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THE ASSESSMENT OF THE CLUBFOOT CHILDREN'S ORTHOTIC NEED FOR THE DEVELOPMENT OF THE FOOT ABDUCTION ORTHOSIS (FAO) PROTOTYPE DESIGN

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Abstract- Foot abduction is an immanent component of treatment within the Ponseti method. It is a treatment procedure where the clubfoot patient adheres to the post-corrective bracing protocol to prevent relapse of the deformity that has turned the foot downward and elevated inwards. In order to encourage the patients' compliance to the foot abduction orthosis (FAO), various designs have been introduced in the market in the hope of improving the rate of compliance. The purpose of this paper is to elucidate the assessment of the clubfoot patients' FAO need at the orthopaedic clinic of Hospital Universiti Sains Malaysia in Kelantan, Malaysia. The assessment aims to understand the clubfoot patients' lower limb movements, in order to generate ideas for the prototype design development to improve the FAO design based on the existing product in the market. The FAO that was referred for further design improvements are the Denis Browne splint and the Markel shoes. In addition, a total of 10 clubfoot patients' parents were interviewed to obtain user experience data. This study suggests the need to eliminate the foot plates and the bulky protruding shoe and brace locks that are heavy due to the material use. Consequently, a conceptual design of the FAO was successfully developed as a proposal for potential future development of the working prototype to optimise the patients' dynamic movement.

Keywords- Clubfoot, Conceptual Design, FAO Design, Prototype Development.

I. INTRODUCTION

Clubfoot, also known as Congenital TalipesEquino Varus (CTEV) is a congenital deformity of the foot among children. It is a condition where the deformity has turned the foot downward and elevated inwards. Initial treatment for this deformity incorporating the Ponseti method; a non-operative with serial manipulation and casting. This is the standard treatment for the correction of clubfoot deformity[1]. The method as [2]underlines in the book titled Clubfoot: Ponseti Management; a standard treatment throughout the world. The technique involves foot manipulation through a series of foot casting and foot bracing (see Fig.1, Fig.2). The objective of foot bracing in Ponseti protocol is to maintain the earlier manipulated foot for a certain period in abduction and dorsiflexion to prevent relapse. The brace is a metal bar, attached to straight-last open-toe shoes and referred as a foot abduction orthosis (FAO) in the medical field. During the intensive phase, the orthosis needs to be worn 23 hours a day for 4 months. It will be followed by the maintenance phase which is the wearing of the FAO at night time until the child is around 4 years old. To keep bracing the foot in the orthosis is extremely important in order to prevent relapse of the clubfoot.

Newly developed brace designs have been introduced and this aims to improve the rate of compliance with post-corrective bracing [3]. Brace designs such as the Mitchell-Ponseti splint, the Dobbs dynamic splint, Steenbeek splint, and Denis Browne splint are the standard FAO products available in the market. However, as emphasised by [4] these newly designed braces are expensive and economically unpurchaseable to low-income population. The purpose of the current design research is to improve the design of the FAO by studying the clubfoot patients' lower limb movements and the physiologic connection to the technical design features of the Denis Browne splint and Markel shoes. On contrary, this study is not denigrating the two established FAO products, rather it proposes the potential of further design expansion, departing from the product that manifest well-built FAO design foundation. The study took place at the orthopaedic clinic of Hospital Universiti Sains Malaysia, in Kelantan, Malaysia.

Fig. 1:Serial Clubfoot casting.
Source:http://www.delhifootankleclinic.com

Fig. 2:Clubfoot bracing using the Foot Abducted Orthosis (FAO).
Source: http://www.nhs.uk