Reusable RF Electrodes

Design Review 4
Team 314
Abbott Laboratories
02/18/22

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FAMU-FSU Engineering

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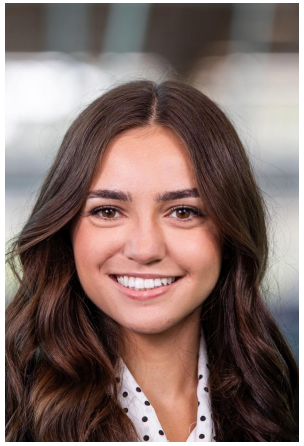

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Sponsor & Advisor

- Sponsor: Abbott Laboratories
- Medical Device Company
- Contact: Bryan Burnett

- Advisor: Dr. Rajendra Arora
- Professor: ECE Department
- Specialty: RF and Electromagnetic Fields

Outline

- Brief Overview (5)
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Figure 1. Product Development [1]

Brief Overview

RF Ablation:

- Radiofrequency ablation is a common procedure for relieving pain.
- It greatly benefits people suffering from chronic pain.

How it works:

- Electric current heats up nerve tissue and stops it from sending pain signals.

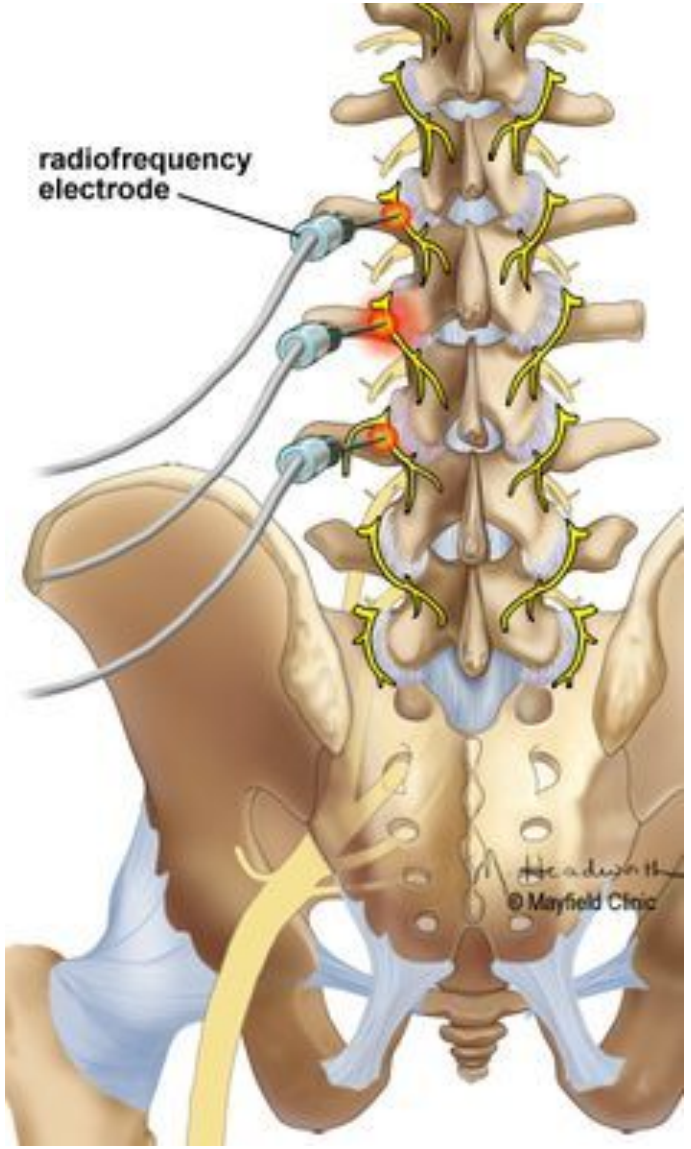

Figure 2. RF Ablation Therapy [2]

Presenter: Brooke Bielski

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Problem Statement

Project Scope:

- Improve Reusability

Customer Needs:

1. Biocompatible Materials
2. Withstand at least 100 uses
3. Propagate RF signals (2 Hz - 460 kHz)
4. Measures temperature
5. Repeated sterilization
6. Repeated procedure stress
7. Production cost less than $200
8. Pass FDA approval

Presenter: Joshua Mechler

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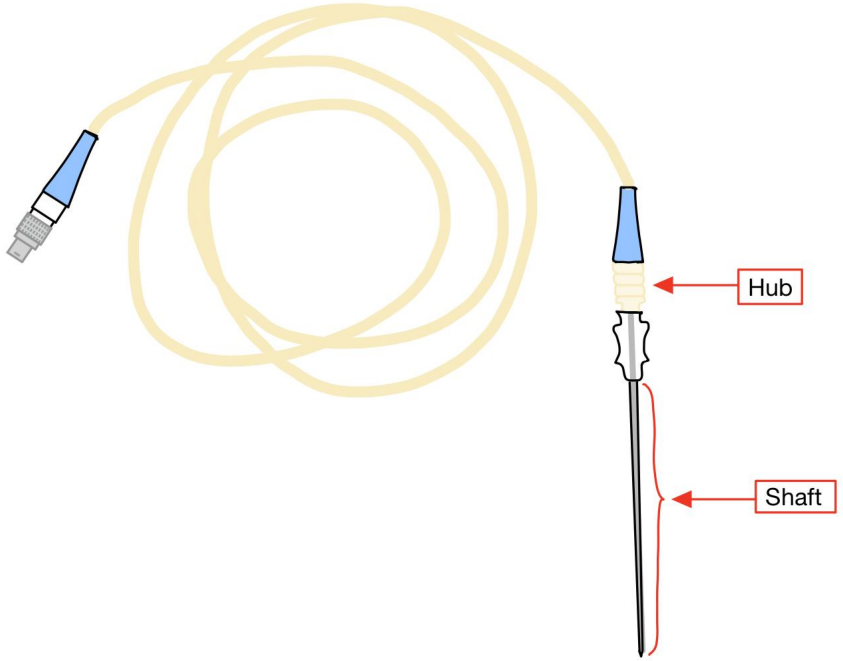
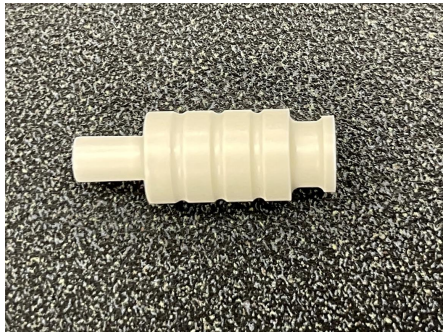
Final Concept

- 304 Stainless Steel shaft
  - + Biocompatible
  - + Cost effective
  - + RF propagation
- PPSU (Polyphenylsulfone) Hub material
  - + Virtually unlimited steam sterilization
  - + Better chemical resistance than PET
  - + Biocompatible
  - + Already in use in the medical field
  - – Higher Cost





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Current Work

- Done with prototyping
- Filling hubs with epoxy
- Starting testing procedure
- Gather data from tests
- Website development

Batch #	Material Type	Temperature	# of cycles	Enzyme?	# of hubs
000	PET	Low	5	Y	4
001	PET	Low	5	N	4
002	PET	Low	15	Y	4
003	PET	Low	15	N	4
004	PET	High	5	Y	4
005	PET	High	5	N	4
006	PET	High	15	Y	4
007	PET	High	15	N	4
008	PPSU	Low	5	Y	4
009	PPSU	Low	5	N	4
010	PPSU	Low	15	Y	4
011	PPSU	Low	15	N	4
012	PPSU	High	5	Y	4
013	PPSU	High	5	N	4
014	PPSU	High	15	Y	4
015	PPSU	High	15	N	4

Presenter: Carolina Hau Loo

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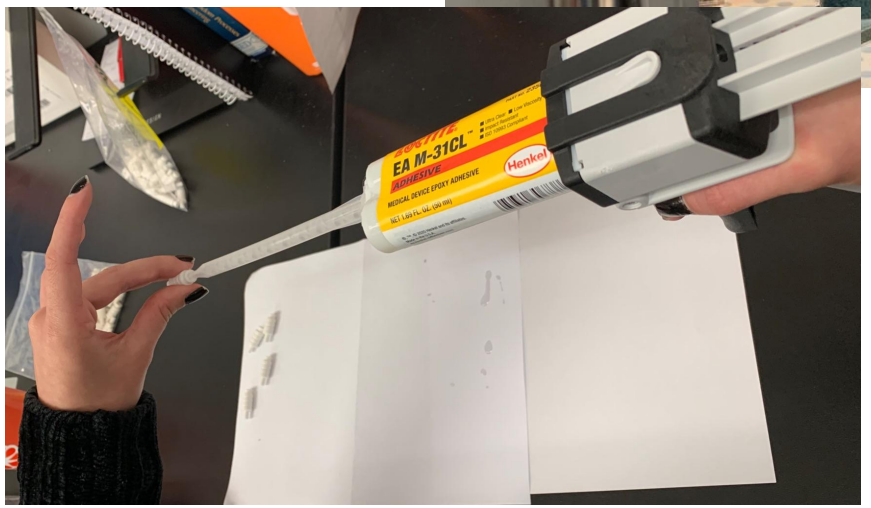
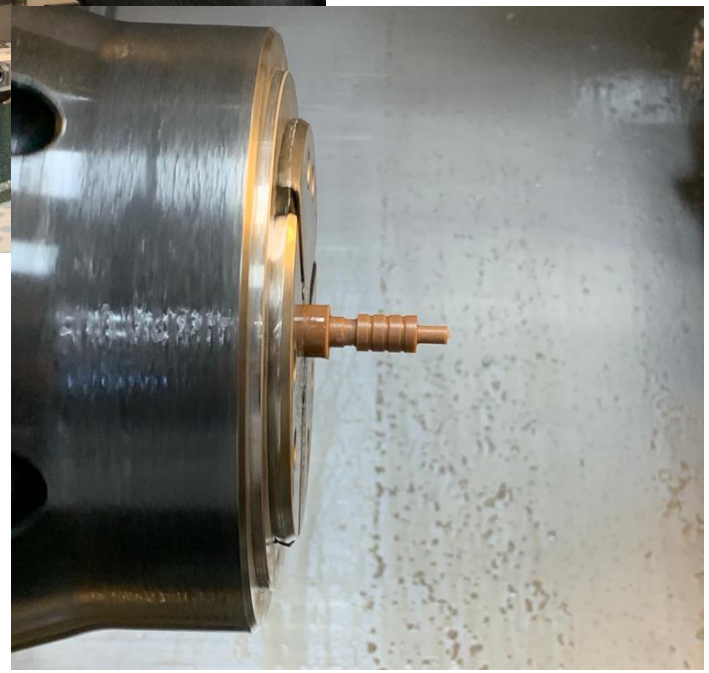
Prototyping

- Machining
  - Prototypes made in the Machine Shop
  - Hass CNC lathe
  - Hass CNC mill
- Epoxy Resin
  - Heat resistant





Presenter: Carolina Hau Loo

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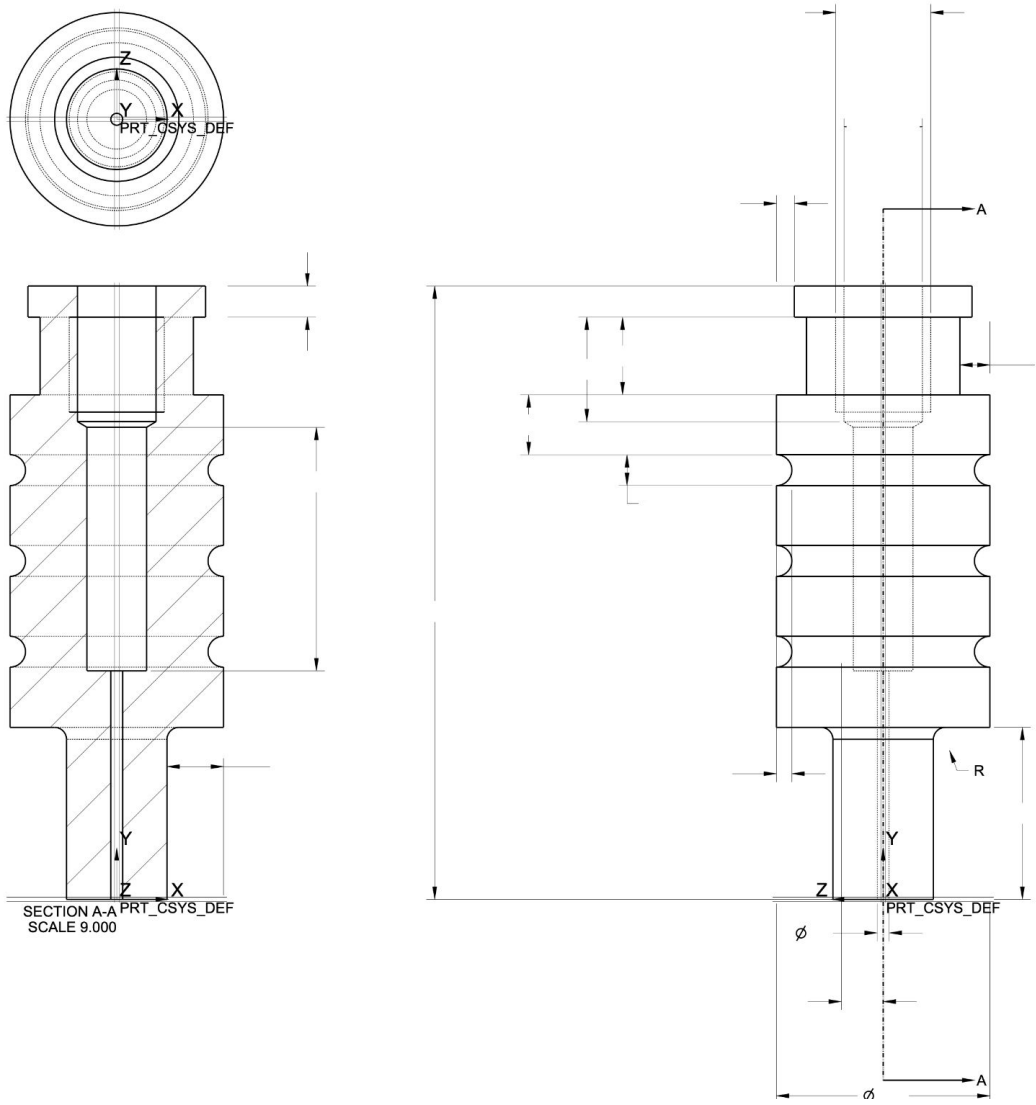
CAD Design

- Measurements taken from original reusable RF electrode using calipers
- 3D hub created using CAD design software



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Quality Assurance Tests

- Mechanical
- Autoclave Sterilization

Device requirements:

- Sterilizations at 132℃
- More information needed from Dr. Campbell*

Equipment:

- Autoclave
- Force Test Stand (MARK-10 model ESM301)

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Future Plans

- Begin testing of prototypes
  - Proof test
  - Autoclave
- Model and compare hub behaviors
- Complete project website

Figure 5. Brainstorming

Website Development

- Current Website Progress

Reusable Radiofrequency Electrodes

By Team 314

Sponsored by Abbott Laboratories

A Collaboration Between the ECE Deppartment and the BME Department

Abstact

Radio Frequency (RF) Spinal Ablation is a minimally invasive procedure used to treat chronic nerve pain along the spinal cord. During the process, a small portion of nerve tissue is heated up, which stops pain signals from being sent to the brain. The medical device company, Abbott Laboratories, makes a reusable device for this procedure that can withstand up to fifty repeated uses. They have challenged our team with increasing the reusability of the device to one hundred uses or more, whilst keeping the manufacturing price down. The device is composed of three main elements: the shaft, the hub, and the RF transmission cable. The shaft is a thin metal cylinder that's inserted into the body; the hub is a plastic component that connects the shaft to the RF transmission cable. After receiving test data from our sponsor, we found that the hub is the problem. Due to the repeated stress of the sterilization procedure, the plastic hub is the first element of the probe to break down. To fix this, we will swap out the hub's material with a different polymer. To select the new material, we found polymers that are suitable for medical devices. From these materials, we choose the one best suited for our needs. Using the new material, Polyphenylsulfone (PPSU), we are making prototypes of the hub. Using these prototypes, we can compare the new material to the old one through different testing PROCEDURES. These tests will include cleaning the probe with an enzyme solution, followed by sterilization using an Autoclave machine. To test the material properties of our prototype, we will run tensile stress tests. These results will help us determine how well our prototype will perform and if it will be suitable for increasing the probe's reusability.

Summary

- Sponsor: Abbott Laboratories
- Product: Reusable RF Electrode
- Use: RF ablation for chronic pain
- Prototyping
- Quality Assurance Tests
- Future Plans

Acknowledgements

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- Dr. Hooker (ECE Professor)
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Figure 7. Problem solving techniques

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Questions?

Figure 8. Customer Insight