**Welcome to the Team Lend a Hand arm rehabilitation support project!**

Contributors:

Yuri Hudak

Dana Honstain

**Background**

This project began as a Wrist-driven Orthosis (WDO), and switched to the arm rehab focus midway through the first quarter, which is why you’ll see information about a WDO in the earlier slides and other material. At our first meeting with our needs expert, Terry, we realized that a WDO wouldn’t be able to support her due to the fact that she was still in very early stages of her rehabilitation. After some brainstorming we settled on the idea of a new arm support orthosis to allow freedom of motion and prevent shoulder dislocation specifically during her rehab exercises, as well as a new approach to the rehab exercises themselves. The intended user is a person who has suffered a stroke and has lost motor function of one arm, although the design could be beneficial for people who have suffered a severe shoulder dislocation and need a support device that allows them to continue rehab exercises. Due to inactivity and muscle/ligament/tendon loosening in stroke patients with arm paralysis, the shoulder joint is at risk of repeated dislocation. Once one dislocation occurs, the risk of further dislocation is increased, and it’s important to prevent this as much as possible. However, it is still very important to allow the user to move their arm in order to perform rehabilitation exercises which are crucial to their recovery.

**Design Focus**

The goal of the arm rehab support design is to help prevent the user’s shoulder from dislocating, and to still allow them to retain full freedom of motion with that arm to feel comfortable to perform their rehabilitation exercises. There are several similar devices available on the market, but they typically lock the user’s arm in one position or if they allow motion it is restricted and often the device is very bulky. Our final prototype was constructed with a 3D printed shoulder cuff, neoprene wraps and strapping to secure around the upper body and arm, and elastic tubing to offload the weight of the arm to the top of the shoulder. Throughout the course of working on this project it became more clear that the focus was not just building an arm support orthosis, but was on the broad goal of promoting the user’s rehabilitation exercises. Many stroke patients find difficulty progressing in their rehabilitation due to the fact that the exercises can be difficult to complete, especially at early stages, and that they don’t feel security with their arm unsupported. We saw the arm support device as a way to promote security for the user, and the redesigned rehab exercises portion as a way to encourage and hopefully excite the user to complete their exercises and accelerate their rehabilitation.

**Future Ideas**

We envision future progress on this project that would further refine the arm support device. Due to time/scheduling we didn’t get the chance to test the device with our needs expert, so that would be a great step to take to get it to a fully-functional stage. The arm support device currently functions as a concept for the most part, but can be further refined and built on to achieve the initial goal.

We also envisioned the use of surface electromyography (EMG) sensors as another way of promoting the user’s rehab exercises and encouraging progress. EMG sensors could be incorporated into the arm support device design in order to give a visual representation of the user’s muscle activity and provide some data via sensor readout as the user progresses. Electromyography measures the voltage across two points on a muscle, and surface EMG is an easy and non-invasive way to measure muscle voltage on muscles near the body’s surface. If EMG sensors could be added and potentially paired with a smartphone app, the user could have a real representation of their muscle activity to encourage them to progress in their rehab exercises. Many stroke patients feel frustration in early stages of their rehab due to the fact that it’s hard to actually tell that there is muscle activity happening in their affected limb, however small it may be. An EMG device could potentially capture that activity and show it to the patient to help encourage them in their rehab.

Please feel free to direct any questions to Yuri Hudak at yfhudak@uw.edu.

Best of luck!