

Product Design Specification

Problem Statement

Stroke is one of the leading causes of adult disability in the United States. It is caused by the disturbance of blood supply to the brain leading to loss in brain functions. Stroke can lead a person to occupational disability, wherein the person is unable to perform the functions required to complete their daily functional tasks satisfactorily. In the Orthopedics and Rehabilitation Department at the UW hospitals nurses and doctors treat patients with physical, occupational and speech therapy. They assess the recovery of upper extremity function in stroke patients with occupational disability, using a grip meter or dynamometer. The grip meter measures the grip strength of an individual.

Current grip meters available in the market are expensive and do not allow measurement of forces due to grip from 0 to 20 lb with 1 lb increment, limiting the ability to measure small changes in very weak patients.

The project consists of designing an ergonomically suitable grip meter that will allow measurement of 1 lb force with a range from 0 to 20 lb and necessary calibration before use. The grip meter should also provide a digital readout of the force on an LCD screen.

Client Requirements:

- Must have at least 1 lb increments
- Must have a max grip read out on a LCD screen
- Must at least measure from 0 to 20 lbs
- Must have the ability to be recalibrated if necessary
- Must have no latex

Design Requirements:

1. Physical and Operational Characteristics

a. *Performance Requirements*

The grip meter must be able to display the max grip on an LCD screen. The device must be portable and hand-held.

b. *Safety*

The device must not contain any latex, as it is to be used in a hospital setting. Water/liquids should not be used around the device as this could pose a threat of electrical shock to the user. Cleaning agents are safe to use on the grip apparatus part of the device. No sharp corner in the device should exist.

c. *Accuracy and Reliability*

Our design must at least have 0.454 kg (1 lb) increments and be able to read from a range of 0 kg (0 lbs) to 9.072 kg (20 lbs). It also must be able to be recalibrated to make sure it remains accurate in the future.

d. *Life in Service / Shelf Life*

The device is believed to be used around 5 to 10 times a month. The shelf life will depend on the circuits remaining intact and the strain gauge remaining plastic. The client expects the device to last three years.

e. *Operating Environment:*

Our device would be used in a hospital setting, but could be used in any environment. The device should not be used in or around water. Water will damage the device and could harm user. Other liquids pose a similar risk.

f. *Ergonomics:*

The device must be extremely user friendly. Anyone should easily be able to use the device. The therapist should be able to hold the LCD screen containment box, while the patient is using the device. Wiring should not be in the way of the patient or therapist. The device was made to have the therapist facing the patient so the wiring from the grip apparatus to the box does not affect either person.

g. *Size:*

The device should not be too cumbersome in its length. If the device bars are too long, patients could have a problem using and holding onto the device. Currently, the device bars are 14 cm (5.5 in) long. The client has stated that this will not be an issue at this length.

h. *Weight:*

The device must be lightweight so a patient recovering from a stroke will be able to lift and hold onto it. A believed maximum weight for the device is 2.268 kg (5 lbs). This weight restriction was given to us by the client. Currently, the device weighs .

i. *Materials:*

The client has requested that the materials be with able to withstand cleaning agents and no made of latex. The materials must also be durable and last for at least three years before breaking. The materials used were aluminum and silicon. These materials meet all requirements given by the client for materials.

j. *Aesthetics, Appearance, and Finish:*

It should be noted that the appearance of the device does not matter to the client. The device is to be covered with silicon tape as a grip, and the containment box for the circuit board and LCD screen is made out of a plastic polymer. These materials were used since they did not contain latex.

2. Production Characteristics

a. *Quantity:* 1 deliverable.

b. *Target Product Cost:* \$310

3. Miscellaneous

a. *Standards and Specifications:* N/A

b. *Customer/Patient related concerns:* N/A

c. *Competition:* There are other grip meters currently on the market. The ones typically used in a rehabilitation setting can cost around \$500.

