

Thesis Project Portfolio

Modular Walker Handles for a Motorized Posterior Walker

(Technical Report)

Disparities in Cerebral Palsy Treatment: A Comparative Analysis of Pakistan and the United States

(STS Research Paper)

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Executive Summary

Cerebral Palsy is a debilitating congenital condition that affects approximately one in 345 children in the United States (Centers for Disease Control and Prevention, n.d.). CP results from abnormal brain development or damage to the developing brain, leading to difficulties in controlling muscles, which therefore affect movement and posture. To combat this issue, the gait lab at UVA is working to create a motorized posterior walker to optimize energy consumption during walking. The walker requires handles attached with force transducers, which are being developed as part of my senior capstone project. In Pakistan CP affects 1.22 in 1000 children. However, that number might alter due to lack of technology in the third world country. Knowing that CP requires an attentive treatment plan and that Pakistan does not have updated research on CP, especially when compared with the states, the STS portion of this paper aims to focus on the variation amongst treatments in Pakistan and the States. A cure for CP has yet to be found, meaning differing treatments are the only option for these children. Furthermore, the symptoms of CP exist on a large scale, ranging from immobility to slight impairment while walking. For these reasons it is important to research on the various treatment options for CP, such as the motorized walker at the Gait Lab, as it allows for increased relief for children.

This research project focuses on addressing the inefficiencies in data collection during a clinical trial aimed at developing a motorized posterior walker for children with CP at the University of Virginia's Motion Analysis and Motor Performance Laboratory. The existing process involves interchanging a pair of force transducers between a standard walker and a motorized version, which is time-consuming, error-prone, and requires multiple personnel. To streamline this process, the locking mechanism was redesigned- integrating the handle and transducer into a single unit. To do so, computer-aided design (CAD) and 3D printing technologies were used to create multiple prototypes, focusing on efficiency and durability. The

final design utilized a button locking mechanism, eliminating the need for external tools and reducing the attachment time to 30 seconds, requiring only one person for the procedure.

The implementation of the redesigned locking mechanism significantly improved efficiency and usability in the clinical trial setup. The final design allowed for rapid attachment and detachment of the handle and transducer, reducing the time required for data collection from five minutes to 30 seconds. Moreover, the new mechanism minimized the risk of data inaccuracies associated with the previous process, where multiple personnel were involved in handling the equipment. Finite element analysis (FEA) confirmed the durability of the design, ensuring it could withstand forces encountered during clinical trials. The project's success in redesigning the handle mechanism holds promise for enhancing data accuracy and operational efficiency in clinical trials involving mobility aids for children with CP.

The sociotechnical portion of the paper investigates the treatment disparities in CP between the United States and Pakistan. The research delves into understanding the differential access to CP treatments in these two countries, given their distinct healthcare landscapes. Significance lies in highlighting the global discrepancies in CP care and the implications for individuals living with the condition. The study employs qualitative interviews with healthcare professionals from both nations to illuminate the contrasting treatment availability and shed light on the need for equitable care worldwide.

Drawing on qualitative interviews with healthcare professionals, the evidence reveals stark differences in CP treatment between the US and Pakistan. While the US boasts comprehensive interventions ranging from physical therapy to surgical procedures, Pakistan faces challenges such as limited healthcare infrastructure and resources. Despite efforts to improve CP care in Pakistan, disparities persist due to factors like financial constraints and a

shortage of trained professionals. It is concluded that there is an urgent need for global collaboration and resource allocation to ensure equitable access to CP care for all individuals, regardless of geographic location or socioeconomic status.

Works Cited

Centers for Disease Control and Prevention. (2019). The importance of preventive care.
<https://www.cdc.gov/healthcommunication/toolstemplates/entertainment/tips/PreventiveCare.html>