VIRTUAL MODELS AND PROTOTYPE OF INDIVIDUAL ANKLE FOOT ORTHOSIS

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INTRODUCTION

Ankle-foot orthoses are used mainly in case of disability of neurological origin (cerebral palsy, stroke, spinal cord injury) or musculoskeletal origin (trauma, ageing).
The study is oriented to develop new orthoses to assist the very frequently observed gait abnormalities relating the human ankle-foot complex using CAD modeling.
Computer modeling is a perspective method for optimal design of prosthesis and orthoses. Using CAD geometry different tests could be made without loosing of material and essential design variables could be modified.

METHODS

The main goal is to assist the ankle-foot flexors and extensors during the gait cycle (stance and swing). To realize this aim it is necessary to propose an orthosis model developed based on the 3D biomechanical lower limb model.
Using CAD technology different models of the system AFO (Ankle-Foot-Orthosis) are developed. On the base of the 3D models, the physical AFO models could be elaborated and it is possible to use advanced design and manufacturing technologies: computer aided design (CAD), computer aided manufacturing (CAM) and to combine with computer numerical control (CNC). As result CAD/CAM/CNC could be combine also with rapid prototyping (RP) and rapid tooling (RT). Laser scanning is used to obtain the individual surfaces of patient ankle-foot in order to create a solid model of ankle-foot.

RESULTS AND DISCUSSION

A basic virtual model of the experimental active ankle-foot is developed and shown on (Fig. 1). The model is based on laser scanning and on the contours representing the ankle-foot geometry. Surface and solid models were constructed in Pro/Engineer. The deformation analysis of the 3D model of the new proposed orthoses in Pro/Mechanica is performed. Using Rapid Prototyping technology a physical prototype is manufactured and is under investigation (Fig.2)

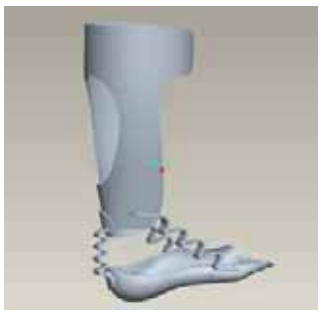

Fig. 1 Virtual ProEngineer Model of Ankle-Foot Orthoses

Fig. 2 Physical Model of Ankle-Foot Orthoses using Rapid Prototyping

CONCLUSIONS

An appropriate AFO design is achieved and manufactured using Rapid Prototyping technology. The difference with the traditional approaches is that the proposed AFO is made using optimal orthoses design on the base of laser scanning by manipulating CAD/CAM methods. The designed AFO is under FEA tests for breaking resistant by frequency and temperature loads.

REFERENCES

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