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Suture Trainer: Improving Tissue Handling Technique

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BIOMEDICAL

Suture Trainer

Improving Tissue Handling Technique

CAPSTONE DESIGN EXPO 2016

Introduction

Tissue handing is fundamental to performing mechanical tasks of suturing and surgery on live humans or animals. While the mechanics of suturing can be taught, there is no available simulation product designed to specifically teach tissue handling skills. Current suture training devices include a pseudo-skin model, scalpel, straight hemostats, Adson forceps, scissors and sutures. Our device focuses on the Adson forceps and improving tactile and proprioception skills to allow development of gentle tissue handling skills outside of a live patient situation.

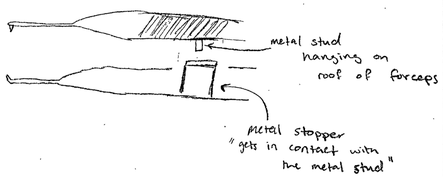
Due Diligence

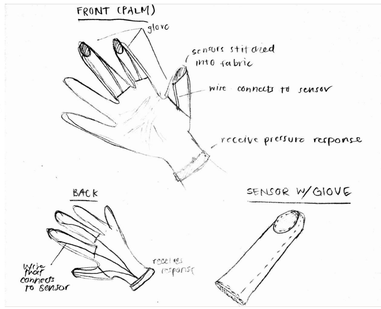
Laryngoscope pressure sensor and alarm consists of a pressure sensor device but it is used for a different application. Pressure-responsive surgical tool assembly, which includes an inflatable enclosure and a pair of electrodes positioned therein, provides an indication of the pressure being applied by the retractor against tissue during surgery. Pressure sensing obstetrical forceps are used for assisting the delivery of a baby. This invention addresses the degree of force applied to a fetus during delivery. A kit for training in surgical techniques was found, however, it mainly focuses on surgical techniques including suture-tying techniques, suture of blood vessels and making incisions and sutures in skin and subcutaneous tissue. It does not focus on tissue handling techniques. Knotless dynamic suture tensioning device provides a mean to compress and hold two tissues beyond which is achieved with the traditional sutures by hand and is used to lengthen retracted tendons or ligaments. Suture-plate scar reduction surgical device does not include the use of sensors but rather a semi-rigid plate with suture made of silicone that helps wound closure.

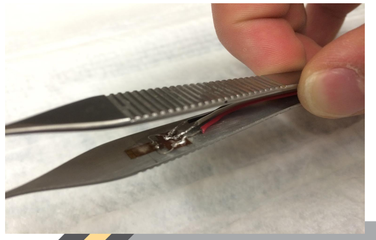
Project Objective

The suture trainer focuses on providing information in order to standardize tissue-handling technique in order to prevent poor habits from developing and preventing unnecessary injury to the tissue via scarring.

Design Concepts

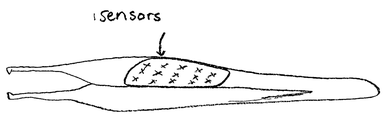


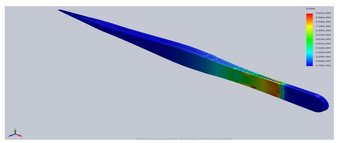




Preliminary Design

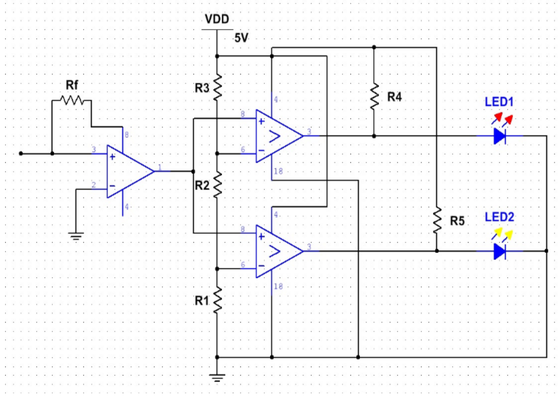
A piezoelectric sensor will be attached onto the top of surgical forceps where the index and middle fingers rest. This way the pressure of the fingers on the forceps will be recorded and calibrated to match the force applied to the skin by the forceps..





Prototype & Testing

There are three stages of alerts: a safe range, a cautionary range, and a danger range. The danger range will be calibrated to the amount of pressure required to appropriately manipulate live human tissue, particularly integument. The cautionary range will be from the pressure required to manipulate the skin up until the threshold value of which risks injury to the skin. The threshold values were calibrated with the help of a plastic surgeon.



Circuit schematic that is attached to sensor