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Dynamic Balance Device

Freyja Heggeland, Noor Awad, Katherine Sattel, Therese Kalt
Advisor: Professor Monica Ohnsorg
Client: Mr. Daniel Kutschera

According to the American Stroke Association, stroke patients are at an increased risk for developing spatial neglect syndrome, a neurological condition that decreases spatial awareness, depth perception, and balance. Currently, the client performs rehabilitative therapy by supporting the patient with one hand, and moving a yardstick with a colorful piece of paper at the end with the other, indicating which hand the patient is intended to use to reach out and touch the paper. This method lacks features such as dynamic visual and audio feedback. Previous designs were difficult to hold for extended periods of time, due to heavy circuitry components. Therefore, it is important that design improvements are made to increase the availability of inexpensive and effective rehabilitative tools to physical therapists who currently lack access. In doing so, work-related injuries for physical therapists will decrease, while improving overall patient outcomes.

This design, a continuing biomedical engineering design project, improves upon existing methods by developing a more ergonomic design that is easier for the user to hold for extended periods of time. With the electronics placed on the user's arm and more weight in the handle, rather than the display, the device feels much more lightweight. It also has multifunctionality and accessibility through the use of color changing LEDs and sensor-activated speaker integration, allowing colorblind patients and those with limited sight to have more effective therapy options.

This full prototype will be tested by surveying biomedical students, gauging their ability to wield, manipulate, and use the device to its intended function. Participants will be surveyed after holding and manipulating an earlier model of this design in comparison to this prototype. Their responses will be quantified and normalized based on body measurements, to ensure accurate data collection. The carbon fiber rod will be tested in 3-point bending to ensure that it is significantly more durable than previous prototypes, allowing for minimal repairs.

Existing devices do not allow for cross-functional therapies because they are too heavy, too expensive, or are not complex enough to effectively improve balance. Some existing devices, such as the Bioness Integrated Therapy System™ allow the patient to perform activities with an interactive touch screen. This design, while effective, costs up to $127,000 per unit, meaning many clinics are unable to afford it. The affordability of this device for therapists and clinics alike is a key difference that makes the dynamic balance device more versatile and will allow the 7 million Americans living with stroke complications the opportunity to regain independence. Thus, the dynamic balance device is a promising development for physical therapy with patients in order to reduce the risk of spatial neglect.