

Development of Assistive Devices for Eye Drop Administration in Patients with Cerebral Palsy

Anthony Kluemper¹, Kristi Hape² Arthur L. Chlebowski^{1,3}

¹Indiana University School of Medicine; ²University of Southern Indiana, Occupational Therapy Program; ³University of Southern Indiana, Department of Engineering

Background

Cerebral Palsy is a non-progressive neurological disorder that affects movement, posture, and muscle coordination, caused by damage to the developing brain. It is one of the most common motor disabilities in childhood, with significant implications for an individual's physical and functional abilities. The severe impact on fine motor control in Cerebral Palsy patients is often most evident when performing actions where precision and accuracy are needed such as applying eye drops. This work addresses the design, development, and deployment of assistive devices for fine motor control of objects.

Methods

Using 3D modeling and printing, three prototypes were created and assessed for their efficacy in assisting patients with eye drop administration based on the needs and abilities of the individual, considering factors such as ease of use, affordability, and adaptability to different environments. After evaluation, changes were made to each prototype in order to better adapt the design according to the feedback received.

Results

Three final products were presented for patient review. Two of these addressed deficiencies of eye drop accuracy and the other fine motor control and bottle manipulation. Patients noted in their final evaluation of the assistive devices improvement in ability to manipulate eye drop bottles as well as better ability to aim the eye dropper for application in comparison to previous methods of application.

Conclusion and Impact

By understanding the challenges faced by the individual and evaluating the need for assistive devices, the fine motor challenges associated with eye drop administration due to cerebral palsy were addressed and three valuable products were created that improved patient autonomy and quality of life. Additionally, these devices could be useful for patients with a variety of motor limitations, enabling self-sufficiency while improving ease and accuracy of administration and minimizing waste.