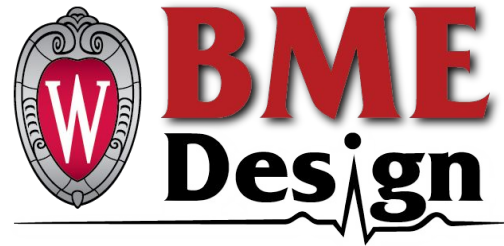


# Thyroid Retractor

UW Madison Department of Biomedical Engineering

BME 400

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# Team

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# Presentation Overview

- Problem Statement
- Background: Procedures & Thyroid
- Commercially Available Designs
- Product Design Specifications
- Inspiration: Weitlaner Retractor
- Preliminary Designs
- Design Matrix
- Proposed Final Design
- Future Work
- References



# Problem Statement

The goal of the design team is to create a device to retract the thyroid in thyroidectomies, as well as allow access to glands below the thyroid. Our client's current retractor is a Rochester Pean Clamp Forceps, or "Peanut." This device only grants one point of contact on the thyroid. This single point of contact does not always allow for complete retraction when dealing with thyroids of a larger size. The client requests a thyroid retractor that has a single handle with two prongs to retract the thyroid gland from multiple points. Since thyroidectomies are performed over 130,000 times per year, the effect of this retractor may go beyond [1].



# Background - Current Retractor

The Rochester Pean Forceps consists of a pean clamp, and ball of gauze at the tip. This retractor is not problematic in operations involving smaller thyroids.



**Figure 1:**  
Image of Rochester Pean Forceps [2]



# Background - Current Problem

Two Peanuts are being used in order to effectively retract a larger thyroid gland.

Using two peanuts is not efficient, as both a surgeon's hands are lost. Operating rooms cannot always accommodate for more people.

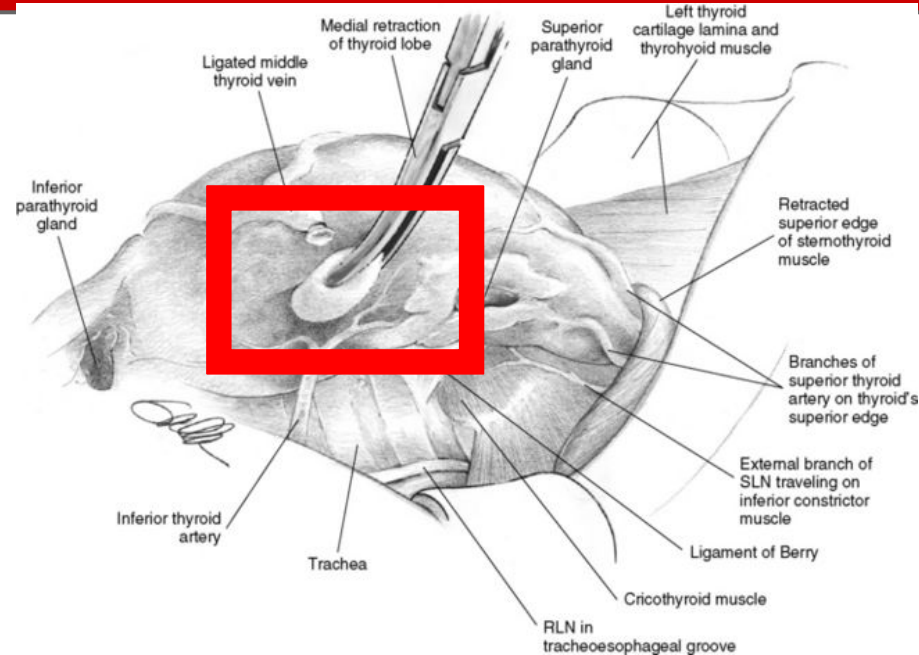


**Figure 2:**  
Image during a thyroid retraction surgery by Dr. Doubleday



# Background - Thyroid

- Thyroid Dimensions
  - 4-4.8 x 1 to 1.8 x 0.8-1.6 cm [3]
  - 10-20 grams [3]
- Reasons for operation:
  - Thyroid is important in hormone production
  - Parathyroids regulate calcium
- Single point of contact difficulties
  - Traction
  - Folding over



**Figure 3:**  
Diagram of a medial thyroid retraction using a peanut [4]



# Commercially Available Designs

- Rochester Pean Forceps [5]
  - Hemostatic
  - AISI 420 stainless steel
  - Client's current instrument
  - Single point of contact
- Allis Tissue Forceps [6]
  - Forcibly grasps and retracts tissues
  - AISI 420 stainless steel
  - Can cause tissue damage



**Figure 4:** Rochester Pean Forceps [7]



**Figure 5:** Allis Tissue Forceps [8]







# Product Design Specifications

- Separated into two prongs
- Adjustable distance between prongs
- Surgical instrument specifications:
  - Surgical grade stainless steel
  - Length: ~ 20 cm [9]
  - Weight: ~ 50 g [10]
- Safe for use on patient
  - No atypical protrusions



# Inspiration: Weitlaner Retractor

- The basis for all preliminary designs
- Ratcheting mechanism [11]
  - Self-retaining
  - Used for holding open wounds or ends of tissues
  - Locked manually



**Figure 6:** Weitlaner Retractor [12]



# Design 1: Shods



**Figure 7:** Adapted Weitlaner with shods

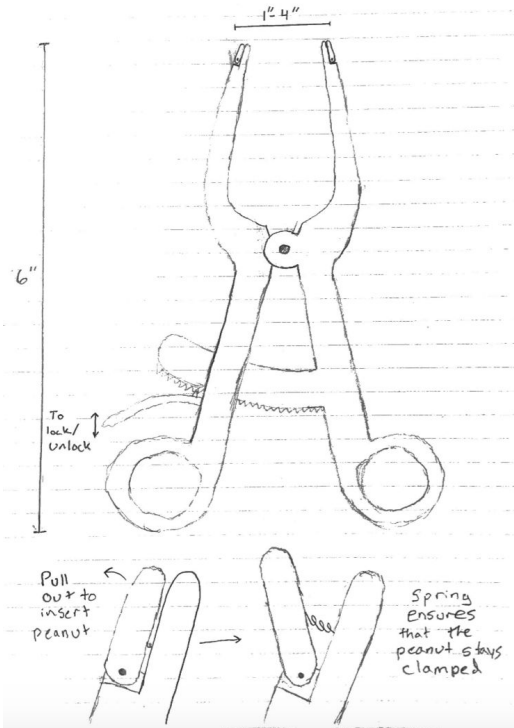
- Final design of Spring 2021
- 3D Printed Shods
  - Single-use & disposable
  - Hollow, cylindrical base
  - Maximizes contact area, minimizes patient harm



**Figure 8:** CAD model of the polymer tips used with the adapted Weitlaner design



# Design 2: Springs



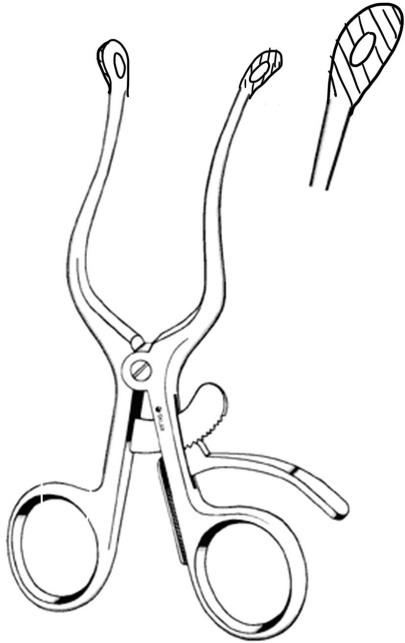
**Figure 9:** Adapted Weitlaner with spring endings

- A preliminary design from the previous semester
- Spring clamp mechanism to hold a ball of gauze
  - Most similar to the current product in use
- Advantages:
  - Increased adjustability
- Disadvantages:
  - May be difficult to adjust spring distance during surgery





# Design 3: Treads

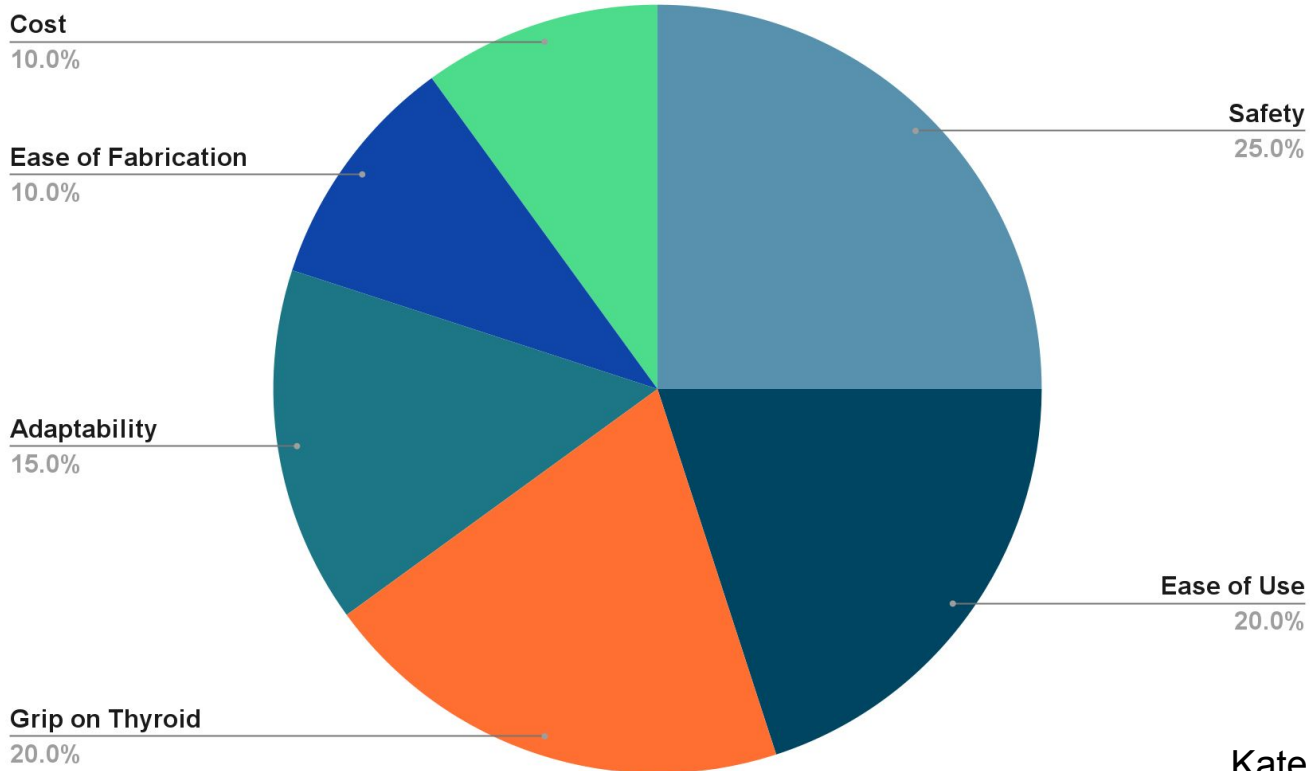


**Figure 10:** Adapted Weitlaner with metal circle endings

- Original weitlaner ratcheting system
- Grooved circular ends for traction
- Inward angle to support retraction
- Advantages:
  - Adjustability of original Weitlaner
  - No need for extra pieces for prong tips
- Disadvantages:
  - Concerns about grooves at ends potentially harboring biocontaminants




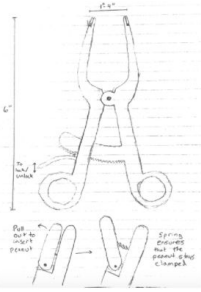
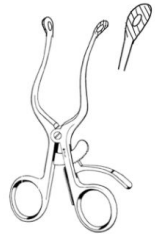
# Design Matrix Criteria





# Design Matrix

**Table 1:** Design Matrix. Red highlighted scores denote a high score

Design		Shods		Springs		Treads	
Criteria	Weight						
Safety	25	4/5	20	5/5	25	5/5	25
Ease of Use	20	3/5	12	3/5	12	5/5	20
Grip on the Thyroid	20	4/5	16	4/5	16	3/5	12
Adaptability	15	5/5	15	1/5	3	4/5	12
Ease of Fabrication	10	3/5	6	4/5	8	5/5	10
Cost	10	3/5	6	4/5	8	5/5	10
<b>Total</b>	<b>100.0</b>	<b>75</b>		<b>72</b>		<b>89</b>	



# Proposed Final Design

## Adapted Weitlaner + Tread Ends

### Modified Weitlaner Retractor

- Treads to increase traction and reduce slippage
- Surface area distributes load
- Locking mechanism
- Ergonomic design
  - fits anthropometry of human hand
  - similar to current instruments

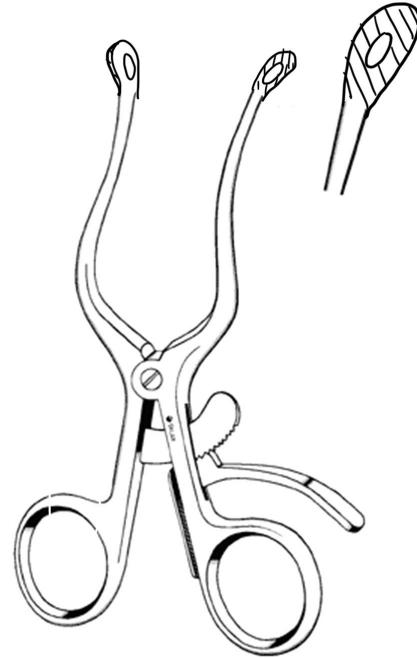


Figure 11: Proposed final design







# Future Work

- Finalize a CAD model of the design
- Intellectual property concerns
  - WARF, patent office, IDR
- Rapid prototyping
  - Polymeric model
  - Ergonomic testing
- Develop a final testing protocol
- Final Fabrication
  - Stainless steel
  - AISI 420 or other surgical grade
- IRB and final cadaveric testing



**WARF**  
Wisconsin Alumni Research Foundation



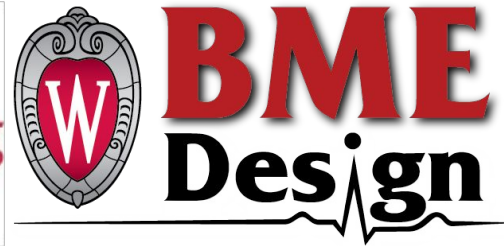
# Acknowledgements

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Professor Mitchell Tyler

Dr. Ed Bersu

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**Questions**