leads to a healthy mind. Most sports activities involve the locomotion of leg muscles. Walking and running are the simplest activities that have been a daily routine for humans being. Walking is when only one foot at a time leaves contact with the ground. According to research, the average human walks a day is about three thousand steps. Running is when both feet are off the ground with each step. Running is a method of terrestrial locomotion allowing humans to move rapidly on foot that is related to the movement of the lower limb. Most of youngest or adults involved in sports as it gives a lot of benefits and can lead to a healthy lifestyle but people with flat feet, they will undergo high risk when doing any sports activities.

Most people have a gap under the arch of their foot when standing. People with flat feet or fallen arches have the low medial longitudinal arch structure of foot either have no arch, or it is very low. People with flat feet will suffer painful or achy feet, especially in the ideas of the arches and heels when walking, running or do any sports activities for long periods due to high forces on foot. Besides that, the person with flat feet also can also have back pain if they do not wear a proper footwear to minimize the forces on their foot.

There are various types of shoes created by inventors nowadays that have trendy and exquisite and design. Shoes is a footwear that becomes indeed necessary accessories for human to protect and comfort feet while doing various activities. Insoles are an interior bottom of a shoe that is placed within the shoe, under the footbed. The insole is an important part of shoes that provide arch support and shock absorption for the heel. The Romans were the originators that encasing shoe to the Mediterranean world. Various type of leather footwear is wore within the Roman Empire. At that moment, the shoe is called 'caliga'(Gill, 2014). The design of caliga is exposing the toes, had a lattice patterned and heavy nail sole. At this age, the shoes represent one status and comfort is not an important matter to be bothered.

During the 1800's, the shoemaker receive complains from the traveller about the pain on foot while travelling (Kaye,2011). Thus, the issue of shoe comfort is highlighted and to be solved by shoe inventor. In 1865, Everett H. Dunbar makes a breakthrough by inventing an arch support orthotic (Hayes,2013). Arch orthotics is a shoe insole that is design like the shape of an arch and it is a function to provide support or cushion to feet and help to curb pain on feet. Everett H. Dunbar inserts a layer of leather between the insole and outsole of the shoe that is shaped like an arch which resembles the shape of