

Design & Analysis of Ankle Foot Orthosis for Assisting Car Driver after Ankle Surgery

Rosdi Daud, M. Daud, H-Mas Ayu, A. Shah

1. Faculty of Mechanical & Automotive Engineering Technology, Universiti Malaysia Pahang, Pekan, Malaysia
2. Faculty of Technical and Vocational, Universiti Pendidikan Sultan Idris, Malaysia.

Abstract:

Car accidents often occur and normally affected the car driver's foot and ankle. If it is involved surgery for the ankle treatment, the recovery process normally takes a long time. As a normal practice, ankle foot orthosis (AFO) will be worn by an ankle injury patient for shorten the recovery process and also to protect the foot from the pressure of the pedal car while driving especially during the event of such a sudden stop. However, the detail investigation of the suitability of AFO in absorbing or stand the pressure from pedal car during emergency stop is still lacking. Thus, the aim of this study is to investigate the suitability of the current AFO in absorbing or stand the pressure from pedal car during emergency stop and then propose the optimum one. The study was carried out by measuring the foot anthropometric of volunteer which it is to be used in designing the proposed AFO using Solidworks software. There are three designs were constructed and analyzed to determine the optimum. Analytical process is done using ANSYS software and carbon fiber and polypropylene (PP) were chosen for analyze the most suitability material for this special AFO (to use for protect immobilize foot during emergency braking). In respect to the material of AFO, results obtained can be concluded that PP is not suitable for this special AFO in absorbing impact during emergency brake. The FE results of the three designs were recorded and compared using the "screening" concept. Design with lowest stress factor is the optimum design and suitable for drivers who have undergone ankle surgery. Based on the screening concept table, the second design is chosen as the optimum one. It gave the lowest maximum stress $4.5495 \text{ E} + 08$ and the safety factor is 7.0337. In respect of the geometry, based on FE simulation result and concept screening table, we can concluded that the design 2 was the optimum design. However, a better confidence of this optimum design to apply in AFO can be obtained by producing the real AFO model and then further testing needs to be conducted in order to evaluate whether or not, this device able to sustain the impact of emergency braking.

Keywords: Ankle Foot Orthosis; Finite Element Analysis; Optimization; Anthropometric And Screening Concept

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