Thyroid Retractor

BME 402: Preliminary Presentation

February 14, 2022

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Client: Dr. Amanda Doubleday, D.O., MBA

Presentation Overview

- Introduction
- Impact of Device
- Fall 2021 Summary
- Spring 2022 Goals
- Final Prototype
- Budget

Introduction

Problem Statement: The team is creating an adjustable device with multiple points of contact to aid in thyroid retraction. The goal is to simplify the procedure and account for multiple thyroid sizes.

Client: Dr. Amanda Doubleday, D.O., MBA

- Endocrine Surgery Fellow at UW School of Medicine and Public Health
- General & Endocrine Surgeon at Waukesha Surgical Specialists

Design Constraints:

- Separates into two prongs
- Adjustable & safe
- Displays characteristics of a typical surgical instrument[1,2]

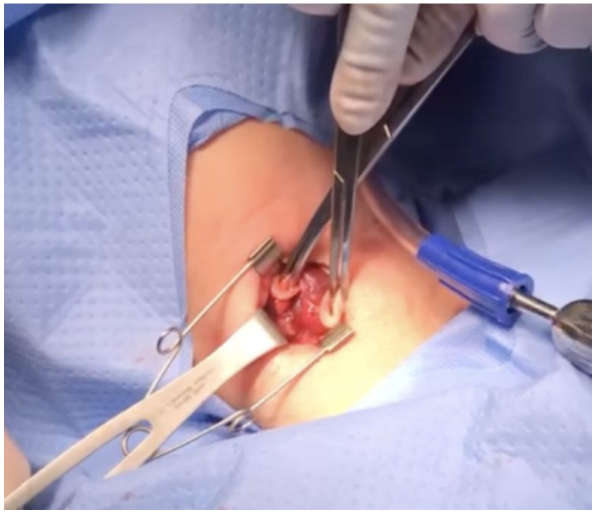

Figure 1: Image during a thyroid retraction surgery by Dr. Doubleday

Impact of Device

Broader Application:

- Increased surgical efficiency and decrease in surgical complications
- Device can be used by other surgeons and other procedures

Commercially Available Designs:

- Rochester Pean Forceps[3]
- Allis Tissue Forceps[4]

Figure 2: Rochester Pean Forceps[5]

Figure 3: Allis Tissue Forceps[6]

Fall 2021 Summary - Final Prototype

- All prototypes made using Ultimaker 3D printer
  - PLA
  - Lack of a robust ratcheting system
- Considered different shapes and angle of legs
  - Circle
  - Square

Figure 4: Five prototypes from the previous semester, the blue prototype being the most recent

Fall 2021 Summary - Testing

Tissue Analog Test

Figure 5: Mock thyroid and trachea used for a retraction demonstration

- Materials used:
  - Chicken breast
  - Paper towel roll
  - Hot glue
- Confirmed functionality of retractor
  - Used three different sets of dimensions

Computational-Modeling Test

- Confirmed the retractor is able to retract a thyroid medially without causing soft tissue damage

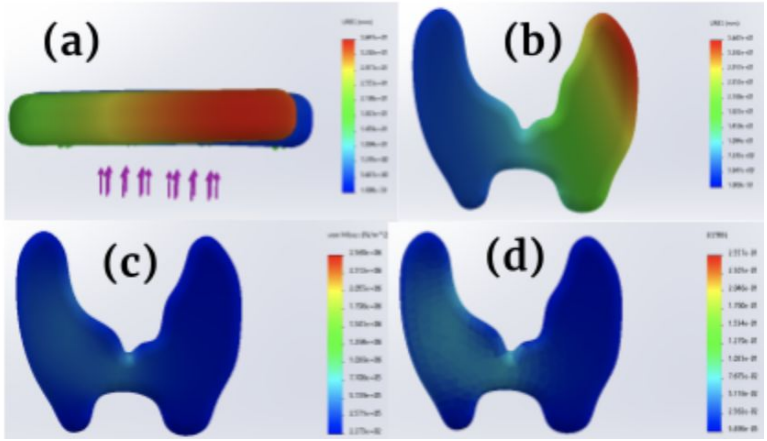

Figure 6: Results of computational analysis derived from tissue analog test

Spring 2022 Goals

- Overarching goals:
  - Solidify prototype design
    - Make changes according to testing results and feedback from client
  - Prove that the design meets client requirements and functions as desired
- Proof of function will be demonstrated through various tests
  - Ergonomics Survey
  - Tissue Analog and computational testing
  - Bio-Contamination testing using total protein assay

Spring 2022 Timeline

Date	Task
2/15	Adjust SolidWorks model based on feedback from cadaveric observations
2/18	3D Print multiple prototypes using the Form 3 printer at UW Makerspace
2/23	Meet with client and give her prototypes to bring to Waukesha for her and her coworkers to evaluate using ergonomics survey
2/24 - 3/3	Receive feedback from client and coworkers via ergonomics survey and adjust device model as needed
3/10	Tissue analog test and further computational testing
3/17	Biocontamination test with total protein assay using fluorescent microscope

Final Prototype

- Reusable design with no disposable components
- AISI 420 or other surgical stainless steel
- Ergonomic handle for single-handed use and adjustment
- Locking mechanism
- Tissue contacting geometry allows for increased surface contact and minimized harm potential
- Sterilized surgical device packaging

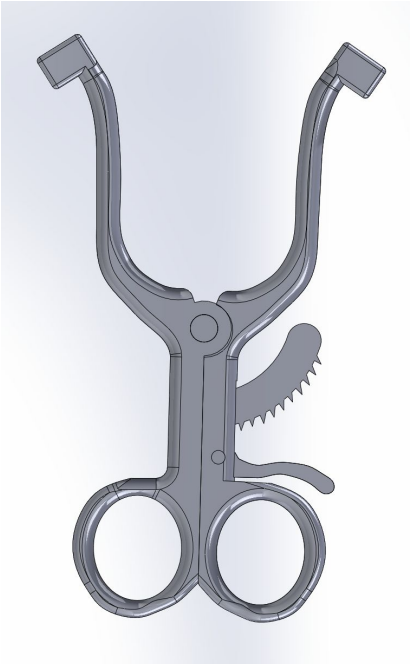

Figure 7: Proposed final design, with locking mechanism

Budget

- Past Expenditures:

Item	Individual Price	Number	Total
Preliminary Fabrication (PLA)	$1.12 - $1.36	5	$6.00
Testing Materials	$5.00	1	$5.00

- Expected Future Expenditures

Item	Individual Price	Number	Total
Final Fabrication	$10*	3	$30.00*
Final Testing Materials	$75	1	$75

References

[1] “Sklar Econo Sterile Stainless Steel Rochester-Pean Forceps,” *quickmedical*. [Online]. Available: https://www.quickmedical.com/sklar-econo-sterile-stainless-steel-rochester-pean-forceps.html. [Accessed: 11-Feb-2021].

[2]“ADC® Kelly Hemostatic Forceps, Straight, 5-1/2‘L, Stainless Steel,” *Global Industrial*. [Online]. Available: https://www.globalindustrial.com/p/medical-lab/medical-equipment/exam-room-supplies/kelly-hemostatic-forceps-straight-5-1-2-l-stainless-steel?infoParam.campaignId=T9F&gclid=Cj0KCQiApY6BBhCsARIsAOI_GjaErxuyu_CezZTVpO3iKXoGy5DLCt760CsGWYqbcB1HmbmZV1jtzcEaApEOEALw_wcB. [Accessed: 10-Feb-2021].

[3] “Kelly forceps - stainless,” *medcareproducts.com*. [Online]. Available: https://www.medcareproducts.com/Kelly-Forceps-Stainless/productinfo/IMK/. [Accessed: 11-Oct-2021].

[4] “Allis tissue forceps,” *Medline Industries, Inc.* [Online]. Available: http://punchout.medline.com/product/Allis-Tissue-Forceps/Tissue-Forceps/Z05-PF13543?question=&index=P8&indexCount=8. [Accessed: 11-Oct-2021].

[5] “Rochester-Pean forceps,” *Anthony Products*. [Online]. Available: https://www.anthonyproducts.com/store/rochester-pean-forceps-5. [Accessed: 14-Oct-2021].

[6] “Thoms-Allis tissue forceps,” *Anthony Products*. [Online]. Available: https://www.anthonyproducts.com/store/thoms-allis-tissue-forceps. [Accessed: 14-Oct-2021].

Questions