

Preliminary Product Design Specifications - September 18, 2015

Title: *Pressure Monitoring During Cast Application for a Distal Radius Fracture*

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Function: Casting is becoming a lost art in medicine, yet many children and adults need casts applied. While this appears to be a benign treatment, complications are known to exist in the placement and removal of these devices. Typically medical students and residents learn these techniques by trial and error. Often direct oversight is lacking in the teaching of these techniques. The client would like a supplement to an already existing fracture model arm that can aid medical students in learning how to appropriately apply casts for distal radius fractures. The device will sense pressure applied to specified areas of the arm/hand and give immediate feedback to the use via a visual interface.

Client Requirements:

- Create an easily removable device for a fracture model arm
- Monitor pressure at specified locations
- Visually display applied pressure

Design Requirements

1. Physical and Operational Characteristics

- Performance Requirements:* Pressure sensing device must be sufficiently affixed to the arm such that sensors are not moving during the procedure. Display must then give immediate visual and quantitative feedback of applied pressure to specified areas.
- Safety:* The product must not damage the model arm or the user.
- Accuracy and Reliability:* Not a great amount of sensitivity is necessary on the lower threshold of pressure, but the device should be able to measure when an excessive and potentially dangerous amount of force is being applied (upwards of 700 N).
- Operating Environment:* Device will be used in a medical classroom setting as well as hospitals and will be subjected to a range of pressures.
- Ergonomics:* Should be able to withstand maximum human grip strength forces of up to 700 N and 25 kN/m of torque.
- Size:* The device must cover the model sawbone arm that has a diameter of 19 cm at the smallest point (the wrist) and a diameter of 37.5 cm at the largest point (the bicep). Its length should fall between 25.4 and 30.5 cm.
- Materials:* Device should use materials which will not be damaged by the plaster or fiberglass materials used in the casting process. Materials should be relatively flat to keep a realistic feel. Materials must not damage the arm model with regular use.

- h. *Aesthetics, Appearance, and Finish*: Device should have a smooth feel and appearance with limited protrusions. Display of feedback should be visually descriptive and given on a laptop or tablet.

2. Production Characteristics

- a. *Quantity*: One complete device is necessary for Dr. Halanski's purposes.
- b. *Target Product Cost*: The total cost of the device should be less than \$1000.

3. Miscellaneous

- a. *Customer*: After practicing with this product, medical students should have knowledge of the proper pressure to apply during the casting process.
- b. *Patient Related Concerns*: The device is to be used on a teaching model, not an actual patient. However, it must be assured that the device accomplishes given requirements to make sufficient teaching possible.
- c. *Competition*: There are currently no pressure sensing devices on the market that assist in the teaching of cast application. Medical students traditionally learn how to apply appropriate amounts of pressure during casting by observing and doing.