Designing a Novel Spill-proof Cup for Individuals with Cerebral Palsy
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Introduction: Individuals with cerebral palsy (CP) face challenges with independence and safety while drinking liquids from traditional cups because of (1) dysphagia due to oral motor weakness and discoordination and (2) limited manual dexterity due to upper extremity (UE) impairment. Specialized cups on the market do not fully address these challenges and are not visually appealing for adults. Our interdisciplinary team designed a visually appealing spill-proof cup to accommodate oral motor and UE impairments and to promote independence and safety with drinking (Figure 1). A dual-chamber design limits sip size to reduce fluid loss and aspiration risk. Additional features facilitate grasping and reduce tipping of the cup. The aim of this pilot feasibility study was to test ergonomics of the novel cup design - comfort, ease of grasp and drinking, and liquid lost in tilting the cup - in people with cerebral palsy (PWCP).

Materials and Methods: Twenty participants, 10 with CP (ages 21-44 years, mean age 30 years; 5 males, 5 females), and 10 healthy volunteers, were recruited from an adult day program and university, respectively. Case eligibility criteria included: adults with CP, capable of independent consent and complying with test procedures, medically stable, not allergic to plastic, and without a history of aspiration. Nineteen participants completed the study (9 PWCP and 10 controls). Informed consent was obtained. Participants drank two sips of water from a regular cup or their own specialized cup, followed by two sips from the novel cup. At least two experienced feeding therapists (speech-language pathologists or occupational therapists) completed the Therapist Observation Scale (TOS) designed to record the participants’ UE function and ease using the cup. At the end of the study, the Participant Rating Scale (PRS) was administered to obtain the participants’ impressions of grasping and using the cup and their overall satisfaction with the cup.

Results and Discussion: Data from the TOS revealed no UE impairments in the control group, with at least one type of UE impairment (e.g., ataxia, tremors) in each participant with CP. Most participants (89% of PWCP and 90% of controls) had no difficulty drinking from the cup. None of the control group had difficulty grasping and lifting the novel cup, while 3 members of the PWCP group (33%) experienced mild difficulty grasping and lifting the cup. No participants demonstrated clinical signs of aspiration during the study. We obtained helpful suggestions to improve the cup from the PRS.

Conclusions: Our pilot study suggested that this novel cup may be a safe and appealing intervention for promoting independence in individuals with UE or oral motor impairments. We plan to incorporate the results of this study into cup design modifications for future research with individuals with CP with and without a history of aspiration.