Ergonomic and human interface design factors for home-based medical devices in movement disorders

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Introduction

Movement disorder monitoring technology was previously developed (Kinesia, Great Lakes NeuroTechnologies) to objectively quantify tremor and bradykinesia severity. Home monitoring increases the resolution of symptom capture and can expand clinical utility, but home monitoring of movement disorders requires very specific ergonomic and human factor design considerations. Based on the existing technology, a Parkinson’s disease (PD) home monitoring system that utilizes accelerometers, gyroscopes, and patient diaries (Kinesia HomeView, GLN) was developed and modified based on feedback from several patient-centered focus groups in order to adequately address various ergonomic and human interface factors.

Methods

PD focus sessions were completed to evaluate and develop home monitoring technology (Figure 1). The first session examined the ease of use of hardware components through participant interaction with test models while remaining sessions examined hardware ergonomics and the software interface.

Evolution of Modifications

Hardware, software, and human interface development were separated in order to address focus group feedback.

- **Figure 2:** The original system consisted of a large wrist module and ring sensor (A) but was modified to only a ring sensor with a flexible silicone sleeve for simplified placement (B).

- **Figure 3:** Nine different docking designs were given to participants to select the slot that was easiest to use (A). The resulting docking station utilizes a large button for easy release and a channel that guides the ring sensor into place by simply pushing down on its sleeve (B).

- **Figure 4:** The original software had more information than necessary on the screen, which was confusing to the subjects (A). To account for this, we decluttered the screen and also added a feature that allowed the patients to skip a video instruction if they already knew how to perform a task (B).

- **Figure 5:** Incorporating a docking station and minimizing the amount of information on the software encourages correct patient use. Additionally, a touch-screen PC with large buttons is important when designing a home monitor for patients with movement disorders.

- **Figure 6:** The patient diaries have a very straightforward rating system to encourage correct use. The elderly PD population needed to be considered when developing the system.

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Resulting System

By utilizing a docking station to complete the data transfer (as opposed to a USB cable) we improved the ergonomics that should lead to better patient compliance due to less reliance on fine dexterity.