SENSORISED CHILD WALKER FOR THE ASSESSMENT OF REHABILITATION THERAPIES

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Introduction

The balance and corporal position of people with movement disorders improve when walkers or devices for the mobility aid are used [1]. The ability to walk and interact with the environment causes improvements in the gait, the muscle strength, the endurance, and the muscle innervation. In addition, the use of gait support systems promotes user participation and interaction, giving them greater autonomy and a better life quality. There are many works that offer solutions adapted to the patient's condition and their pathology and allow doctors to personalize rehabilitation therapies based on patient's evolution [2, 3]. However, many static training platforms, pediatric exoskeletons and smart walkers can be unfeasible for most rehabilitation centers. This project addresses the development of an affordable sensorised walker capable of detecting and storing parameters induced by the patient in a passive posterior walker prototype. The walker is designed for training the gait and monitoring of the patient's progress. In this way, professionals in the rehabilitation field such as orthopedists, doctors and physiotherapists will be able to use the electronic instrumentation of the walker to complement the obtained information through observational assessment scales and personalize recovery therapies taking into account the data provided by each user in the performed tests.

Methods

The proposed sensorised child walker (protected by the patent application: P202230983) is shown in Figure 1 and offers posterior support to patients between 3 and 8 years old with mobility problems. The wheeled U-shaped structure envelopes the user and allows the subject to move safely, avoiding any direct collisions between the child and the environment. In order to measure the exerted force by the patient, the walker integrates one load cell in the seat (SIWAREX® WL200 SP-S AA, Siemens Process Instrumentation, Germany), and two load cells in the upper front hand support (model 1042 Tedea Huntleigh, Vishay Precision Group, EU). In this way, the patient's interaction with the stand-up structure can be registered. Moreover, the back inclination is measured thanks to an inertial measurement unit (InvenSense® MPU6050, TDK Corporation, Japan) and the lower body muscular activity with the use of eight low cost electromyography sensors (MyoWare®, Advancer Technologies). All the signals mentioned are acquired by a controller (myRIO-1900 of National Instruments). An intuitive and easy application has been developed in LabView and allows the medical personnel to control the acquisition system, configure the patient's session, view the data in real time during the session and save them once the test has finished.

Three pediatric volunteers without mobility problems performed the first tests to evaluate the walker prototype during a simple trial. The patient had to follow a L-shaped path marked on the ground and return to the initial point with a normal gait without time limitation.

Figure 1: Sensorised child walker with subject during the experimental trial.

Once different sensors are located appropriately on the child and the structure is adapted to the subject, the friendly interface allows the acquisition and the recording of the sensor parameters during the different trials.

Results and Discussion

The results obtained with healthy children show that the subjects exerted loads between 40% and 70% of their corporal weight on the seat, whereas the magnitude of the loads is around 7% of the corporal weight on the superior hands support. Besides, specialists have verified that the users walked with the back straightened during all the trial and the different legs muscular groups were activating as expected in each step during the gait.

References

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Acknowledgements

This work was supported by the University of Malaga.