Let's Ride: design of an adaptive tricycle system for client with cerebral palsy

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INTRODUCTION

Cycling has been proven to be a beneficial form of physical therapy for people with cerebral palsy (CP) because it improves coordination and balance [1], strengthens muscles, and improves bone mineral density [2]. In addition, having access to recreational activities such as cycling has been shown to positively influence self-esteem and quality of life in people with disabilities [3].

The client, a 17 year-old female with Gross Motor Function Classification System level III spastic CP wished to ride a tricycle but could not find one that accommodated her leg length discrepancy and severely limited flexibility in her knees and hips. The client's right leg was 3.5 centimeters shorter than her left, both knees were limited to 61% of typical knee flexion (calculated based on the average person at the 50th percentile) and the right and left hips were limited to 66% and 62% of typical hip flexion respectively (a summary is provided in Table 1) [4]. From a young age, the client had ridden an upright adapted tricycle by Rifton Equipment for therapy and recreation. She outgrew her Rifton tricycle at the age of 14 and an adult size semi-recumbent tricycle, by Freedom Concepts, the ASR 2011 as shown in Figure 1, was donated to her. However, the adjustability of the tricycle was limited and she was unable to complete a pedal rotation, which prevented her from riding. During the past three years, she has attempted modifications to this tricycle while also testing many adapted tricycles on the market. She has been unable to complete a full rotation on any of the tricycles. She sought help from the University to adapt her Freedom Concepts tricycle to allow her to ride.

Figure 1. The Freedom Concepts tricycle that was

The purpose of the project was to adapt the client's semi-recumbent tricycle to allow her to ride. The design criteria included: independent cycling for at least 30 minutes at a time, low cost, and ease of maintenance for a non-technical parent. This paper outlines the design process used to solve this problem.

ACKNOWLEDGEMENTS

We would like to thank Dr. Davies, Elizabeth Delarosa, Karen Forbes and Jan Sneep for advising us, Karen Forbes for bringing the project forward, and Andrew Gowthorpe and Louise Munro for assisting in implementing the designs. Most importantly, we would like to thank the client and her family for their dedication to the project and patience while we learned.