



DEPARTMENT OF
Biomedical Engineering
UNIVERSITY OF WISCONSIN-MADISON

Dislodgement Resistant Endoscopic Dissecting Cap

Eli Miland, Aidan Brey, Leo DiCataldo, Will Martin, Sofia Castagnozzi, Helen
Sargeant

Advisor: Dr. Megan Settell

Client: Dr. Amber Shada

Friday, October 6th



DEPARTMENT OF
Biomedical Engineering
UNIVERSITY OF WISCONSIN-MADISON

Overview of Presentation

- Problem Statement
- Background Material
- Product Design Specifications
- Design Alternative
- Preliminary Designs
- Design Matrix
- Future Work
- References and Acknowledgements



Problem Statement

- Develop a dislodgement resistant cap for endoscopic procedures
- Endoscopic cap is a small attachment, generally $< 12\text{mm}$ diameter
- Dislodgement of the cap significantly prolongs the operation



Figure 1: Olympus EVIS EXERA III Gastroscope [1]
[2]

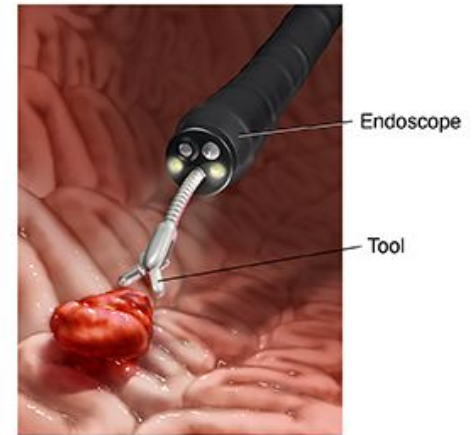


Figure 2: Example endoscope biopsy [3]





Figure 3 endoscopic cap in use [4]

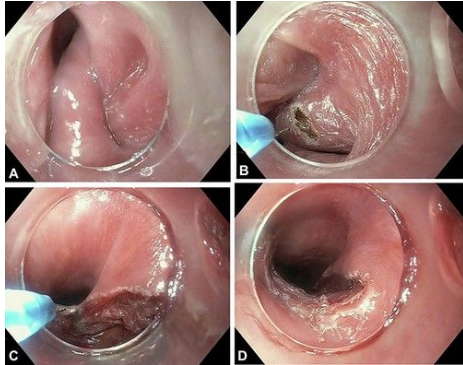


Figure 4 view from endoscope with cap attachment [5]

Background Research

- Specific type of endoscopy
- Current dislodgement prevention techniques
- Retrieval methods for a dislodged cap
- Additional benefits of endoscopic caps



Competing Designs

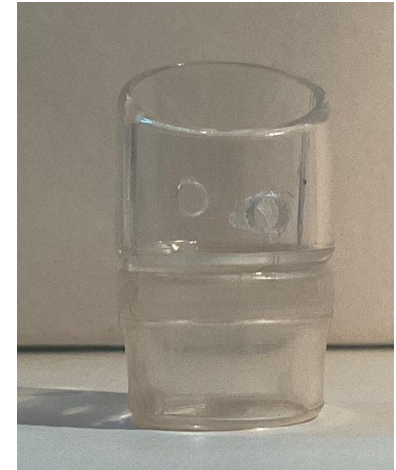
- Three current caps used by client
- Varying in flexibility and length
- Client prefers the more rigid material with longer length for better viewing field
- Client prefers beveled end for enhanced maneuverability



Figure 5 shown above, soft distal cap with short bevel.

Figure 6 shown at top right favored cap design, less flexible material, longer viewing field and beveled end.

Figure 7 shown bottom right, shorter cap with more flexible material



Competing Designs

- MAJ-2315 Disposable Distal Cap
 - Single use
 - Does not contain natural rubber latex

- Halo cap
 - Discontinued



Figure 8 shown above: MAJ-2315 Disposable Distal Cap [4]

Figure 9 shown on the left: Halo cap [6]



Summary product design specification

- 10.2 mm diameter
- Dislodgement resistant
- Detachable and reattachable
- Sterilizable
- Specific shape with a beveled end
- Rigid and safe material
- Withstand bodily conditions
- Reusable

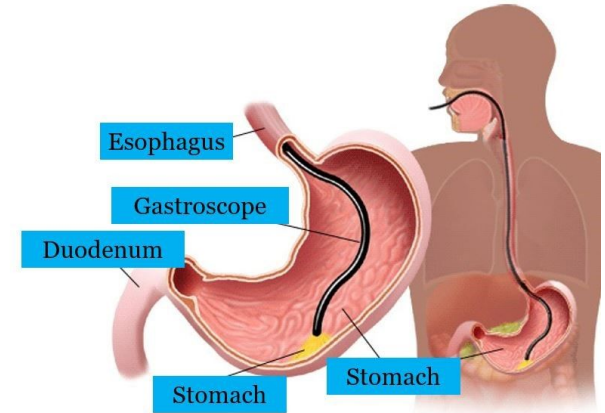


Figure 10: diagram of gastroscopy procedure [4]



Design 1: Internal Flaps

Pros:

- Single piece to reduce risk of breakage in use
- Ease in attachment and detachment
- Reusable

Cons:

- Difficult to fabricate
- Precise design and measurements

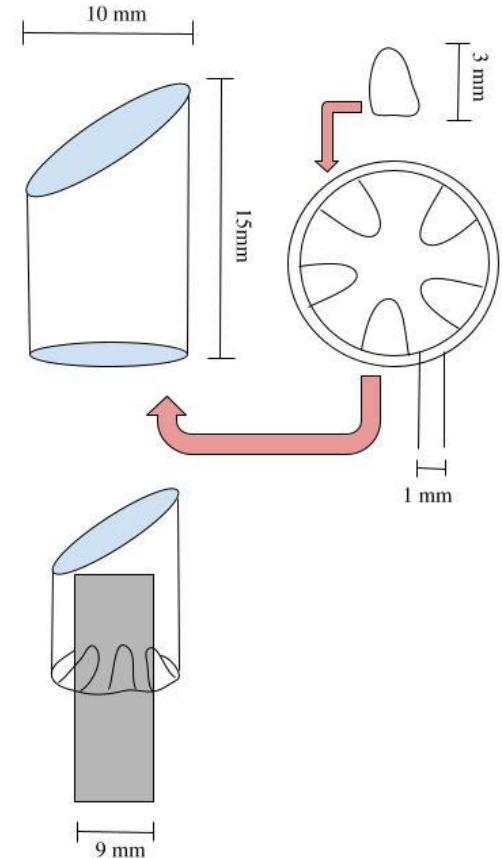


Figure 11: Internal Flaps schematic



Design 2: Internal Band

Pros:

- Dislodgement resistance

Cons:

- Intricate fabrication
- Two parts leads a higher risk of breakage
- Band is not reusable

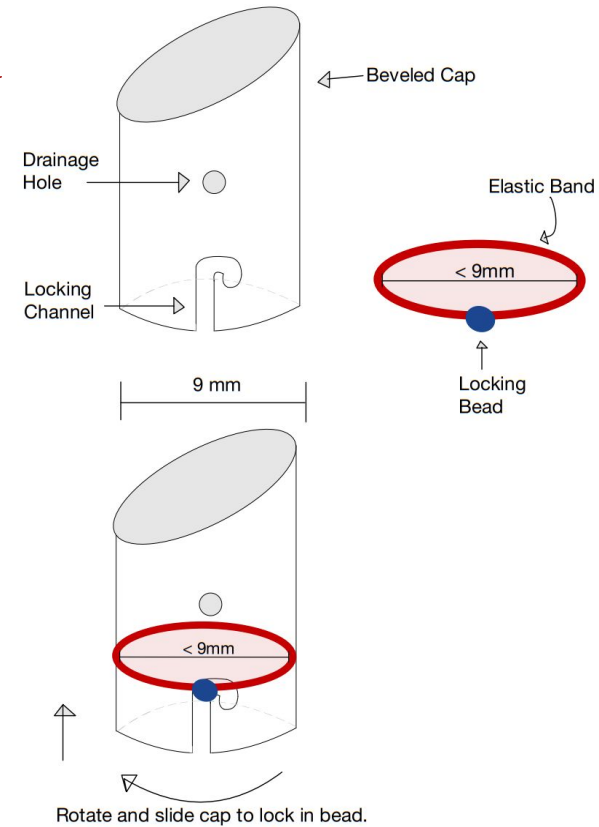


Figure 12: Internal band schematic



Design 3: External Band

Pros:

- Simplest design
- Ease of fabrication

Cons:

- Increased risk of dislodgement
- Band is not reusable

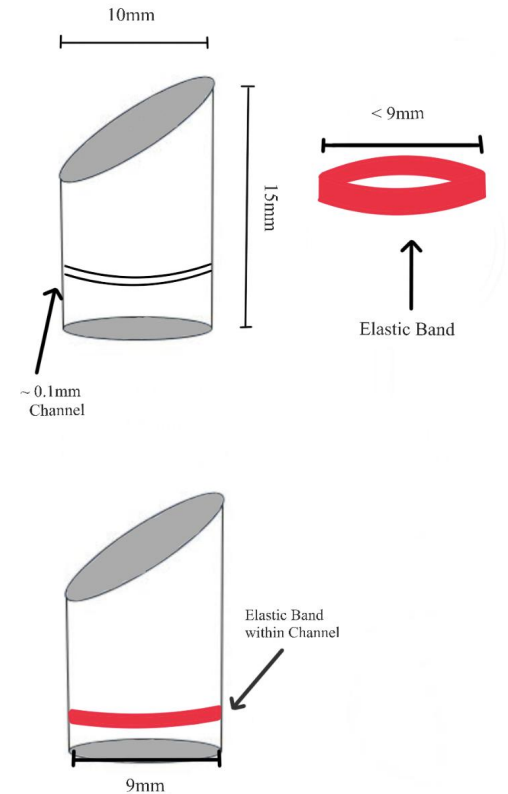


Figure 13: External band schematic



Design matrix

- Overall winner:
Internal Flaps Design
- Scoring highest in:
 - Dislodgement resistance
 - Patient safety
 - Attachment and Detachment
 - Reusability
 - Cost

Example Criteria	Weight	Internal Flaps		External Band Compression Channel		Internal Band Locking Mechanism	
Dislodgement Resistance	25	4	20	2	10	4	20
Patient Safety	25	5	25	3	15	4	20
Attachment and Detachment	20	5	20	4	16	3	12
Ease of Fabrication	15	2	6	4	12	3	9
Reusability	10	5	10	3	6	3	6
Cost	5	5	5	4	4	4	4
Total	100	SUM	86	SUM	63	SUM	71



Future work

We expect a variety of unique challenges with this project

- The type of material we use to fabricate our cap is very restricted. We will need to research potential materials extensively.
- The fabrication methods we can use are also restricted. We will need to research fabrication methods that can be done on a small scale with our possible materials.
- We will need to begin designing a testing procedure that produces accurate and relevant dislodgement resistance testing results by comparing the current cap and our design.



Acknowledgements

The team would like to thank our client, Dr. Amber Shada as well as our advisor, Dr. Megan Settell for each of their contributions to our project.



References

- [1] OLYMPUS AMERICA INC., “EVIS EXERA III GASTROINTESTINAL VIDEOSCOPE GIF-HQ190.” Olympus America Inc, 2012. Available: https://medical.olympusamerica.com/sites/default/files/us/files/pdf/OAIGI0312BRO8801_GIFHQ190.pdf. [Accessed: Sep. 17, 2023]
- [2] “Olympus Academy - How to use the MAJ-2315 Disposable Distal Cap with the TJF-Q190V Duodenoscope - YouTube.” Available: https://www.youtube.com/watch?v=WFKbOjWf-Lw&ab_channel=OlympusAustraliaandNewZealand. [Accessed: Sep. 13, 2023]
- [3] “Endoscopic Examination for Cancer,” Endoscopic Examination for Cancer | Spectrum Health Lakeland, <https://www.spectrumhealthlakeland.org/population-health/health-library/Content/85/p07190/> (accessed Oct. 5, 2023).
- [4] “Gastroscopy [Upper Endoscopy] - Maher A. Abbas, MD | Dubai/UAE,” Maher A. Abbas, MD. Available: <https://drmaherabbas.com/colonoscopy-endoscopy/gastroscopy-upper-endoscopy/>. [Accessed: Oct. 05, 2023]
- [5] GIEJOURNAL, “Endoscopic treatment of Zenker’s diverticulum,” Dec. 13, 2016. Available: <https://endoscopy.com/2016/12/13/cai/>. [Accessed: Oct. 05, 2023]
- [6] P. Re, S. Vk, and B. Jj, “• Maintains endoscopic visualization during cleaning of treatment area”. Available: http://www.synmed.co.uk/_discontinued/halo_system_accessories/pdf/HaloCapBrochureandCompatibility.pdf. [Accessed: Oct. 05, 2023]

