UNIVERSITI TEKNOLOGI MARA

EFFECTS OF MATERIAL AND INFILL DENSITY TOWARDS ADJUSTABLE HEADREST ORTHOSIS DEVELOPMENT BASED ON 3D PRINTING TECHNOLOGY

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Dissertation submitted in partial fulfilment
of the requirements for the degree of
Master of Science
(Mechanical Engineering)

Faculty of Mechanical Engineering

March 2020

AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This dissertation has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

In recent years, there has been a number of noteworthy improvements and considerable advances s in the medical management of cerebral palsy (CP). Children with spastic or dyskinetic CP struggle to stand still and they spend most of their time seated, spending most of their time in a wheelchair. Therefore, a suitable headrest to maximize independence and functionality in sitting position, is a good addition. This study aims to analyze the effects of material properties and infill density in selected 3D printing material in an adjustable headrest for total body involvement in CP children as well as to determine the material used to fabricate the adjustable headrest in addition to fabricate the adjustable headrest using the chosen material in a 3D printer. The headrest is designed as a curved headrest with lateral support by means of three-point lateral control and affixed with a head strap for temporal support. It is subjected for use with children with age range from seven to nine years and limited to a five types of 3D printing materials namely ABS (Acrylonitrile Butadiene Styrene), Nylon (Polyamide), PETG (Polyethylene Terephthalate), PC (Polycarbonate) and PLA (Polylactic Acid). A Computer Aided Design (CAD) software is utilised in the design process and subsequently the final design is analysed using the Finite Element Model (FEA). A selection of 20%, 40%, 60% and 80% of infill density is applied as well as increment of pressure magnitudes of 5 kPa, 10 kPa, 15 kPa, 20 kPa and 25 kPa to predict the safety of the product at higher impact load. PLA is selected as the final material as it has the optimum value in stress, deformation and safety factor parameters.

ACKNOWLEDGEMENT

Allah planned. And Allah is the best of planners (Al-Imran 3:54)

With his grace, I would like to thank the almighty for realizing my dream to finalized my Master's degree. It has been ten years in the making. With His grace I am now absolved.

My gratitude and everlasting thanks go to my supervisor TS Dr. Abdul Halim bin Abdullah and co-supervisor Dr. Mohd Hafiz bin Mohd Noh for the guidance given and the unassuming faith in my ability to actually conclude the dissertation. If I can be half as good as an educator as both of them, I would consider it my privilege.

I am forever indebted to my family, especially my parents Ahmad bin Meran and Raoyah binti Chu for their immovable believe in me. Special thanks to my sister, for veering me from being hoisted by my own petard. No amount of words can express my appreciation.

Disclaimer: No blood, sweat and tears were spilled during the completion of the dissertation. However a copious amount of coffee were consumed along the duration, in combination with the background noise of a franchise set a long time ago in a galaxy far, far away.

May The Force Be With You.

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