

DESIGN OF A WOUND PROTECTOR FOR THYROID SURGERY

Molly Krohn (Leader), Kim Maciolek (Communicator), Armand Grabowski (BSAC), Naomi Humpal (BWIG)

Client: Dr. Rebecca Sippel, Dr. David Yu Greenblatt

Advisor: Professor Mitchell Tyler

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Thyroid Anatomy

- Located at front of neck
- 2 lobes
- Positioned around trachea¹
- Produces hormones that regulate metabolism¹

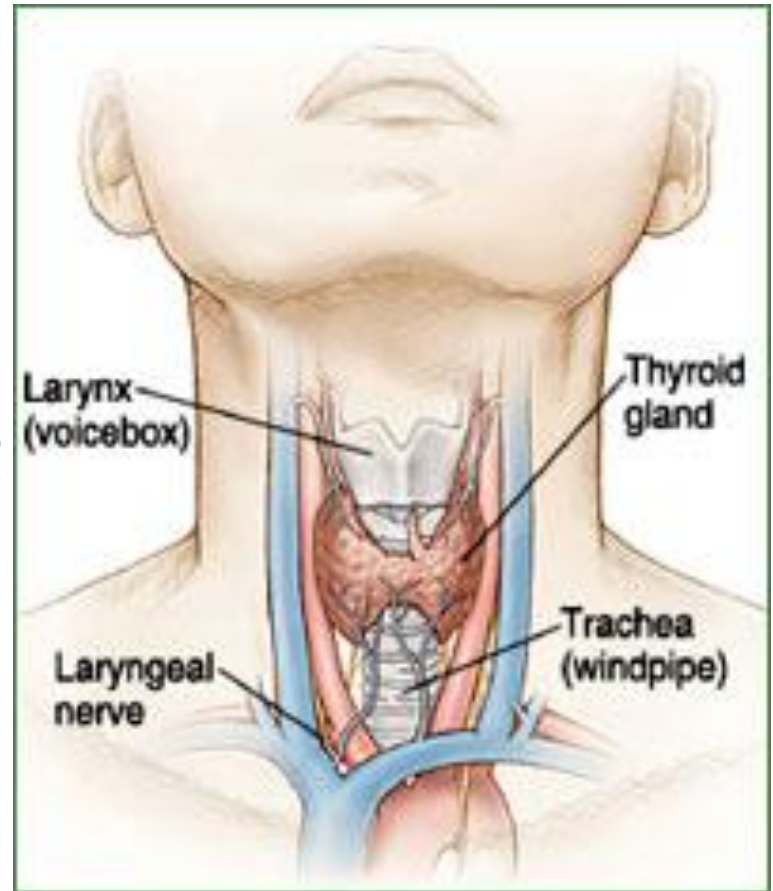


Figure 1: Diagram of thyroid in neck²

Conditions that Require Removal

- Hyperthyroidism: produces too many hormones, “overactive thyroid”³
- Goiter: enlargement of the thyroid, can impair breathing or eating¹
- Cancer⁴
- Approx. 34,500 thyroid surgeries each year⁶

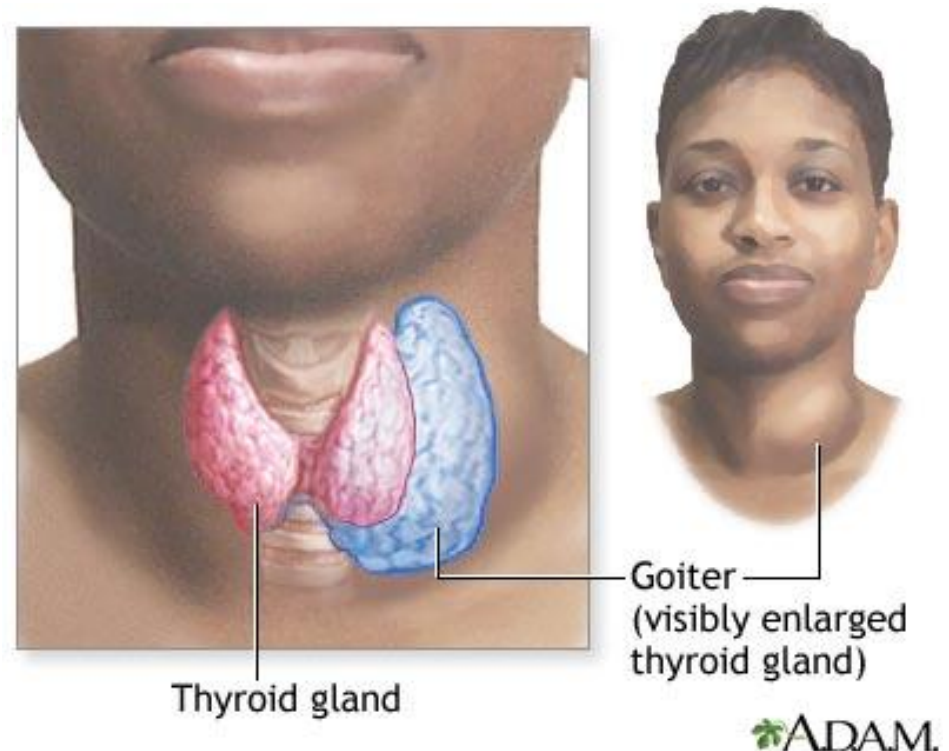


Figure 2: Illustration of enlarged thyroid (goiter)⁵

Surgical Removal of Thyroid

- 3-4 cm incision across the neck, above collar bone¹
- Retractors used to expose thyroid¹
- Thyroid separated from the trachea & removed¹
- Duration: 60-90 minutes¹

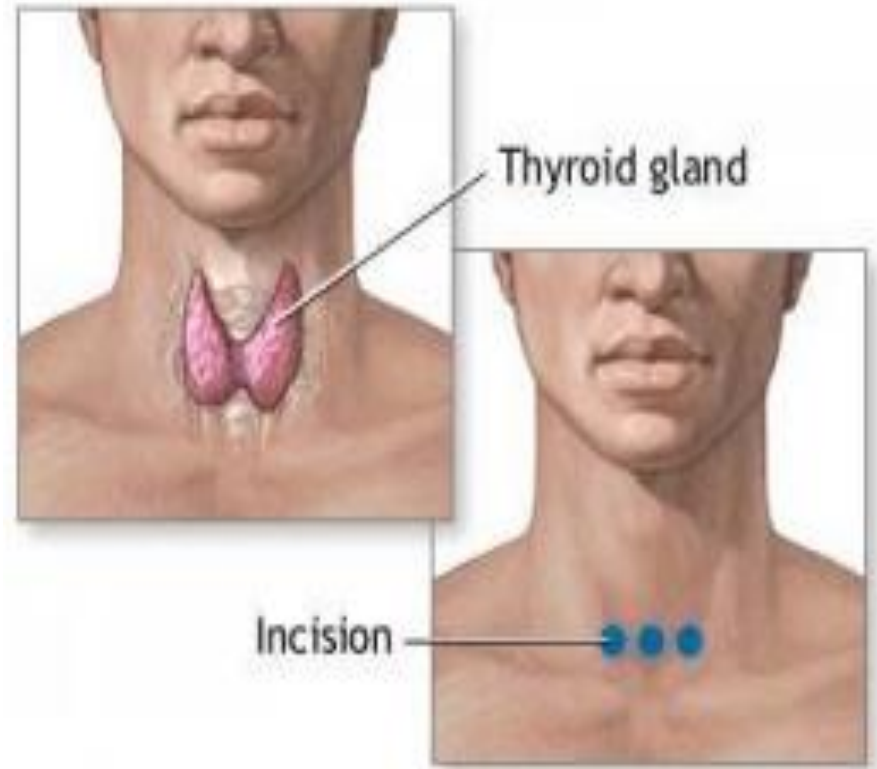


Figure 3: Illustration of incision for removal⁷

Currently Used: Metal Retractors

Uneven pressure distribution = tissue damage + bruises +

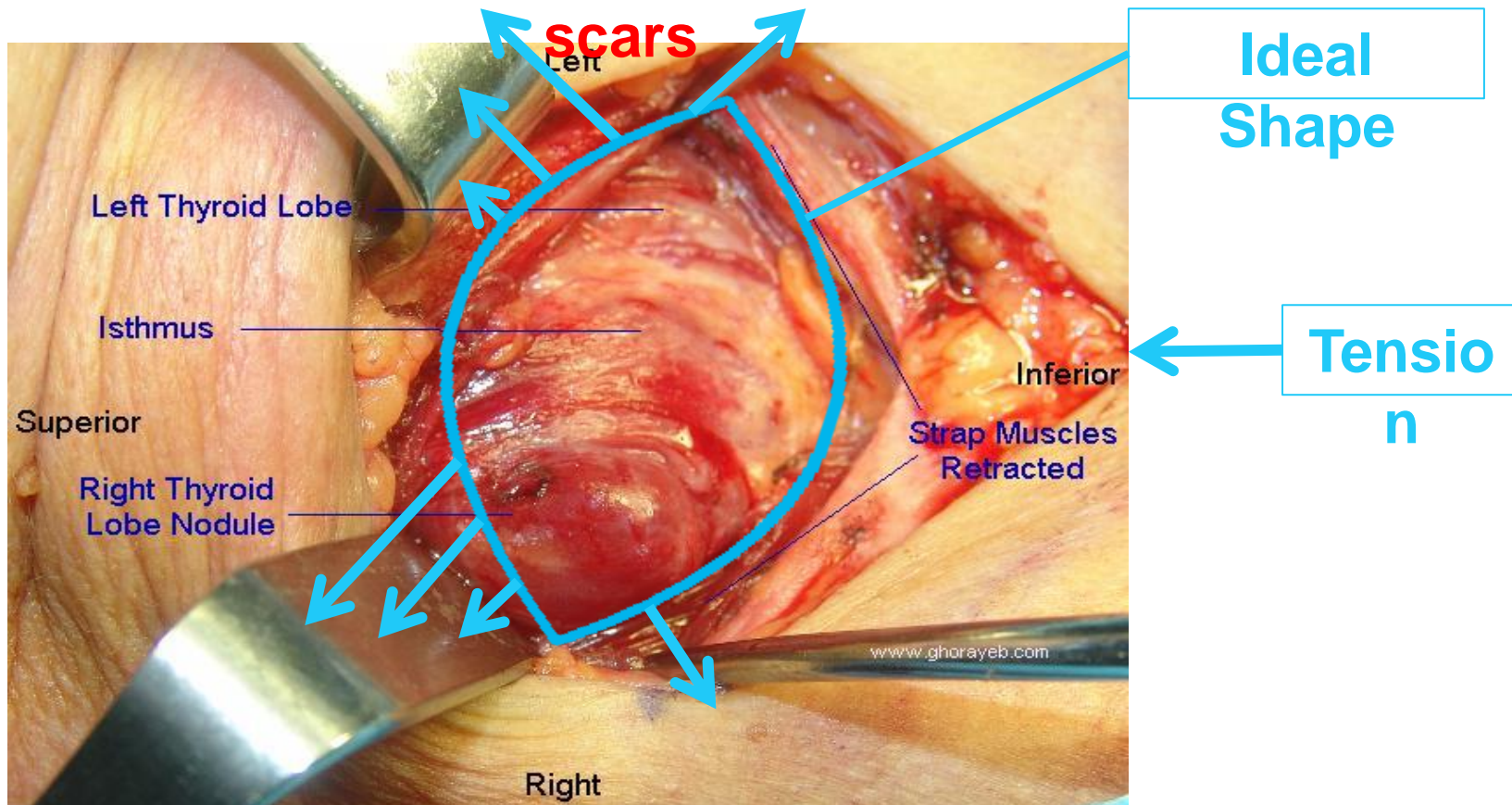


Figure 4: View of thyroid with metal retractors⁸

Metal Retractors Currently In Use

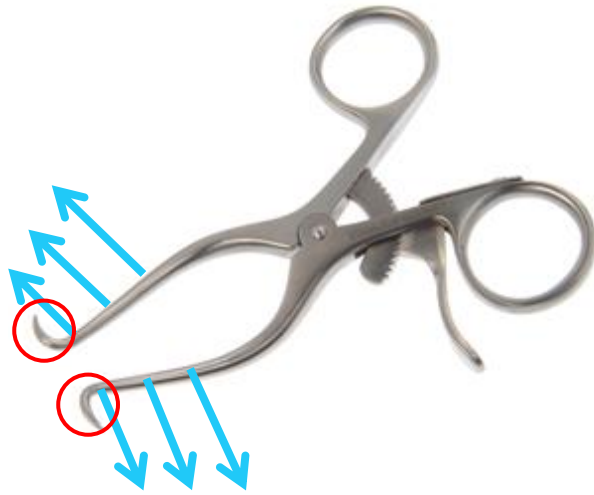


Figure 5: Gelpi Retractor⁹

- Uneven force distribution
- Sharp edges, small surface area (pierces skin)

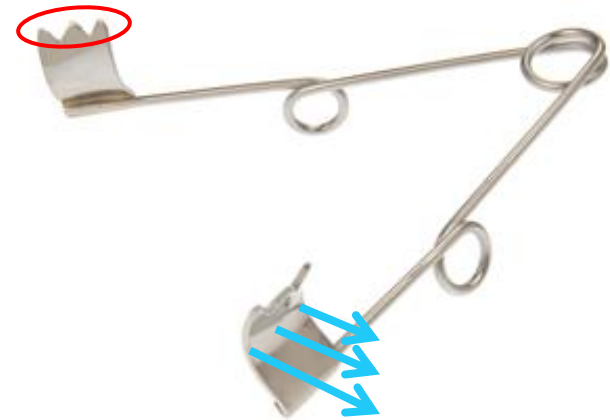


Figure 6: Spring Retractor⁹

- Provides a lot of force
- Very sharp, small surface area (digs into skin)

Scarring Results from Uneven Force Distribution



Figure 7: Two weeks after thyroid surgery¹⁰

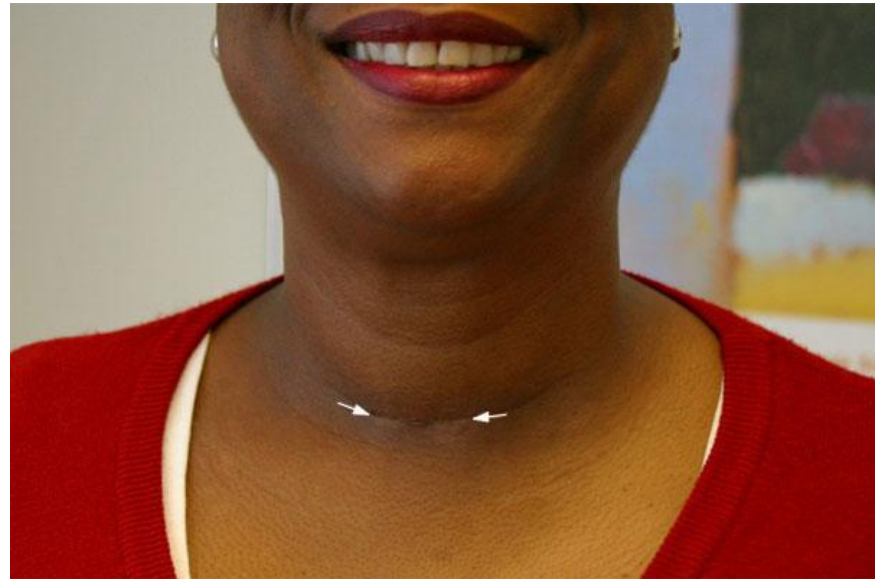


Figure 8: Three months after thyroid surgery¹⁰

Alexis O Wound Protector



Figure 9: Alexis O Wound Protector¹¹

- Used in abdominal surgeries¹¹
- Provides even force distribution¹¹
- Made from polyurethane¹¹



Figure 10: Alexis O Wound Protector in incision¹¹

Problem Statement & PDS

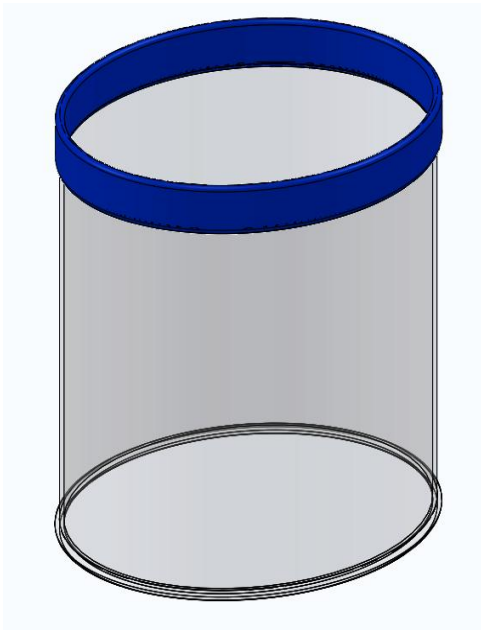
Summary

- Our clients seek a better protector/retractor for thyroid surgeries.
- Goal: Modify existing protectors/retractors to:
 - Comply with the varying anatomy of the neck
 - Be compatible with surgical opening size & shape
 - Incision: 3.5 cm
 - Opening: 3x4 cm
 - Distribute force evenly
 - Eliminate scarring
 - Prevent unnecessary trauma

Device Sterilization

- Single use devices produced in sterile environment
- Removes biological contaminants between uses for reusable devices
- Limits materials used
- Techniques:
 - High Temperature (Steam, Dry Heat)¹²
 - Low Temperature (Gas, Chemical)¹²

Our Designs



**Revised Alexis Device
+ Oval Rings**



**Revised Alexis
Device
+ Wire Mesh**



**Revised Metal
Spring
Retractor**

Design Matrix

Categories	Weight	Revised Alexis Device + Oval Rings	Revised Alexis Device + Wire Mesh	Revised Metal Spring Retractor
Pressure Distribution	0.20	10	10	4
Compatible with varying anatomies	0.20	9	8	6
Safety Features	0.20	9	10	5
Ease of Production	0.15	8	6	5
Ease of Use (Ergonomics)	0.15	9	8	5
Environmental Impact	0.10	4	3	10
Total:	1.00	8.55	8.00	5.50

Future Work

- Continue researching biocompatible materials
- Construct final design (Revised Alexis Device with Oval Rings)
- Pressure Testing
- Animal Model
- Questionnaire to demonstrate need

Acknowledgements

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 - ▣ Dr. David Yu Greenblatt (client)
 - ▣ Professor Mitchell Tyler (advisor)

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Questions?