

BME Design-Fall 2023 - SOFIA CASTAGNOZZI

Complete Notebook

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Team contact Information

SOFIA CASTAGNOZZI - Dec 04, 2023, 4:14 PM CST

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Castagnozzi	Sofia	Leader	castagnozzi@wisc.edu	414-550-4826	
Martin	Will	Communicator	wimartin@wisc.edu	414-331-2140	
Brey	Aidan	BSAC	anbrey@wisc.edu	262-899-5833	
Dicataldo	Leo	BWIG	dicataldo@wisc.edu	781-738-1690	
Miland	Eli	BPAG	emiland@wisc.edu	715-321-4215	
Sargeant	Helen	BSAC	hsargeant@wisc.edu	920-572-9677	



Project description

John Puccinelli - Aug 14, 2013, 12:01 PM CDT

Course Number:

Project Name:

Short Name:

Project description/problem statement:

About the client:



2023/9/13 Client Meeting

SOFIA CASTAGNOZZI - Sep 13, 2023, 6:41 PM CDT

Title: Meeting with Dr. Shada

Date: 9/13/2023

Content by: Sofia, Will, Leo, Helen, Eli, Aidan

Present: Sofia, Will, Leo, Helen, Eli, Aidan

Goals: To get a better understanding of client's requirements

Content:

- Questions
 - When would be a good time for us to pick up the current models of endoscope caps?
 - What is the price range you are looking for? \$500
 - What size endoscope should this fit?
 - Are there other current attachment methods besides tape?
 - Can modifications (permanent/semi-permanent) be made to the endoscope itself?
 - Single use?- probably
 - New design of cap or strictly connection point to existing cap
 -
- Notes
 - Cap pushes interior wall so endoscope can push forward more easily
 - Shear force from moving back and forth, cap can fall off
 - Uses water resistant tape rn
 - ERCP scope cap - different size, she doesn't use this
 - Next tuesday could meet to get cap - university hospital
 - 608-444-8548 (cell)
 - Use device with fiber optic lights and CO2 channel, suction channel, within housing is two knobs at top that look up and down and left and right
 - Scope comes in variety of sizes she uses 9.9 mm in diameter
 - Need to push inside wall of intestines
 - Can add attachments to scope but must be removable
 - Can make it reusable (autoclavable)
 - Prefers bevel cap (needs to be longer than the flat cap)
 - Tape link https://www.amazon.com/Original-Pink-Tape-QTY/dp/B0002Q0AJI/ref=sr_1_2?crid=9V280V53FOGC&keywords=hy+tape+1%2F2+inch&qid=1694646980&s=hpc&sprefix=hy+tape+1%2F2+inch%2Chpc%2C126&sr=1-2

Conclusions/action items:

Continue research on endoscopic cap products and attachment methods. Meet with advisor to discuss next steps



2023/11/01 Client Meeting

SOFIA CASTAGNOZZI - Nov 03, 2023, 11:48 AM CDT

Title: Meeting with Dr. Shada

Date: 11/01/2023

Content by: Sofia, Will, Leo, Helen, Eli, Aidan

Present: Sofia, Will, Leo, Helen, Eli, Aidan

Goals: To explain our design concept to our client and get feedback

Content:

- Design
 - Endoscopic cap will be composed of two sections for the use of two materials
 - The current design will not be reusable because of the two parts, but the idea for the future is that the piece will be manufactured in a manner that does not create gaps between materials
 - Show design on solidworks drawing
 - [polycarbonate top section](#)
 - [silicone detachment resistant section](#)
- Fabrication
 - Silicone to sit on endoscope and resist detachment
 - Polycarbonate to maneuver through tissue (rigid material similar to preferred cap)
 - We are printing our prototype by friday, it will be similar in size to current designs, but after printing we will most likely need to do some alterations to ensure that the two sections fit together correctly
 - The materials we use to print will not be the exact same as they are not available to print with, but the goal for the future is to acquire the correct materials
- Testing
 - Come in and fit on endoscope to ensure correct sizing and see approximately how well the cap resists detachment
 - For testing we will use a dowel or flexible rod the same size as the endoscope and either borrow an esophageal model from a lab, or simulate an esophagus environment with a tube and a material to mimic tissue.
 - If we were unable to acquire an esophageal model, would you say it was justifiable for us to purchase one for our own use?
- Other
 - If we have time throughout the semester, or if the original design fails, we plan on moving forward with the internal band design.
 - We did not choose this initially due to its higher patient risk with the dislodgement of the band

Conclusions/action items:

Continue fabrication of endoscopic caps and once ready for testing, Dr. Shada will set up a time for us to come in and test dislodgement on a pig esophagus



2023/9/15 Advisor Meeting

SOFIA CASTAGNOZZI - Sep 17, 2023, 11:38 AM CDT

Title: Advisor Meeting

Date: 9/15/2023

Content by: Sofia, Will, Leo, Eli, Helen, Aidan

Present: Sofia, Will, Leo, Eli, Helen, Aidan

Goals: To determine the next steps in initiating our semester project

Content:

- LabArchives Notes checks will be graded weekly
- The PDS is due the following Friday 9/22
- The preliminary presentations will take place on 10/6
- Send slides to Dr. Settell before presentation for feedback

Conclusions/action items:

Work on Product Design Specification and continue relevant research. Pick up endoscopic cap samples from client to get a better idea of how to approach the project.



2023/9/22 Advisor Meeting

SOFIA CASTAGNOZZI - Sep 22, 2023, 1:22 PM CDT

Title: Advisor Meeting

Date: 9/22/2023

Content by: Sofia, Will, Leo, Eli, Helen, Aidan

Present: Sofia, Will, Leo, Eli, Helen, Aidan

Goals: To determine the next steps in initiating our semester project

Content:

- Think about testing - how often the current cap falls off compared to ours. Over specific distances, turning corners, etc.
- Design matrix due next week?
- Ask about getting pig intestine/esophagus to use for testing.
- Ask about how they currently sterilize the reusable beveled cap.
- Client prefers a harder material cap, a little bit of flexibility is okay.

Conclusions/action items:

Work on Design Matrix and continue relevant research. Design 3 caps to evaluate.



2023/9/29 Advisor Meeting

SOFIA CASTAGNOZZI - Oct 06, 2023, 5:13 PM CDT

Title: Advisor Meeting

Date: 9/29/2023

Content by: Sofia, Will, Leo, Eli, Helen, Aidan

Present: Sofia, Will, Leo, Eli, Helen, Aidan

Goals: To determine the next steps in creating our preliminary presentation

Content:

- Follow the rubric for presentation.
- 1 slide per heading.
- Bold the headings.
- Need a physical prop.
- Business casual dress.

Conclusions/action items:

Work on preliminary presentation and continue relevant research.



2023/9/14 Progress Report 1

SOFIA CASTAGNOZZI - Sep 17, 2023, 1:07 PM CDT

Title: Progress Report 1

Date: 9/14/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

Work on the Product Design Specification due the following week and continue to track weekly progress

SOFIA CASTAGNOZZI - Sep 17, 2023, 1:08 PM CDT

Dislodgement Resistant Endoscopic Dissecting Cap Progress Report 1

Client: Dr. Amber Szala

Advisor: Dr. Megan Schall

Team:

Team Leader: Sofia Castagnozzi (scastagn@uic.edu)
 Co-Lead: Will Martin (wmartin@uic.edu)
 BSAC: Alden Bray (alden@uic.edu)
 Co-BSAC: Leonardo DiCarlo (ldcarlo@uic.edu)
 Co-BSAC: Helen Sargent (hlsargent@uic.edu)
 Advisor: Dr. Michael (michael@uic.edu)

Project Website: [LINK](#)

Dates: September 8, 2023 - September 14, 2023

Problem Statement

The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting cap are used for surgeries occurring within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic surgeries, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment using procedures.

Current Goals

- Attend client meeting
- Conduct further research based on input from the client
- Complete PDS for meeting with the client

Team Design Accomplishments

- Team roles were assigned
- Our first client meeting was conducted on September 13
- We individually began researching background information on the procedure of endoscopic surgeries and the current design of endoscopic dissecting caps

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Endoscopic_Dissecting_Cap_Progress_Report_1.pdf (140 kB)



2023/9/21 Progress Report 2

SOFIA CASTAGNOZZI - Sep 22, 2023, 1:27 PM CDT

Title: Progress Report 2

Date: 9/22/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

Sketch out cap design ideas and begin design matrix.

SOFIA CASTAGNOZZI - Sep 22, 2023, 1:28 PM CDT

Dislodgement Resistant Endoscopic Dissecting Cap Progress Report 2

Client: Dr. Amber Stala

Advisor: Dr. Megan Schall

Team:

Team Leader: Sofia Castagnozzi (scastagn@uiowa.edu)
 Co-Leader: Will Martin (wmartin@uiowa.edu)
 BFTU: Lorenzo DiCintio (ldicintio@uiowa.edu)
 Co-BSAC: Aidan Brey (abrey@uiowa.edu)
 Co-BSAC: Helen Sargeant (hsargean@uiowa.edu)
 Advisor: Dr. Mikael (mikael@uiowa.edu)

Project Website: [LINK](#)

Dates: September 15, 2023 - September 21, 2023

Problem Statement

The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting capsules used for surgeries occurring within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic surgeries, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment during procedures.

Current Goals

- Complete Product Design Statement
- Reach out to Dr. Stala with further questions

Team Design Accomplishments

- Split up PDS sections for individual research
- Conducted research on our assigned aspects of the project.

Summary of Team Role Accomplishments

- Sofia Castagnozzi (Team Leader)
 - Continued research related to Product Design Specification

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Endoscopic_Dissecting_Cap_Progress_Report_2.pdf (134 kB)



2023/9/29 Progress Report 3

SOFIA CASTAGNOZZI - Oct 06, 2023, 5:07 PM CDT

Title: Progress Report 3

Date: 9/29/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

Create slides and prepare for preliminary presentation.

SOFIA CASTAGNOZZI - Sep 29, 2023, 8:48 PM CDT

**Dislodgement Resistant Endoscopic
Dissecting Cap**
Progress Report 3

Client: Dr. Amber Szala
Advisor: Dr. Megan Schall

Team:
Team Leader: Sofia Castagnozzi (scastagn@uic.edu)
Classmates: Will Martin (willmartin@uic.edu)
BFTU: Lorenzo DiCarlo (ldicarlo@uic.edu)
Co-BSAC: Aidan Brey (abrey@uic.edu)
Co-BSAC: Helen Sargent (hsargent@uic.edu)
BFTU: Eli Miland (emiland@uic.edu)

Project Website: [LINK](#)

Dates: September 22, 2023 - September 28, 2023

Problem Statement
The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting capsules used for surgeries occurring within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic surgeries, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment using procedures.

Current Goals

- Complete Design Matrix
- Meet with client to discuss designs

Team Design Accomplishments

- Came up with three main designs to assess
- Determined criteria to rank our designs on

Summary of Team Role Accomplishments

- Sofia Castagnozzi (Team Leader)
 - o Brainstormed design ideas

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Endoscopic_Dissecting_Cap_Progress_Report_3.pdf (134 kB)



2023/10/4 Progress Report 4

SOFIA CASTAGNOZZI - Oct 06, 2023, 5:09 PM CDT

Title: Progress Report 4

Date: 10/5/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

Work on the preliminary presentation.

SOFIA CASTAGNOZZI - Oct 06, 2023, 5:10 PM CDT

Dislodgement Resistant Endoscopic Dissecting Cap Progress Report 4

Client: Dr. Amber Szala

Advisor: Dr. Megan Schall

Team:

Team Leader: Sofia Castagnozzi (scastagnozzi@uic.edu)
 Co-Leader: Will Martin (willmartin@uic.edu)
 BFTU: Lorenio DiCintio (ldicintio@uic.edu)
 Co-BSAC: Aidan Brey (abrey@uic.edu)
 Co-BSAC: Helen Sargent (hsargent@uic.edu)
 BFTU: Eli Miland (emiland@uic.edu)

Project Website: [LINK](#)

Dates: September 20, 2023 - October 5, 2023

Problem Statement

The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting capsules used for surgeries occurring within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic surgeries, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment during procedures.

Current Goals

- Complete preliminary presentation slides
- Present preliminary presentation to advisor and other groups

Team Design Accomplishments

- Completed design matrix comparing three cap designs
- Continued research on cap specifications and design

Summary of Team Role Accomplishments

- Sofia Castagnozzi (Team Leader)
 - Worked on preliminary presentation slides

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Endoscopic_Dissecting_Cap_Progress_Report_4.pdf (133 kB)



2023/10/12 Progress Report 5

SOFIA CASTAGNOZZI - Oct 13, 2023, 10:29 AM CDT

Title: Progress Report 5

Date: 10/12/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

Work on the preliminary report.

SOFIA CASTAGNOZZI - Oct 13, 2023, 10:31 AM CDT

Dislodgement Resistant Endoscopic Dissecting Cap Progress Report 5

Client: Dr. Amber Szala

Advisor: Dr. Megan Schall

Team:

Team Leader: Sofia Castagnozzi (scastagnozzi@uiowa.edu)
 Co-Leader: Will Martin (willmartin@uiowa.edu)
 BFTO: Lorenz DiCintio (ldicintio@uiowa.edu)
 Co-BSAC: Aidan Brey (abrey@uiowa.edu)
 Co-BSAC: Helen Sargeant (hsargeant@uiowa.edu)
 Advisor: Dr. Mikael (mikael@uiowa.edu)

Project Website: [LINK](#)

Date: October 6, 2023 - October 12, 2023

Problem Statement

The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting capsules used for surgeries occurring within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic surgeries, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment during procedures.

Current Goals

- Finalize fabrication plans
- Begin fabrication of prototype

Team Design Accomplishments

- Completed Preliminary Report
- Gave Preliminary Presentation

Summary of Team Role Accomplishments

- Sofia Castagnozzi (Team Leader)
 - Completed section of preliminary report

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Endoscopic_Dissecting_Cap_Progress_Report_5.pdf (132 kB)



2023/10/27 Team Meeting Notes

SOFIA CASTAGNOZZI - Oct 27, 2023, 2:29 PM CDT

Title: Team Meeting Notes

Date: 10/27/2023

Content by: Sofia Castagnozzi

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To discuss the next steps in fabricating our prototype

Content:

Notes:

Client's preferred cap was measured

Measurements will be applied to current team design

The team will move forward with printing the cap out of two different materials

Two pieces will lock together, possibly glue

Research possible materials for simulating an esophagus

Reach out to research labs about esophageal model

Conclusions/action items:

Goals for the next week:

Complete solidworks design

3D print cap for show and tell



2023/10/19 Progress Report 6

SOFIA CASTAGNOZZI - Nov 09, 2023, 2:25 PM CST

Title: Progress Report 6

Date: 10/19/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

To begin fabrication of endoscopic cap prototype

SOFIA CASTAGNOZZI - Nov 09, 2023, 2:25 PM CST

Dislodgement Resistant Endoscopic Dissecting Cap Progress Report 6

Client: Dr. Amber Szala

Advisor: Dr. Megan Schall

Team:

Team Leader: Sofia Castagnozzi (scastagnozzi@uic.edu)
 Co-Lead: Will Martin (willmartin@uic.edu)
 BFTO: Lorenzo DiCarlo (ldicar@uic.edu)
 Co-BSAC: Aidan Brey (abrey@uic.edu)
 Co-BSAC: Helen Sargent (hsargent@uic.edu)
 Advisor: Dr. Michael (michael@uic.edu)

Project Website: [LINK](#)

Date: October 13, 2023 - October 19, 2023

Problem Statement

The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting cap are used for surgeries occurring within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic surgeries, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment using procedures.

Current Goals

- To begin fabrication of endoscopic cap prototype

Team Design Accomplishments

- Completed Preliminary Report

Summary of Team Role Accomplishments

- Sofia Castagnozzi (Team Leader)
 - Conducted research on possible 3d printing materials
 - Designed initial design
- Will Martin (Communication)

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Endoscopic_Dissecting_Cap_Progress_Report_6.pdf (133 kB)



2023/10/26 Progress Report 7

SOFIA CASTAGNOZZI - Nov 09, 2023, 2:28 PM CST

Title: Progress Report 7

Date: 10/26/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

To begin fabrication of endoscopic cap prototype

SOFIA CASTAGNOZZI - Nov 09, 2023, 2:26 PM CST

Dislodgement Resistant Endoscopic Dissecting Cap Progress Report 7

Client: Dr. Amber Szala

Advisor: Dr. Megan Schall

Team:

Team Leader: Sofia Castagnozzi (scastagnozzi@uic.edu)
 Co-Leader: Will Martin (willmartin@uic.edu)
 BFTU: Lorenzo DiCarlo (lcarlo@uic.edu)
 Co-BSA: Aidan Brey (abrey@uic.edu)
 Co-BSA: Helen Sargent (hsargent@uic.edu)
 Advisor: Dr. Michael (michael@uic.edu)

Project Website: [LINK](#)

Dates: October 30, 2023 - October 26, 2023

Problem Statement

The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting caps are used for surgeries occurring within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic surgeries, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment using procedures.

Current Goals

- To begin fabrication of endoscopic cap prototype

Team Design Accomplishments

- Began 3D rendering of endoscopic cap

Summary of Team Role Accomplishments

- Sofia Castagnozzi (Team Leader)
 - Continued solidworks design of endoscopic cap
- Will Martin (Co-Leader)
 - Contributed to new 2 part cap design

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Endoscopic_Dissecting_Cap_Progress_Report_7.pdf (133 kB)



2023/11/2 Progress Report 8

SOFIA CASTAGNOZZI - Nov 09, 2023, 2:30 PM CST

Title: Progress Report 8

Date: 11/2/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

To make alterations to design of endoscopic cap and begin testing

SOFIA CASTAGNOZZI - Nov 09, 2023, 2:29 PM CST

Dislodgement Resistant Endoscopic Dissecting Cap Progress Report 8

Client: Dr. Amber Szala

Advisor: Dr. Megan Schall

Team:

Team Leader: Sofia Castagnozzi (scastagnozzi@u.wisc.edu)
 Co-Lead: Will Martin (willmartin@u.wisc.edu)
 BFTU: Lorenzo DiCarlo (lcarlo@u.wisc.edu)
 Co-BSAC: Aidan Brey (abrey@u.wisc.edu)
 Co-BSAC: Helen Sargent (hsargent@u.wisc.edu)
 Advisor: Dr. Michael (michael@u.wisc.edu)

Project Website: [LINK](#)

Dates: October 27, 2023 - November 2, 2023

Problem Statement

The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting caps are used for surgeries occurring within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic surgeries, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment using procedures.

Current Goals

- To fabrication of endoscopic cap prototype and bring to show and tell presentations.

Team Design Accomplishments

- Began 3D rendering of endoscopic cap

Summary of Team Role Accomplishments

- Sofia Castagnozzi (Team Leader)
 - Completed solution to design of endoscopic cap
- Will Martin (Co-Lead)
 - Conducted UW-Madison endoscopy lab for testing models

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Endoscopic_Dissecting_Cap_Progress_Report_8.pdf (133 kB)



2023/11/9 Progress Report 9

SOFIA CASTAGNOZZI - Nov 09, 2023, 2:30 PM CST

Title: Progress Report 9

Date: 11/9/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

To make alterations to design of endoscopic cap and begin testing



2023/11/16 Progress Report 10

SOFIA CASTAGNOZZI - Nov 19, 2023, 2:38 PM CST

Title: Progress Report 10

Date: 11/16/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

To make alterations to design of endoscopic cap polycarbonate and silicone section, print out three different sizes of each part, and use them to test dislodgement in a pig esophagus within the next two weeks

SOFIA CASTAGNOZZI - Nov 19, 2023, 2:38 PM CST

**Dislodgement Resistant Endoscopic
Dissecting Cap**
Progress Report 10

Client: Dr. Anshu Shah

Advisor: Dr. Megan Small

Team:
Team Leader: Sofia Castagnozzi (scastagn@uic.edu)
Communicator: Will Martin (willmartin@uic.edu)
BFTO: Lorenzo DiCarlo (lcarlo@uic.edu)
Co-BSAC: Aidan Brey (abrey@uic.edu)
Co-BSAC: Helen Siegel (hsiegel@uic.edu)
BPOG: Eli Miland (emiland@uic.edu)

Project Website: [Link](#)

Date: November 10, 2023 - November 16, 2023

Problem Statement
The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting capsules used for margin assessment within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic resection, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment during procedures.

Current Goals

- To redesign the rigid section of the endoscopic cap so that it is more ergonomic and fits with the silicone section.

Team Design Accomplishments

- Assessed the prototype with new dimensions and determined that a redesign would be necessary.

Summary of Team Role Accomplishments

- Sofia Castagnozzi (Team Leader)
 - Redesigned rigid cap section redesign
- Will Martin (Communicator)

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Endoscopic_Dissecting_Cap_Progress_Report_10.pdf (140 kB)



2023/11/23 Progress Report 11

SOFIA CASTAGNOZZI - Nov 30, 2023, 9:14 AM CST

Title: Progress Report 11

Date: 11/23/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

Reprint ripped silicone section and begin testing on pig esophagus using testing protocol.

SOFIA CASTAGNOZZI - Nov 30, 2023, 9:14 AM CST

Dislodgement Resistant Endoscopic Dissecting Cap Progress Report 11

Client: Dr. Amber Szala

Advisor: Dr. Megan Schall

Team:

Team Leader: Sofia Castagnozzi (scastagnozzi@uiowa.edu)
 Communication: Will Marks (wmarks@uiowa.edu)
 BFTO: Lorenzo DiCarlo (lodicarlo@uiowa.edu)
 Co-BSAC: Aidan Brey (abrey@uiowa.edu)
 Co-BSAC: Helen Sargent (hsargent@uiowa.edu)
 Advisor: Dr. Michael (michael@uiowa.edu)

Project Website: [LINK](#)

Dates: November 17, 2023 - November 23, 2023

Problem Statement

The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting capsules used for surgeries occurring within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic surgeries, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment using procedures.

Current Goals

- To complete fabrication of the endoscopic cap and begin testing.

Team Design Accomplishments

- Completed design for endoscopic cap and created three different sizes in two different versions of the design for testing.

Summary of Team Role Accomplishments

- Sofia Castagnozzi (Team Leader)
 - Completed Solidworks of endoscopic cap design.
- Will Marks (Communication)

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Endoscopic_Dissecting_Cap_Progress_Report_11.pdf (141 kB)



2023/11/30 Progress Report 12

SOFIA CASTAGNOZZI - Dec 06, 2023, 10:44 PM CST

Title: Progress Report 12

Date: 11/30/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

Test on Friday 12/1 using porcine esophagus and stomach

SOFIA CASTAGNOZZI - Dec 06, 2023, 10:43 PM CST

Dislodgement Resistant Endoscopic Dissecting Cap Progress Report 12

Class: Dr. Amber Szala

Advisor: Dr. Megan Schall

Team:

Team Leader: Sofia Castagnozzi (scastagn@uic.edu)
 Co-Leader: Will Martin (willmartin@uic.edu)
 BFTU: Lorenzo DiCarlo (ldicarlo@uic.edu)
 Co-BSAC: Aidan Brey (abrey@uic.edu)
 Co-BSAC: Helen Sargent (hsargent@uic.edu)
 Advisor: Dr. Mikael (mikael@uic.edu)

Project Website: [LINK](#)

Date: November 30, 2023 - November 30, 2023

Problem Statement

The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting capsules used for surgeries occurring within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic surgeries, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment using procedures.

Current Goals

- Begin testing endoscopic cap models using porcine esophagus and stomach
- Test on Friday 12/1

Team Design Accomplishments

- Completed design for endoscopic cap and created three different sizes in two different versions of the design for testing

Summary of Team Role Accomplishments

- Sofia Castagnozzi (Team Leader)
 - Repeatedly fabricated all team sections of endoscopic cap

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Endoscopic_Dissecting_Cap_Progress_Report_12.pdf (141 kB)



2023/12/7 Progress Report 13

SOFIA CASTAGNOZZI - Dec 06, 2023, 10:45 PM CST

Title: Progress Report 13

Date: 12/1/2023

Content by: Sofia, Will, Leo, Eli, Aidan, Helen

Present: Sofia, Will, Leo, Eli, Aidan, Helen

Goals: To track our team's progress throughout the week and keep track of upcoming deadlines

Content:

attached below

Conclusions/action items:

Present final poster at 12/8 poster session and complete final report by 12/13

SOFIA CASTAGNOZZI - Dec 08, 2023, 9:25 AM CST

**Dislodgement Resistant Endoscopic
Dissecting Cap**
Progress Report 13

Class: Dr. Amber Szala

Advisor: Dr. Megan Schall

Team:
Team Leader: Sofia Castagnozzi (scastagn@uic.edu)
Co-leaders: Will Martin (wmartin@uic.edu)
BFTU: Lorenzo DiCarlo (ldicarlo@uic.edu)
Co-BSAC: Aidan Brey (abrey@uic.edu)
Co-BSAC: Helen Sargent (hsargent@uic.edu)
BSAC: Eli Milrod (emilrod@uic.edu)

Project Website: [LINK](#)

Dates: December 1, 2023 - December 7, 2023

Problem Statement

The goal of this project is to design and fabricate an endoscopic dissecting cap that resists dislodgement when in use. Endoscopic dissecting capsules used for surgeries occurring within the GI tract through a scope. The dissecting cap attaches at the end of the endoscope and is an essential part of endoscopic surgeries, so when the cap detaches from the scope it can cause complications. The current plastic design allows for easy attachment to the scope, but can only be fixed in place with tape. Due to this problem, the aim of this project is to design an endoscopic dissecting cap that both attaches easily, and resists detachment using procedures.

Current Goals

- Present project at poster session

Team Design Accomplishments

- Completed prototype testing
- Completed testing analysis

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Endoscopic_Dissecting_Cap_Progress_Report_13.pdf (143 kB)



Project Expenses

Will Martin - Dec 15, 2023, 7:56 PM CST

Title: Project Expenses

Date: 12/15/23

Content by: Eli

Present: --

Goals: Log all expenses the team had throughout the semester

Content:

Expenses

Item	Description	Manufacturer	Part Number	Date	QTY	Cost Each	Total	Link
Category 1								
Print 1	First 3D printed prototype	UW Makerspace		11/01	1		\$1.22	
Print 2	Second 3D printed prototype	UW Makerspace		11/08	1		\$0.53	
Print 3	Third 3D printed prototype	UW Makerspace		11/10	1		\$0.36	
Print 4	Fourth 3D printed prototype	UW Makerspace		11/17	1		\$1.26	
Print 5	Fifth 3D printed prototype	UW Makerspace		11/20	1		\$4.07	
Category 2								
							\$0.00	
							\$0.00	
						TOTAL	\$7.44	

Conclusions/action items:



2023/10/27 Preferred Cap Measurements

SOFIA CASTAGNOZZI - Oct 27, 2023, 2:19 PM CDT

Title: Preferred Endoscopic Cap Measurements

Date: 10/27/2023

Content by: Will Martin and Sofia Castagnozzi

Present: Sofia, Will, Leo, Helen, Aidan, Eli

Goals: Obtain the measurements of client's preferred cap to base design measurements on

Content:

short end of bevel: 17.37mm

tall end of bevel: 21.12

polycarbonate thickness: 1.08mm

silicone thickness: 0.83mm

silicone diameter: 11.66mm

polycarbonate diameter: 13.46mm

silicone height: 9.4mm

polycarbonate height to drainage hole: 6.26mm

Conclusions/action items:

The next steps are to incorporate these dimensions into the SolidWorks design



2023/10/30 Endoscopic Cap Prototype Design

SOFIA CASTAGNOZZI - Oct 30, 2023, 11:59 AM CDT

Title: Endoscopic Cap Prototype Design

Date: 10/30/2023

Content by: Sofia Castagnozzi

Present: Sofia, Eli, Will, Leo, Helen, Aidan

Goals: To create the first design of our Endoscopic Cap

Content:

The cap design attached below is composed of two sections, a rigid plastic tip made of polycarbonate, and a stretchy silicone bottom section. The silicone section is designed to stretch over the top of the polycarbonate section and the grooves of the two pieces will fit together "locking" the design in place. The silicone section also has 4 internal "flaps" on the base of the design, these are used to create friction and a compressive force on the endoscope, keeping the cap from slipping during procedure. The polycarbonate section has a beveled top for easier maneuverability, and two drainage holes to improve the endoscopic viewing field.

Conclusions/action items:

The design will be 3D printed using Formlabs elastic resin and biomed clear resin. While these materials do not have the exact properties of silicone and polycarbonate, they will be similar enough for prototyping.

SOFIA CASTAGNOZZI - Oct 30, 2023, 11:52 AM CDT



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endoscopic_cap_polycarbonate_section.SLDDRW (236 kB)

SOFIA CASTAGNOZZI - Oct 30, 2023, 11:52 AM CDT



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Endoscopic_Cap_Silicone_Section.SLDDRW (216 kB)

SOFIA CASTAGNOZZI - Oct 30, 2023, 11:52 AM CDT



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spikes_part.SLDPRT (112 kB)



2023/11/ 09 Endoscopic Cap Prototype Design - UPDATED DIMENSIONS

SOFIA CASTAGNOZZI - Nov 09, 2023, 10:12 PM CST

Title: Endoscopic Cap Prototype Design

Date: 11/09/2023

Content by: Sofia Castagnozzi

Present: Sofia, Eli, Will, Leo, Helen, Aidan

Goals: To update the dimensions of the first design of our Endoscopic Cap

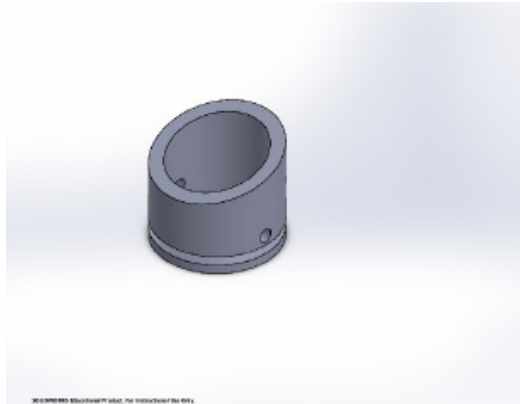
Content:

The diameter of the silicone section was increased to match the diameter of the polycarbonate section, this will allow the silicone to successfully stretch over the polycarbonate section. The thickness of the polycarbonate section was increased to allow for a deeper groove to connect the two pieces. The protrusion on the silicone section was increased to better join the two pieces.

Conclusions/action items:

The design will be 3D printed again using Formlabs elastic resin and clear resin. Once completed, the pieces will be analyzed to determine if they are fit to move on to testing

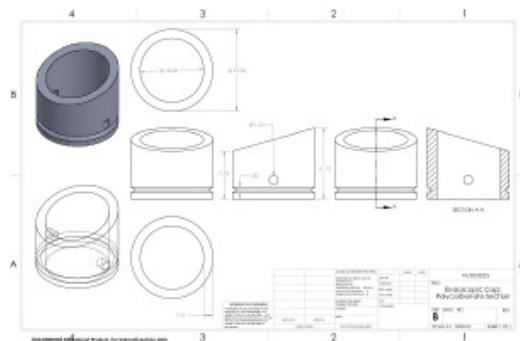
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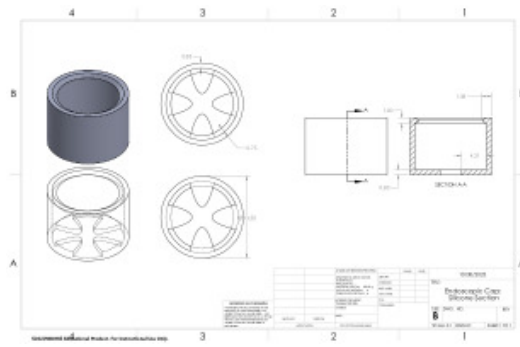
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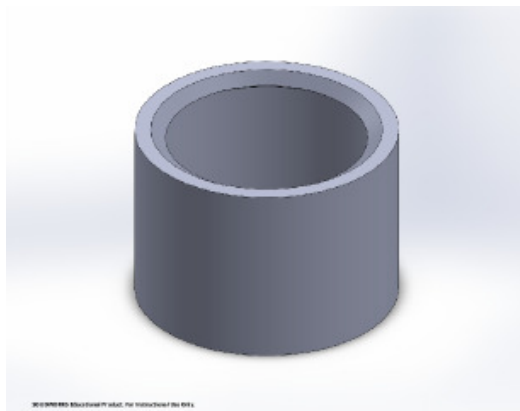
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Endoscopic_Cap_Silicone_Section_pdf.PDF (90.2 kB)



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spikes_part_pdf.pdf (490 kB)



2023/11/19 Endoscopic Cap Design- models for testing

SOFIA CASTAGNOZZI - Nov 19, 2023, 2:22 PM CST

Title: Endoscopic Cap Prototype Design - Models for Testing

Date: 11/19/2023

Content by: Sofia Castagnozzi

Present: Sofia, Eli, Will, Leo, Helen, Aidan

Goals: To finalize the endoscope cap design and create the different caps that will be used for testing

Content:

After analyzing the past two endoscope cap designs, the team decided to alter the dimensions and features to optimize dislodgement resistance. The ridge is moved to the top of the silicone section and the channel is now along the inner diameter of the polycarbonate section. The silicone will no longer be stretched over the top of the polycarbonate, now it will fit underneath with the polycarbonate sitting on top. We will print out these new cap designs, along with a version of the cap and silicone that do not include any channels or ridges to determine which design will fit together more successfully. Three sizes of each type of component will be printed, the step size in which they will be increased is 0.5 mm. In total there will be 6 silicone sections and 6 polycarbonate sections printed.

Conclusions/action items:

The designs will be 3D printed again using Formlabs Elastic resin and Biomed clear resin. Once completed, the pieces will be used for testing. We will first use an endoscope to determine which size fits the best, and then proceed to testing on the pig esophagus with the two different designs in the correct size.

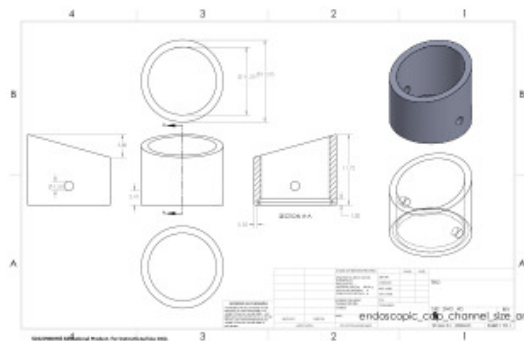
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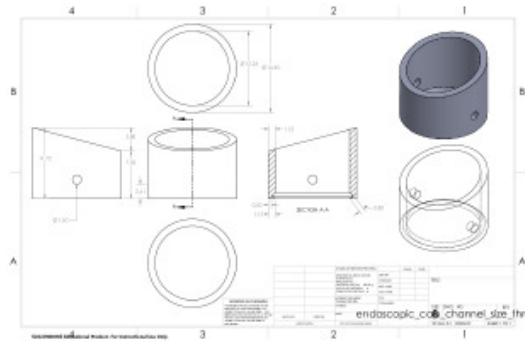
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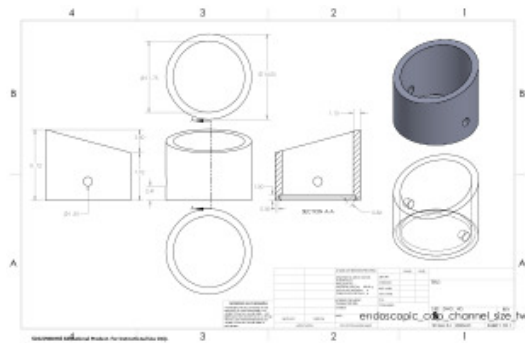
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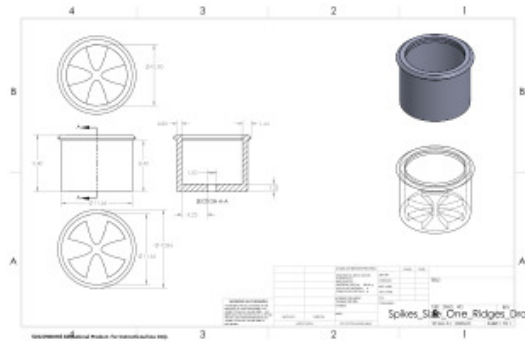
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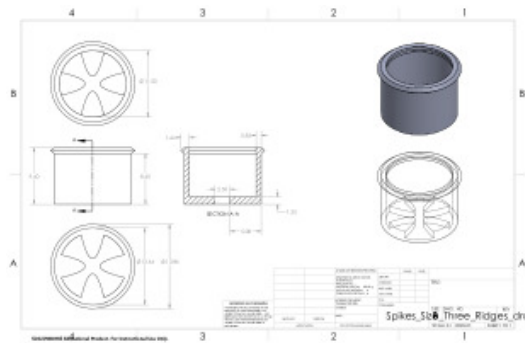
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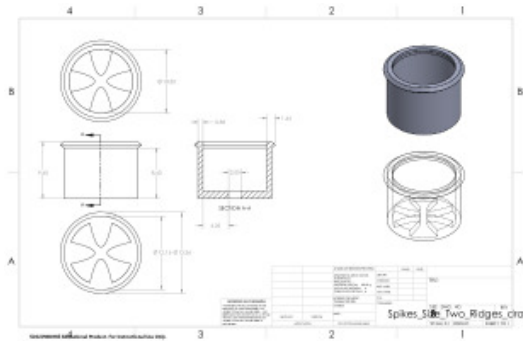
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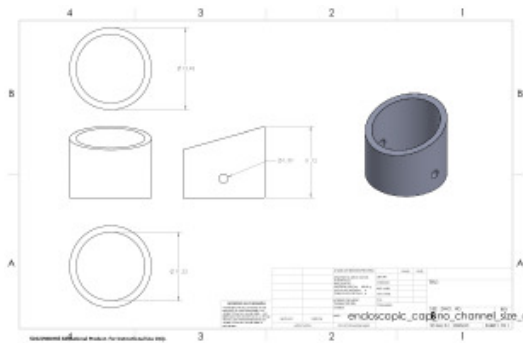
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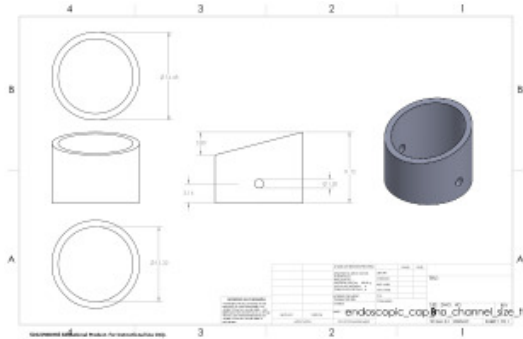
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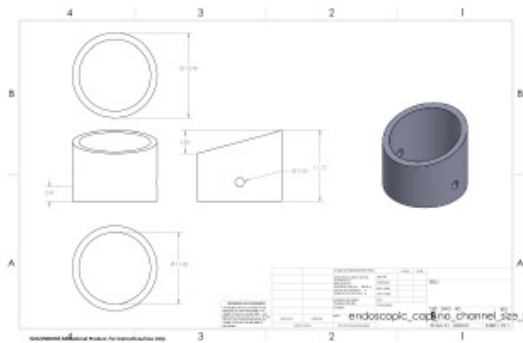
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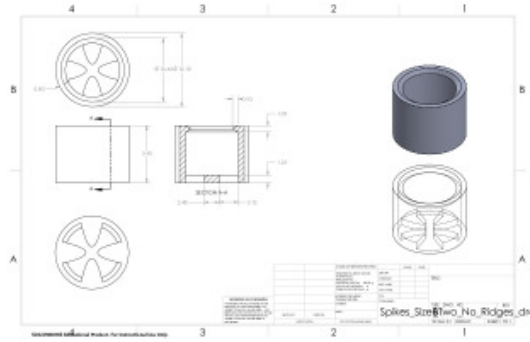
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2023/11/20 Endoscopic Cap Design- Polycarbonate Channel Updated

SOFIA CASTAGNOZZI - Nov 20, 2023, 12:34 PM CST

Title: Endoscopic Cap Prototype Design - Models for Testing

Date: 11/20/2023

Content by: Sofia Castagnozzi

Present: Sofia, Eli, Will, Leo, Helen, Aidan

Goals: To update the height of the channel in the polycarbonate endoscopic cap section

Content:

The team realized that a channel directly at the bottom of the piece would not allow enough space for the two sections to overlap. To fix this, the channel in the polycarbonate section was moved to 1 mm from the bottom, the channel now sits slightly below the drainage holes.

Conclusions/action items:

The updated designs will be printed using the Formlabs biomed clear resin in the makerspace and then be used for testing the following week.

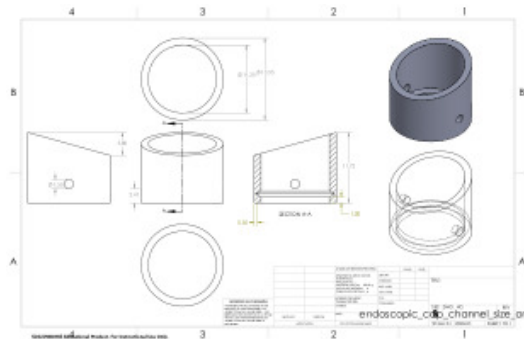
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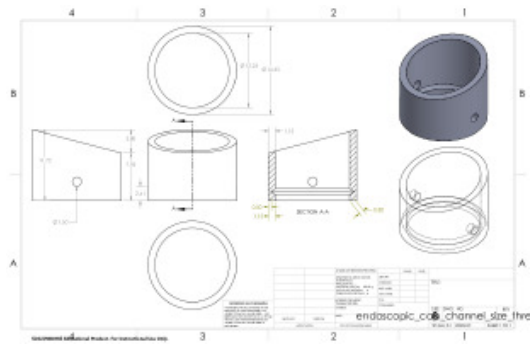
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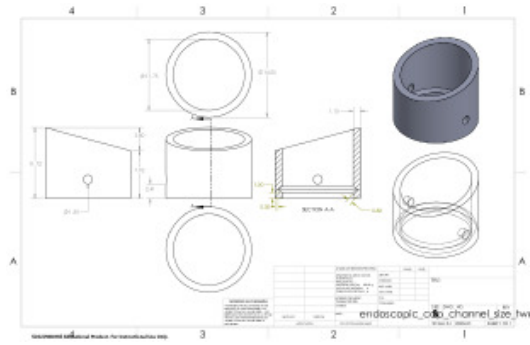
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2023/12/13 3D printed prototype

Title: 3D Printed Prototype

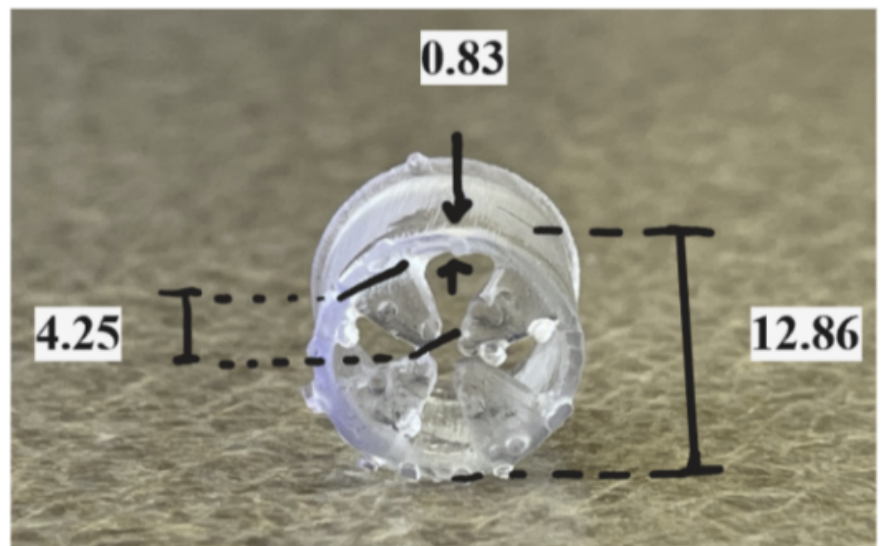
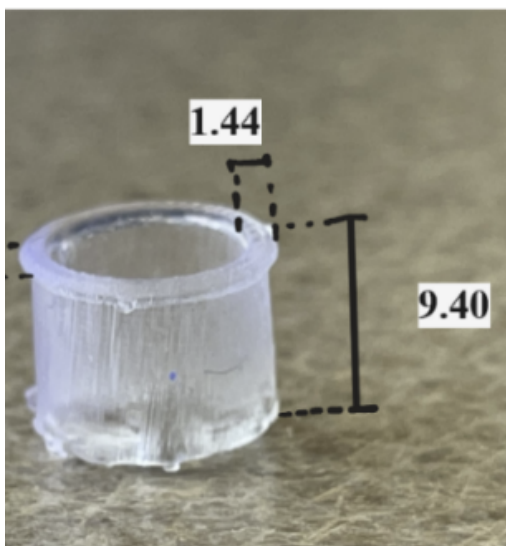
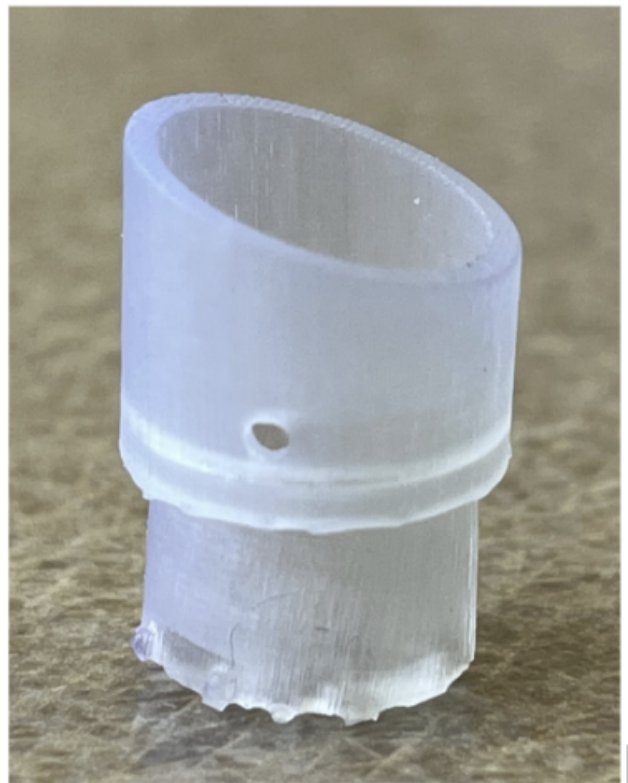
Date: 12/13/2023

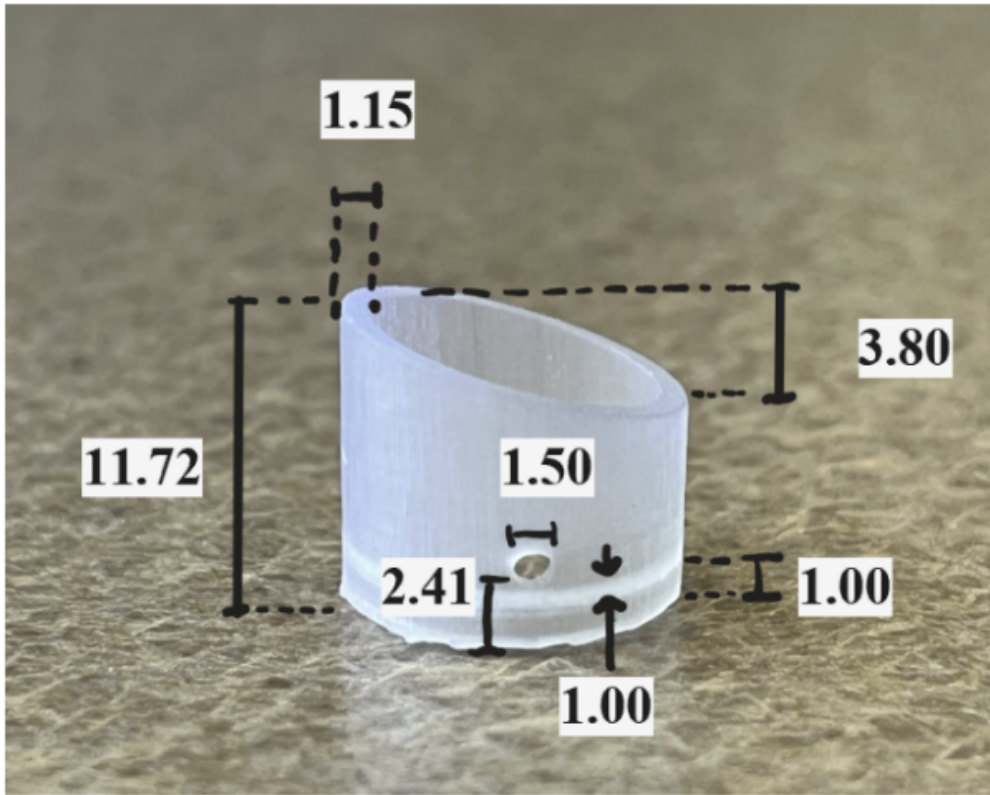
Content by: Sofia, Eli, Leo, Will, Aidan, Helen

Present: Sofia, Eli, Leo, Will, Aidan, Helen

Goals: To create a dislodgement resistant endoscopic cap prototype

Content:





Conclusions/action items:

The next step is to complete the final report



2023/12/15 Flap Cap Fabrication Protocol

SOFIA CASTAGNOZZI - Dec 15, 2023, 10:03 PM CST

Title: Flap Cap Fabrication Protocol

Date: 12/15/2023

Content by: Sofia Castagnozzi

Present: Sofia Castagnozzi

Goals: Establish clear protocol for the fabrication of the Flap Cap

Content:

The design for the dislodgement-resistant endoscopic dissecting cap was modeled in SolidWorks software before fabrication. The two pieces were then printed separately, using FormLabs Elastic Resin for the flexible bottom section and FormLabs Biomed Clear Resin for the top rigid section. To attach the two pieces, the flexible section is inserted into the bottom of the rigid section. The ridge on the top exterior surface of the flexible piece aligns with the channel on the bottom interior surface of the rigid piece, allowing the two to fit together and lock in place.

Conclusions/action items:

Use protocol to fabricate future caps and add protocol to the Final Report



11/29 Testing Protocol

Title: Testing Protocol

Date: 11/28/23

Content by: Will, Sofia

Present: -

Goals: Create step by step guide for when the group goes to the Sim center to try our cap.

Content:

Cap Design	Attempt number and description	Tape (Y/N)	Displacement from original position (mm)	Complete dislodgement (Y/N)
Current cap with tape	1D motion #1			
	1D motion #2			
	Longitudinal and twisting #1			
	Longitudinal and twisting #2			
	Longitudinal, twisting, angles #1			
	Longitudinal, twisting, angles #2			
New cap no tape	1D motion #1			
	1D motion #2			
	Longitudinal and twisting #1			
	Longitudinal and twisting #2			
	Longitudinal, twisting, angles #1			
	Longitudinal, twisting, angles #2			
New cap with tape	1D motion #1			
	1D motion #2			

Longitudinal and
twisting #1

Longitudinal and
twisting #2

Longitudinal,
twisting, angles #1

Longitudinal,
twisting, angles #2

1. Preview with Dr. Shada the specific movements that the scope will go through throughout testing
 1. Be able to consistently move the scope in the same ways (twisting, pushing, pulling) to try to reduce differences between tests just to cap type
 2. Different trials of a given cap design should include: (open to change once meeting with Dr. Shada)
 1. Just one-directional/longitudinal movement
 2. Longitudinal motion and twisting
 3. Longitudinal motion, twisting, and pressure at different angles
2. Beginning using the current cap with tape, work through six trials, with two trials for every bullet point under 1b.
 1. After trial, record in the table whether or not there was complete dislodgement, and if not, measure any displacement that occurred
3. Perform successive trials following the same steps using the new cap without tape, and finally the new cap with tape

Conclusions/action items:

Meeting scheduled for 11/29/23, certain aspects of the testing may have to change once going over everything with Dr. Shada



12/2 Testing Protocol Update

HELEN SARGEANT - Dec 03, 2023, 6:29 PM CST

Title: Updated Testing Protocol

Date: 12/3/2023

Content by: Helen Sargeant

Present:

Goals: Update the testing protocol based on meeting with Dr. Shada and testing procedure used day of.

Content:

See PDF

Conclusions/action items:

Use/review test results for discussion and further modifications to cap if necessary.

HELEN SARGEANT - Dec 03, 2023, 6:30 PM CST

Notes: All trials will be no flap. Dr. Shada performed each trial consistently replicating typical use of the endoscope.
 Post trial comments from Dr. Shada: Median Cap has more bulk too it feels wider going through. Small cap high profile not obstructive/ similar feel to standard current cap. Bigger caps can be harder on tissues, especially on with the harder resin top.

Cap Design and Esophagus Additional comments from Dr. Shada relevant to each trial.	Attempt number and description	Complete dislodgement (Y/N) and notes
Current cap Resin/silicone	ID motion #1 Forward and Back with twisting	N
	ID motion #2 Forward and Back with twisting	Y
	ID motion #3 Forward and Back with twisting	Y
Current cap All soft silicone Switched esophagus after this trial	ID motion #1 Forward and Back with twisting	N
	Current cap All soft silicone on new esophagus	ID motion #1 Forward and Back with twisting
ID motion #2 Forward and Back with twisting		Y - fell off at lower esophagus/stomach muscle.
ID motion #3 Forward and Back with twisting		Y - fell off at lower esophagus/stomach muscle.
Largest new cap. New cap no taps. More resistance going down.	ID motion #1 Forward and Back with twisting	Y - Slide farther down the endoscope. No flaps ripped

[Download](#)

Updated_Testing_Protocol.pdf (969 kB)



2023/9/29 Design Matrix

SOFIA CASTAGNOZZI - Sep 29, 2023, 8:47 PM CDT

Title: Endoscopic Dissecting Cap Design Matrix

Date: 9/29/2023

Content by: Sofia, Leo, Will, Helen, Aidan, Eli

Present: Sofia, Leo, Will, Helen, Aidan, Eli

Goals: Complete Design Matrix

Content:

Attached below

Conclusions/action items:

Prepare slides and presentation for the preliminary presentations.

SOFIA CASTAGNOZZI - Sep 29, 2023, 8:47 PM CDT



Design Matrix

Dislodgement Resistant Endoscopic Dissecting Cap

Team Members:
Sofia Castagnozzi
Leo DiCataldo
Will Martin
Helen Sargeant
Aidan Brey
Eli Miland

Client: Dr. Amber Shoda

Advisor: Dr. Megan Setell

September 29, 2023

[Download](#)

Endoscopic_Dissecting_Cap_Design_Matrix.pdf (454 kB)



2023/9/22 Product Design Specification

SOFIA CASTAGNOZZI - Sep 29, 2023, 8:51 PM CDT

Title: Endoscopic Dissecting Cap Product Design Specification

Date: 9/22/2023

Content by: Sofia, Will, Leo, Eli, Helen, Aidan

Present: Sofia, Will, Leo, Eli, Helen, Aidan

Goals: To complete Product Design Specification

Content:

Attached Below

Conclusions/action items:

To come up with three designs for the dislodgement resistant cap to rank for the design matrix

SOFIA CASTAGNOZZI - Sep 29, 2023, 8:51 PM CDT



Product Design Specification

Dislodgement Resistant Endoscopic Dissecting Cap

Team Members:
Sofia Castagnozzi
Leo DiCataldo
Will Martin
Helen Sargeant
Aidan Brey
Eli Miland

Client: Dr. Amber Shoda

Advisor: Dr. Megan Setell

September 22, 2023

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Endoscopic_Dissecting_Cap_PDS.pdf (153 kB)



2023/10/5 Preliminary Presentation

SOFIA CASTAGNOZZI - Oct 06, 2023, 5:04 PM CDT

Title: Preliminary Presentation

Date: 10/3/2023

Content by: Sofia, Will, Leo, Aidan, Helen, Eli

Present: Sofia, Will, Leo, Aidan, Helen, Eli

Goals: To highlight the goals and accomplishments of the project so far

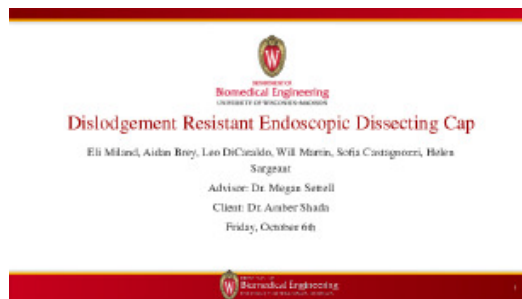
Content:

Attached below

Conclusions/action items:

Work on the preliminary report and continue research relevant to the project.

SOFIA CASTAGNOZZI - Oct 06, 2023, 5:05 PM CDT



[Download](#)

Endoscopic_Dissecting_Cap_Preliminary_Presentation.pdf (2.31 MB)



2023/10/13 Preliminary Report

SOFIA CASTAGNOZZI - Oct 13, 2023, 8:30 PM CDT

Title: Preliminary Report

Date: 10/13/2023

Content by: Sofia, Will, Aidan, Leo, Helen, Eli

Present: Sofia, Will, Aidan, Leo, Helen, Eli

Goals: To document all of our progress on the project so far this semester

Content:

Attached Below

Conclusions/action items:

The next steps for the team are to begin procurement of materials and begin fabrication.

SOFIA CASTAGNOZZI - Oct 13, 2023, 8:30 PM CDT



Team Members:

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

Helen Sargent

Client:

Dr. Amber Shada

Advisor:

Dr. Megan Settell

[Download](#)

Endoscopic_Dissecting_Cap_Preliminary_Report.pdf (570 kB)



SOFIA CASTAGNOZZI - Dec 06, 2023, 10:40 PM CST

Title: Final Poster

Date: 12/7/2023

Content by: Sofia, Will, Leo, Aidan, Helen, Eli

Present: Sofia, Will, Leo, Aidan, Helen, Eli

Goals: To complete a poster summarizing our project for the final presentation

Content:

Attached below

Conclusions/action items:

The next steps are to present the presentation during the poster session on 12/8 and complete the final report due 12/13

SOFIA CASTAGNOZZI - Dec 06, 2023, 10:38 PM CST



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Final_Poster.pdf (1.47 MB)



Disinfection Resistant Endoscopic Dissecting Cap

Biomedical Engineering Design 200/300



Department of Biomedical Engineering
University of Wisconsin-Madison
December 13, 2023

Team Members:

Sofia Catagnuzzi (Team Leader)
Leonzio DiCataldo (BWIG)
Will Martin (Communicator)
Helen Sargeant (Co-BSAC)
Aishat Beye (Co-BSAC)
Eli Miland (BPAG)

Client: Dr. Amber Shaha

Advisor: Dr. Megan Setroll

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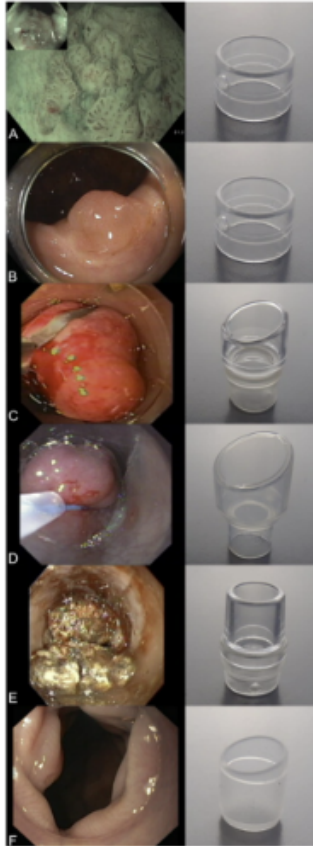
Final_Report.pdf (17.2 MB)



2023/9/12 Endoscopic Cap Overview

Title: Endoscopic Cap Overview**Date:** 9/12/2023**Content by:** Sofia Castagnozzi**Present:** Sofia Castagnozzi**Goals:** To research the functions of endoscopic dissecting caps**Content:**

- Endoscopic caps come in many different shapes, materials and sizes



- (A, The Disposable Distal Attachment caps (DAC, Olympus America, Center Valley, Pa) are available with 2-mm and 4-mm working distance types, which are intended for maintaining the optimal field of view and keeping the correct depth of field, respectively. An anal intraepithelial neoplasm was imaged under water with a 2-mm DAC in place for magnification. The cap was slightly visible under standard view (see inset). On $\times 1.2$ digital magnification, the cap was not visible. The irregular microvessels were observed. B, A recurrent adenoma on an EMR scar was examined by using the DAC, which was placed at 4 mm from the tip of the endoscope. The DAC obscured the periphery of the visual field. C, The oblique hard endoscopic mucosal resection cap (Olympus) was used to suction a bleeding diverticulum from its dome. The cap housed a previously opened clip, which was awaiting the bleeding vessel before it was clipped. Complete hemostasis was achieved. D, A large oblique soft EMR was used to suction a 2-cm hemangioma in the sigmoid colon, while an endoloop was being applied. E, The cap of the endoscopic variceal ligation (Cook Medical, Salem, NC) was used to remove pancreatic phlegmon from inside a pseudocyst. F, The Halo cap (Barrx Medical, Sunnyvale, Calif), a frosted soft silicone cap that was designed to facilitate removal of coagulated esophageal tissue after radiofrequency ablation, was used to keep the gastroesophageal junction open in order to allow detailed examination.)
- Endoscopic caps are routinely used in surgeries like variceal ligation and endoscopic mucosal resection
- In Japan these caps have also been used in more diagnostic and therapeutic treatments, like magnification endoscopy
- Manufacturing companies: Olympus, Cook, BarrX and Fujinon
- Keywords: cap, cap-fitted, distal attachment, hood, colonoscopy, and endoscopy
- Attachment
 - Attached to distal tip of endoscope using waterproof adhesive tape (Hy-Tape pink tape; Hy-Tape International, Patterson, NY).
- Tip

- "The distal part of the cap is its working part. It can be conic, straight, or funnel-shaped with a horizontal or oblique end, which, in turn, may be rounded or internally beveled. Some caps have one or more side holes designed to prevent fluid accumulation within the cap"
- Retractable caps are not often used
- Depth
 - Some caps have a predetermined depth, while others can be adjusted
- Mechanical Functions
 - Keep mucosa within a range of the focal depth of endoscope
 - push aside tissue
 - stabilize positioning of endoscope tip
 - align the treatment target
 - provide housing for endoscopic accessory
 - selective suction

Purpose	Mechanism
Improving visualization	Maintaining the optimal field of view and keeping the correct depth of field; pushing aside folds, angulations, tissues, or sphincters; and stabilizing the position of the tip of the endoscope
Distancing the tip of the endoscope to the ideal distance for delivering treatment	Placing the target of therapy en face, rather than tangential, at the ideal and constant distance for delivering treatment
Aligning the target of therapy with the axis of the accessory channel	Pushing aside folds, angulations, tissues, or the wall of the GI tract
Diagnosis and treatment of diverticular bleeding	Inverting a diverticulum for examination of its dome and treatment of a bleeding vessel
Improving suction capability	Enlarging the area of suction to the opening of the cap rather than the opening of the channel
Creating a submucosal tunnel	Pushing aside submucosal tissues
Housing for an accessory	Placing an accessory within the cap allows protection of the surrounding tissue and keeps the target of treatment in view

- Limitations
 - cap can reduce angle of view and maneuverability
 - can decrease view from 170 degrees to 130 degrees
 - can complicate insertion into narrow or bendy areas
 - single use

Conclusions/action items:

Endoscopic caps are an essential part of endoscopic treatments, but can come with some complications. Although this article did not specify the problem with caps detaching during operations, it described many other factors that are important to keep in mind. The next step is to continue research on endoscopic caps and find literature on cap attachment.

Citation:

A. Sanchez-Yague, T. Kaltenbach, H. Yamamoto, A. Anglemyer, H. Inoue, and R. Soetikno, "The endoscopic cap that can (with videos)," *Gastrointestinal Endoscopy*, vol. 76, no. 1, pp. 169-178.e2, Jul. 2012, doi: [10.1016/j.gie.2012.04.447](https://doi.org/10.1016/j.gie.2012.04.447)



2023/10/13 Polycarbonate in Medical Settings

SOFIA CASTAGNOZZI - Oct 13, 2023, 1:45 PM CDT

Title: Medical Applications of Polycarbonate

Date: 10/13/2023

Content by: Sofia Castagnozzi

Present: Sofia Castagnozzi

Goals: To understand the usage of polycarbonate in surgery and determine if it is a safe material for endoscopic caps

Content:

- Commonly used engineering resin in medical device market
- Bisphenol-A polycarbonate is specifically used in medical devices
- provides glasslike clarity
- good heat resistance
- low water absorption
- There are grades of polycarbonate that comply with biocompatibility standards such as ISO 10993-1 and USP Class VI.
- It is processed with standard injection molding, blow molded into hollow containers or extruded into film
- Can be sterilized using ethylene oxide, irradiation and steam autoclaving
- Can be disinfected using isopropyl alcohol
- not suitable for repeated autoclaving
- has been used in surgical instruments such as trocars

Conclusions/action items:

- look into grades of polycarbonate that can withstand multiple radiation sterilizations, as EtOH can leave residue

- Look into polycarbonate discoloration, this will impact endoscopic viewing field

citation:

"Medical Applications of Polycarbonate," *mddionline.com*, Sep. 01, 1998. Available: <https://www.mddionline.com/news/medical-applications-polycarbonate>. [Accessed: Oct. 13, 2023]



2023/9/13 MAJ-2315 Disposable Distal Cap Olympus

SOFIA CASTAGNOZZI - Sep 13, 2023, 8:14 AM CDT

Title: MAJ-2315 Disposable Distal Cap

Date: 9/13/2023

Content by: Sofia Castagnozzi

Present: Sofia Castagnozzi

Goals: To learn more about current endoscopic caps on the market

Content:

Video on how to use the MAJ-2315 Disposable Distal Cap provided by Olympus Australia and New Zealand: https://www.youtube.com/watch?v=WFKbOjWf-Lw&ab_channel=OlympusAustraliaandNewZealand

Device ID: 14953170403016

Company Name: OLYMPUS MEDICAL SYSTEMS CORP.

- The product is single use
- Does not contain natural rubber latex

Conclusions/action items:

Citations:

"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]

"SINGLE USE DISTAL COVER MAJ-2315 Medical Device Identification." Available: <https://fda.report/GUDID/14953170403016>. [Accessed: Sep. 13, 2023]



2023/9/13 Halo Cap Barrx

Title: Halo Cap (discontinued)

Date: 9/13/2023

Content by: Sofia Castagnozzi

Present: Sofia Castagnozzi

Goals: To compare different endoscopic caps

Content:

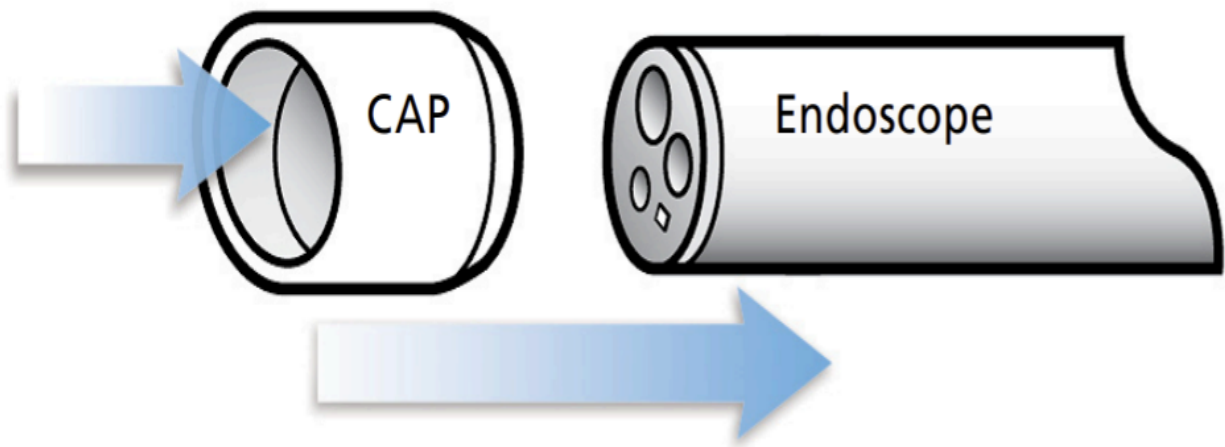
- designed to facilitate removal of coagulated esophageal tissue
- Maintains endoscopic visualization during cleaning of treatment area
- Two sizes available for use with endoscopes ranging from 8.5 mm to 9.8 mm (outer diameter)
-





- Instructions for Use
1. Insert the distal end of the endoscope into the proximal end of the HALO CAP.
 2. Advance the endoscope into the CAP until the tip of the endoscope is aligned with the distal ridge line inside the cap.

Distal Ridge Line



3. The longest extent of the beveled edge should be positioned at the 12 o'clock position in the video endoscopic view.
4. Water may be used to lubricate the endoscope and CAP to facilitate placement, but do not use alcohol or gel lubrication.
5. Reintroduce the endoscope and inspect the treatment zone for completeness of treatment.

6. Using the endoscope with irrigation and the HALO CAP, remove the coagulum from the coagulation zone.



7. Reinsert the guidewire and remove endoscope.
8. Remove the HALO CAP from the endoscope and discard the CAP.

- Single Use

Conclusions/action items: This article did not provide information on the material used for the endoscopic cap, so further research will need to be conducted on the different types of materials available.

Citations:

http://www.synmed.co.uk/_discontinued/halo_system_accessories/pdf/HaloCapBrochureandCompatibility.pdf



2023/9/17 Surgical Instrument Standards and Specifications

SOFIA CASTAGNOZZI - Sep 17, 2023, 12:21 PM CDT

Title: Surgical Instrument Standards

Date: 9/17/2023

Content by: Sofia Castagnozzi

Present: Sofia Castagnozzi

Goals: To research standards and specifications for surgical instruments

Content:

- ISO 10993 [1]

- "The selection of material(s) to be used in device manufacture and its biocompatibility evaluation should initially take into account the likelihood of direct or indirect tissue contact"
- "The material(s) of manufacture, the device in its final finished form, and possible leachable chemicals or degradation products should be considered for their relevance to the overall biocompatibility evaluation of the device."
- "Endpoints relevant to the biocompatibility evaluation should take into account the nature, degree, frequency, duration, and conditions of exposure of the device materials to the body. This principle may lead to the categorization of devices that would facilitate the selection of appropriate endpoints for inclusion in the overall biocompatibility evaluation."
- "Any in vitro or in vivo biological safety experiments or tests should be conducted in accordance with recognized Good Laboratory Practice (GLP) regulations³⁰ including, but not limited to, the assignment of competent trained staff in the conduct of biocompatibility testing"

- Endoscopes are a class two medical device [2]

- FDA approval of all medical devices in the United States is required [3]

- ISO 8600-4 Third Edition 2023-01 [4]

- Endoscopes - Medical endoscopes and certain accessories - Part 4: Determination of maximum width of insertion portion

Conclusions/action items:

Continue research related to product design specification. Include this research in the Standards and Specifications section of the PDS

Citations:

[1] "Biological evaluation of medical devices—Part 1: Evaluation and testing within a risk management process," in *ANSI/AAMI/ISO 10993-1:2018*; *Biological evaluation of medical devices—Part 1: Evaluation and testing within a risk management process*, AAMI, 2020. doi: 10.2345/9781570207556.ch1. Available: <http://array.aami.org/doi/10.2345/9781570207556.ch1>. [Accessed: Sep. 17, 2023]

[2] "Product Classification." Available: <https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPCD/classification.cfm?ID=FDA>. [Accessed: Sep. 17, 2023]

[3] L. Christl, "Overview of the Regulatory Pathway and FDA's Guidance for the Development and Approval of Biosimilar Products in the US". www.fda.gov. [Accessed: 17-Sep-2023].

[4] "Recognized Consensus Standards: Medical Devices." Available: https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfStandards/detail.cfm?standard__identification_no=44399. [Accessed: Sep. 17, 2023]



2023/9/17 Endoscopic Cap Dimensions

SOFIA CASTAGNOZZI - Sep 17, 2023, 12:51 PM CDT

Title: Endoscopic Cap Dimensions

Date: 9/17/2023

Content by: Sofia Castagnozzi

Present: Sofia Castagnozzi

Goals: To find the dimensions of similar products

Content:

Caps

- Olympus distal attachment D-201-10704 (Short transparent cap) [1]
 - outer diameter: 11.35 mm, length from distal end of endoscope: 4 mm
- Olympus distal attachment MH-593 (Long transparent cap) [1]
 - outer diameter: 12.9 mm, length from distal end of endoscope: 11 mm

Endoscopes

- OLYMPUS GIF-HQ190 [2]
 - Distal end outer diameter 9.9 mm
 - Insertion tube outer diameter 9.9 mm
 - Channel inner diameter 2.8 mm

Conclusions/action items:

Citations:

- [1 Y. R. Choi *et al.*, "Efficacy of cap-assisted endoscopy for routine examining the ampulla of Vater," *World J Gastroenterol*, vol. 19, no. 13, pp. 2037–2043, Apr. 2013, doi: [10.3748/wjg.v19.i13.2037](https://doi.org/10.3748/wjg.v19.i13.2037)
- [2 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]



9/13 Cap Dislodgement Example

Will Martin - Sep 13, 2023, 10:58 PM CDT

Title: Retrieving an Endoscopic Cap From the Submucosal Tunnel During a POEM Procedure: Keep an Eye on the Cap Before Closing the Mucosal Incision

Date: 9/13/23

Content by: Will Martin, Article by Anush Vasikaran

Present: --

Goals: Learn about the potential dangers in using endoscopic caps that are not fully secured with risk of dislodging during procedure

Content:

article summary: 74 year old women undergoes Peroral endoscopic myotomy. Mucosectomy was made, and the endoscope was used to enter the submucosal tunnel. mucosectomy site was closed with 4 endoclips and then it was realized that the endoscopic cap was missing. This led to lots of complications, because the endoscope had to be reinserted, clips removed, and the cap had to be located and grabbed by rat tooth forceps. It was a success, but clearly a large inconvenience and unnecessary risk for medical staff and patient.

article link: <https://oce-ovid-com.ezproxy.library.wisc.edu/article/00000434-202210002-00381/PDF>

Conclusions/action items:

This example shows the reality of the issue at hand and how useful a more reliable cap could be in this setting. This would lead to fewer unforeseen accidents and unnecessary prodecudes



9/13 Dislodgement Complications

Will Martin - Sep 13, 2023, 10:56 PM CDT

Title: Esophageal Dislodgment of a Reused Variceal Ligator Cap: A Complication of Endoscopic Variceal Ligation

Date: 9/13/23

Content by: Will Martin, article from A O Silvério

Present: -

Goals: Learn more about how an unsecured endoscopic cap can cause complications in surgery, what is currently being done to prevent this from happening

Content:

Summary: Esophageal dislodgment of ligator caps occurring because of a mismatch of sizes between the ligator cap and the endoscope diameter. The cap had been reused and got dislodged. Similar to other articles mentioned, surgeons had to go back in with rat tooth forceps to retrieve the cap. For such frequently used medical equipment, it is shocking how frequently this seems to occur.

Silvério, A. O., J. C. F. Resplande, and F. H. P. B. Ramos. "Esophageal Dislodgment of a Reused Variceal Ligator Cap: A Complication of Endoscopic Variceal Ligation." *Endoscopy* 36, no. 8 (August 2004): 745–46. <https://doi.org/10.1055/s-2004-825702>.

Conclusions/action items: This is showing the current method of retrieving dislodged endoscopic caps. The article talks about the caps made for different endoscopes (made for a range of diameters). This, to me, shows that there is a need for more specialized caps that are designed for one diameter of endoscope, rather than made for multiple sizes. This could reduce risk of dislodgement.



9/19 Endoscope Shelf Life

Will Martin - Sep 20, 2023, 6:55 PM CDT

Title: Endoscope Shelf Life (General research)

Date: 9/19/23

Content by: Will Martin, authors listed below

Present: n/a

Goals: Find out more general information about endoscopies to find out the conditions that the cap would be going through regularly. Look into shelf life, so that the cap can ideally be comparable.

Content:

Current research suggests that for certain types of gastrointestinal endoscopes, longer shelf life (the interval of storage after which endoscopes should be reprocessed before their reuse) may not increase the likelihood of endoscope contamination. The purpose of this study evaluated the presence of bacteria and fungus following liquid chemical sterilization in colonoscopes and gastroscopes, after 12 weeks of shelf life during which time personal protective equipment was used during endoscope storage cabinet access. Scopes were tested for bacteria and fungus at the end of 12 weeks. No bacteria or fungus grew on any of the scopes. This study provides further support that contaminated endoscopes may be related to either inadequate disinfection or contamination during storage, not shelf life.

Lacey, Valerie, Karron Good, Chris Toliver, Shirley Jenkins, and Pamela B. DeGuzman. "Evaluation of 12-Week Shelf Life of Patient-Ready Endoscopes." *Gastroenterology Nursing: The Official Journal of the Society of Gastroenterology Nurses and Associates* 42, no. 2 (2019): 159–64. <https://doi.org/10.1097/SGA.0000000000000364>.

Conclusions/action items:

This gives a good idea to our team about how long our product should be lasting in a hospital. It's worth mentioning that the team is attempting to make a product that can be autoclaved, potentially extending the life span. If this is not accomplishable, the caps would likely be single use. That wouldn't be ideal because of material waste.



9/22 Endoscope In Use

Will Martin - Sep 22, 2023, 2:05 PM CDT

Title: Gastroscope / Video Gastroscope / EVIS EXERA III (GIF-HQ190)

Date: 9/22

Content by: Will Martin

Present:

Goals: Find out specs about the endoscope that the client is currently using/ the scope that the team is creating the cap for. Learn specifically about how long the gastroscope can be in service for in a hospital, as well as use the specs to begin designs for the cap. (outer diameter of 9.9)

Content:

<https://medical.olympusamerica.com/products/gastroscope/evis-exera-iii-gif-hq190>

Video: <https://www.youtube.com/watch?v=vSixvseFgjA>



Conclusions/action items:

Website Citation:

Olympus America | Medical. "EVIS EXERA III (GIF-HQ190)." Accessed September 22, 2023.
<https://medical.olympusamerica.com/products/gastroscope/evis-exera-iii-gif-hq190>.

Title: Flat-Based over-the-Scope Clip

Date: 9/25/23

Content by: Will Martin

Present: Sofia

Goals: Find new ways to connect a cap that is resistant to dislodgement

Content:



A pointy mechanism like is pictured above could be attached to inside of the cap, allowing the cap to be put onto the scope, but the spikes would lightly dig into the scope if it tried to move away from the end (falling off). Things to think about with this design- too pointy of spikes could damage the external material of the gastroscope, removing the cap could be difficult if it is made to resist movement in that direction.

In this article, the intention of the clips is not to keep the cap on, but rather open and close on the tissue in front of it. This is why they are able to use strong pointy materials.

Kappelle, Wouter, Yara Backes, Gerlof Valk, Leon Moons, and F.P. Vleggaar. "Endoscopic Full-Thickness Resection of Gastric and Duodenal Subepithelial Lesions Using a New, Flat-Based over-the-Scope Clip." *Surgical Endoscopy* 32 (June 1, 2018). <https://doi.org/10.1007/s00464-017-5989-8>.

Conclusions/action items:

Altering this design to be better suited for a gastroscope would include finding materials that will still resist movement without damaging scope exterior. My initial thoughts are less sharp points or a slightly softer material (picture looks like metal). A softer plastic with similar shape would still oppose the force of getting dislodged without puncturing the scope itself.



10/19 Material Comparison

Title: Material comparison

Date: 10/19/23

Content by: Will Martin

Present: Sofia

Goals: Compare specs between current cap materials and 3D printed resin

Content:

Model	Material Code	Characteristics	Ø Outer (mm)	Ø Inner tip (mm)	Tip length (mm)	Accessory guide	Applicable endoscopes	Unit
DH-28GR	16426426	Transparent; silicone rubber, polycarbonate resin	11.5	8.0	7.0	Without	EG-760Z EG-600ZW EC-740T/M, L	5
DH-29CR	16426438	Transparent; silicone rubber, polycarbonate resin	12.4	8.0	7.0	Without	EG-760CT EC-760P-V/M, L	5
DH-30CR	16426440	Transparent; silicone rubber, polycarbonate resin	13.8	8.0	7.0	Without	EC-760R-V/M, I, L EC-760ZP-V/M, L EC-760Z-V/M, I, L EC-720R/M, I, L EC-600WM/WI/WL EC-600ZW/M, L	5
DH-33GR	16635493	Transparent; guide type; silicone rubber, polycarbonate resin	11.8	7.0	7.0	Yes	EG-760Z EG-760CT EC-740T/M, L	5
DH-34CR	16635508	Transparent; guide type; silicone rubber, polycarbonate resin	13.6	7.0	7.0	Yes	EC-760R-V/M, I, L EC-760ZP-V/M, L EC-600WM/WI/WL	5



<https://www.fujifilm.com/sg/en/healthcare/endoscopy/accessories/endoscopy-esd/st-hood>

chrome-extension://efaidnbmninnibpcjpcglclefindmkaj/https://fujifilm-endoscopy.com/storage/app/media/products/files/5_Fujifilm_EndoSolutions%20GI_EN.pdf (page 52)

Important:

Current successful models are using silicone rubber and polycarbonate resin. If possible, it would be ideal for us to print the harder material with a groove and then the softer material (with flaps) with a ridge on the inside to sit tightly in the groove.

3D printable resin for soft section: 50A Shore hardness, malleable without ripping/permanent deformation, unsure if able to be sterilized

chrome-extension://efaidnbmninnibpcjpcglclefindmkaj/https://formlabs-media.formlabs.com/datasheets/Elastic_Resin_Technical.pdf

3D printable BioMed Clear for hard section - biocompatible photopolymer resin - rigid for distal end of the scope cap, sterilizable

<chrome-extension://efaidnbmninnibpcjpcglclefindmkaj/https://formlabs-media.formlabs.com/datasheets/2001432-TDS-ENUS-0.pdf>

Conclusions/action items:



Title: Caliper measurements of current cap

Date: 10/27/23

Content by: Will, Sofia

Present: Team

Goals: Get measurements of the current preferred cap for solidworks design

Content:

short end of bevel: 17.37mm

tall end of bevel: 21.12

polycarbonate thickness: 1.08mm

silicone thickness: 0.83mm

silicone diameter: 11.66mm

polycarbonate diameter: 13.46mm

silicone height: 9.4mm

polycarbonate height to drainage hole: 6.26mm

Conclusions/action items:



Show and Tell / Meeting Notes

Title: Notes from 11/1 meeting and for 11/3 Show and Tell**Date:** 11/2/23**Content by:** Will, Sofia**Present:** --**Goals:** Get prepared with the most important information for the 11/3 show and tell. Make sure I'm well versed in the designs and background information to be able to give a thorough and concise speech.**Content:**Side note: <https://www.medicine.wisc.edu/gastroenterology-and-hepatology/people-division-gastroenterology-and-hepatology>

Contacted Mark Benson, MD, Advanced Endoscopy Section Chief on 10/31 regarding esophageal model, yet to hear back from him

Notes:

- Design
 - Endoscopic cap will be composed of two sections for the use of two materials
 - The current design will not be reusable because of the two parts, but the idea for the future is that the piece will be manufactured in a manner that does not create gaps between materials
 - Show design on solidworks drawing
 - [polycarbonate top section](#)
 - [silicone detachment resistant section](#)
- Fabrication
 - Silicone to sit on endoscope and resist detachment
 - Polycarbonate to maneuver through tissue (rigid material similar to preferred cap)
 - We are printing our prototype by friday, it will be similar in size to current designs, but after printing we will most likely need to do some alterations to ensure that the two sections fit together correctly
 - The materials we use to print will not be the exact same as they are not available to print with, but the goal for the future is to acquire the correct materials
- Testing
 - Come in and fit on endoscope to ensure correct sizing and see approximately how well the cap resists detachment
 - For testing we will use a dowel or flexible rod the same size as the endoscope and either borrow an esophageal model from a lab, or simulate an esophagus environment with a tube and a material to mimic tissue.
 - If we were unable to acquire an esophageal model, would you say it was justifiable for us to purchase one for our own use?
- Other
 - If we have time throughout the semester, or if the original design fails, we plan on moving forward with the internal band design.
 - We did not choose this initially due to its higher patient risk with the dislodgement of the band
- From Dr. Shada:

- She will get in contact with testing lab to procure pig esophagus

Conclusions/action items:

follow up with Dr. Shada about pig esophagus for testing, run through info to feel good about giving short talks during show and tell



12/5 Statistical analysis

Will Martin - Dec 10, 2023, 2:51 PM CST

Title: Statistical analysis from testing

Date: 12/5/23

Content by: Will

Present: --

Goals: Complete statistical analysis on data collected from testing to find significance of results for final poster and report

Content:

https://www.statskingdom.com/121proportion_normal2.html

pooling data from hospital caps - dislodged on 5/7 attempts

pooling data from small and medium new caps - dislodged on 1/9 attempts

refer to testing protocol updated for complete data

Results:

The p-value equals **0.00671271**, ($P(x \leq 2.47228) = 0.993287$). It means that the chance of type I error (rejecting a correct H_0) is small: 0.006713 (0.67%). The smaller the p-value the more it supports H_1 .

Conclusions/action items:

our data is significant, shown by the p value of 0.0067 - this tells us that our caps dislodged significantly less than the hospital caps



9/28 Internal Flaps

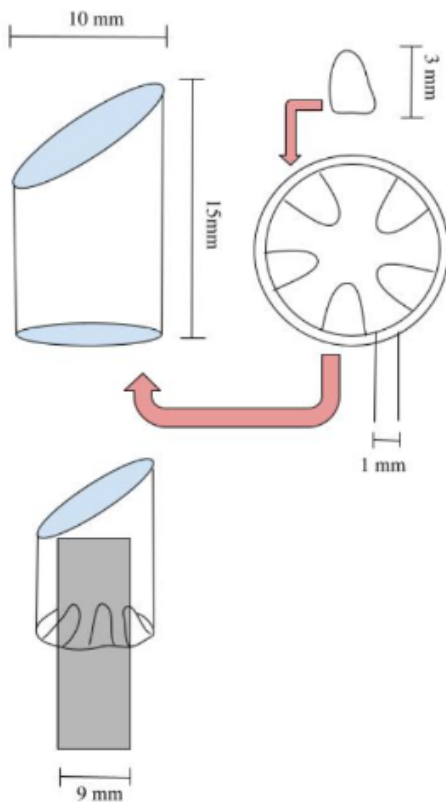
Title: Internal Flaps Design Idea**Date:** 8/25/23**Content by:** Will Martin, Sofia**Present:** Will, Sofia**Goals:** Find a way to secure the endoscope cap without using an elastic band, try to come up with something unlike proposed ideas**Content:**

Based on the Endoclip (more information in competing designs), the concept is to attach flexible flaps to the inside of the base of the clip. Below is the original design of their clip, made to open and close on the front of the scope to grab tissue in front of it.



While the general concept could stay the same, many changes would have to be made to make this a viable concept. Placed near the bottom of the cap, and turned into a soft flexible material, these flaps could still exert force resisting movement away from the scope.

Sketch by Sofia:

**Conclusions/action items:**

Check in with client to see if this design seems plausible, take this to the design matrix to see how it compares to the other team members' designs.



2023/09/13-Endoscope cap attachment method research

LEONZIO DICATALDO - Sep 22, 2023, 2:40 PM CDT

Title: Endoscope attachment mechanism

Date: 09/13/23

Content by: Leo DiCataldo

Present: Leo DiCataldo

Goals: Learn how other companies have attached caps to there endoscopes

Content:

[https://www.giejournal.org/article/S0016-5107\(12\)02162-1/fulltext](https://www.giejournal.org/article/S0016-5107(12)02162-1/fulltext)

“To prevent displacement or even dislodgement of the cap, the cap can be secured to the endoscope by using waterproof adhesive tape (Hy-Tape pink tape; Hy-Tape International, Patterson, NY).”

Article states that cap was attached to endoscope via waterproof adhesive tap which is the same tape as the client

Conclusions/action items: While this tape may have worked well for other companies and labs our client has asked us to look for better solutions to secure the cap to the endoscope



2023/09/13-Endoscopic attachment mechanism

LEONZIO DICATALDO - Sep 22, 2023, 2:46 PM CDT

Title: Endoscope attachment mechanism

Date: 09/13/23

Content by: Leo DiCataldo

Present: Leo DiCataldo

Goals: Learn how other companies have attached caps to there endoscopes

Content:

https://journals.lww.com/eurojgh/fulltext/2007/04000/Multiband_mucosectomy_for_endoscopic_resection_of.5.aspx

Article states that cap was attached to endoscope via a special kind of elastic band known as as multiband

Conclusions/action items: Using a multiband could be a potential solution for our group to attach the cap to the endoscope



2023/09/15-Endoscopy Tools Research

ELI MILAND - Sep 15, 2023, 12:50 PM CDT

Title: Endoscopy Tools Research

Date: 09/15/23

Content by: Eli Miland

Present: Eli Miland

Goals: Learn basics of endoscopes and their attachments

Content:

[1] "Endoscopic discectomy (selective endoscopic discectomy): Disc," Desert Institute for Spine Care, <https://www.sciatica.com/endoscopic-spine-surgery/endoscopic-discectomy/> (accessed Sep. 15, 2023).

This article states that the endoscope is the base of operation, while various micro-instruments are used through the endoscope to complete different tasks throughout the procedure. Some examples of tools they use are a laser for precisely removing obstructive tissue and a camera to see what they are doing.

Conclusions/action items: Endoscopic discectomies require many tools but we need to focus on a certain cap. We need to research more on the specific cap. We need to get a tangible cap to know more on what we are working with.



2023/09/19 Endoscopic Dissecting Practices

ELI MILAND - Sep 22, 2023, 12:30 PM CDT

Title: Endoscopy Practice Research

Date: 09/19/23

Content by: Eli Miland

Present: Eli Miland

Goals: Learn who can legally or should be performing endoscopies.

Content:

[1] A. Condon, "Should pain management physicians perform endoscopic spine surgery? 9 spine specialists discuss," Becker's Spine Review, <https://www.beckersspine.com/spine/48042-should-pain-management-physicians-perform-endoscopic-spine-surgery-8-spine-specialists-discuss.html#:~:text=I%20would%20say%20it%20is,surgeon%20scrub%20in%20the%20case.> (accessed Sep. 19, 2023).

In this article there are different opinion statements from medical professionals regarding who can/should perform endoscopies. They all essentially agreed that as long as a licensed professional has the proper training it is okay.

Conclusions/action items: Endoscopic discectomies can be performed by someone with adequate training. There is not one extremely specific doctor/surgeon that has to perform this. We need to conduct more research on the endoscopy process and tools.



2023/10/26 Esophagus Model Research

Title: Esophagus Model Research

Date: 10/26/23

Content by: Eli Miland

Present: Eli Miland

Goals: Search for potential esophagus models for testing

Content:

https://www.google.com/searchsca_esv=576993793&rlz=1C1ONGR_enUS1075US1075&q=3d+esophagus+model&tbm=shop&source=Inms&sa=X&v

On google shopping there are multiple vendors who offer life-size esophagus models. One main site is Anatomy Warehouse, who offers multiple models op

Conclusions/action items: We need to evaluate our 3D printed model this week. We need to decide how we will test and if we want to buy one of



2023/10/19 Endoscope Cap Fabrication

ELI MILAND - Oct 19, 2023, 7:17 PM CDT

Title: Endoscope Cap Fabrication

Date: 10/19/2023

Content by: Eli Miland

Present: Eli Miland

Goals: Learn how a cap can be fabricated

Content:

<https://onlinelibrary.wiley.com/doi/10.1111/den.12546>

This article says that a cap was 3D printed and used in many trials. The trials were successful, but it does not specify the material they used.

Conclusions/action items: We will most likely 3D print a prototype. If that is not plausible, we will alter a current cap. We will design a cap on SolidWorks soon.



2023/09/27 Design Sketch

ELI MILAND - Sep 29, 2023, 12:59 PM CDT

Title: Design Sketch

Date: 2023/09/27

Content by: Eli Miland

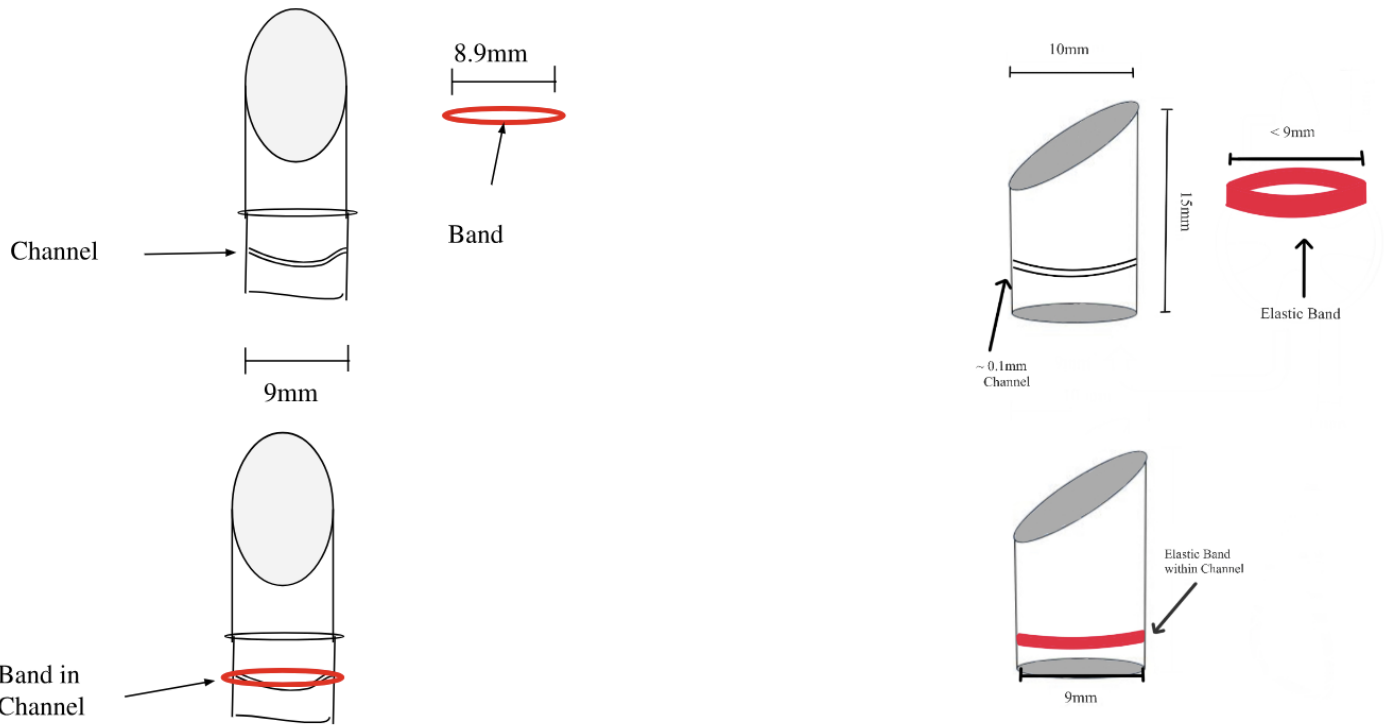
Present: Eli Miland

Goals: Brainstorm and sketch a design

Content:

This idea is very simple and does not differ much from the existing cap. There would be a channel cut into this cap, on the area that goes overtop of the endoscope. The idea is that the material of the cap will be flexible enough to allow a band in said channel to tighten the cap. The purpose of the channel is so the band does not fall out during the operation. The band would be something similar to a band used for braces.

EXTERNAL BAND



Conclusions/action items: We need to evaluate all of the designs we made. We then need to choose three to put in our design matrix which we also need to complete. We then need to discuss our design choice with our client.



2023/09/29 BPAG Meeting Notes

Title: BPAG Meeting Notes

Date: 09/29/2023

Content by: Eli Miland

Present: Eli Miland

Goals: Learn the responsibilities of the BPAG

Content:

- Keep receipts in notebook
- Client can just pay
- ShopUW+
 - Client pays through funding string
 - We cannot order directly
- Makerspace
 - Client can have a fund number
- TEAMLab
 - \$50/semester shopfee per student - our responsibility
- Reimbursement
 - Only BPAG will be reimbursed
 - Has to be within 90 days of purchase
 - Must provide original receipts
 - Takes 3+ weeks submitted electronically
- Non-reimbursable expenses
 - Our responsibilities:
 - Labarchives notebook ~ \$15 per team
 - Poster printing ~ \$50 per team
 - TEAMLab and Makerspace ~ \$50 per team
- Accounting
 - Table with all vital information needed to purchase again
 - Put table in: progress reports
 - Team part of notebook
 - Report
- General Notes
 - Have client make purchases
 - Have purchases approved by client before buying
 - Save receipts and get reimbursed before poster session
 - Keep track of all expenses

Conclusions/action items: Our project should not require a large amount of spending. There are no complex devices we are using. The most expensive thing would be buying a specific material to make a prototype or fabricating something. This being said, I will do an excellent job of documenting our purchases.



Initial Research 9/13/2023

HELEN SARGEANT - Sep 13, 2023, 7:00 PM CDT

Title: Initial Research

Date: 9/13/2023

Content by: Helen Sargeant

Present:

Goals: Gather background on the project topic.

Content:

[Endoscopic Caps - ScienceDirect](#)

There are many types of endoscopic caps. Each has a different function.

Can be used for resection of lesions.

Hard and soft caps exist. Different shapes and sizes. Caps can include other functions - hooded knife cap for large resections - cap with flushing port to keep view clear of blood and mucosa.

[Endoscopy: Types, preparation, procedure & risks \(medicalnewstoday.com\)](#)

Endoscopy is useful for many areas of the body.

Gastrointestinal, Respiratory, through small incisions, female reproductive organs.

Conclusions/action items:

Continue researching with a focus on existing cap attachments.

**Title: Weight, Material, and Aesthetics Research for PDS****Date:** 9/18/2023**Content by:** Helen Sargeant**Present:****Goals:** Gather research on weight, material, and aesthetics of existing caps.**Content:**

Similar products have material restrictions. The material of the cap must be sterile and is typically single use. The material should be smooth, soft, and thin so as to not cause damage to the human body. The shape of the cap is different depending on purpose. Client's preferred cap has a beveled end beyond 4mm working length.

[1]J.-Y. Jang, "Future Development of Endoscopic Accessories for Endoscopic Submucosal Dissection," *Clinical Endoscopy*, vol. 50, no. 3, pp. 242–249, May 2017, doi: <https://doi.org/10.5946/ce.2017.073>.

[2]A. Sanchez-Yague, T. Kaltenbach, H. Yamamoto, A. Anglemyer, H. Inoue, and R. Soetikno, "The endoscopic cap that can (with videos)," *Gastrointestinal Endoscopy*, vol. 76, no. 1, pp. 169-178.e2, Jul. 2012, doi: <https://doi.org/10.1016/j.gie.2012.04.447>.

[3]A. Goldis, R. Goldis, and T. V. Chirila, "Biomaterials in Gastroenterology: A Critical Overview," *Medicina*, vol. 55, no. 11, p. 734, Nov. 2019, doi: <https://doi.org/10.3390/medicina55110734>.

Conclusions/action items:

Fill out my sections of the PDS. Continue research.



Fabrication Research 10/19/2023

HELEN SARGEANT - Oct 19, 2023, 2:34 PM CDT

Title: Fabrication Research

Date: 10/19/2023

Content by: Helen Sargeant

Present:

Goals: Research ways to fabricate our design with typical cap material.

Content:

It is possible to 3D print a mold and then cast liquid silicone in it [1]. So we could 3D print a mold of our design and then mix a two part silicone polycarbonate to fill the mold. Possibly use a vacuum chamber to de-gas the silicone before pouring and reduce bubbles.

[1] <https://formlabs.com/blog/casting-silicone-guide/>

Conclusions/action items:

Research 3D printing molds.



Initial design sketches 9/25/2023

HELEN SARGEANT - Sep 25, 2023, 9:27 PM CDT

Title: Initial Design Sketches

Date: 9/25/2023

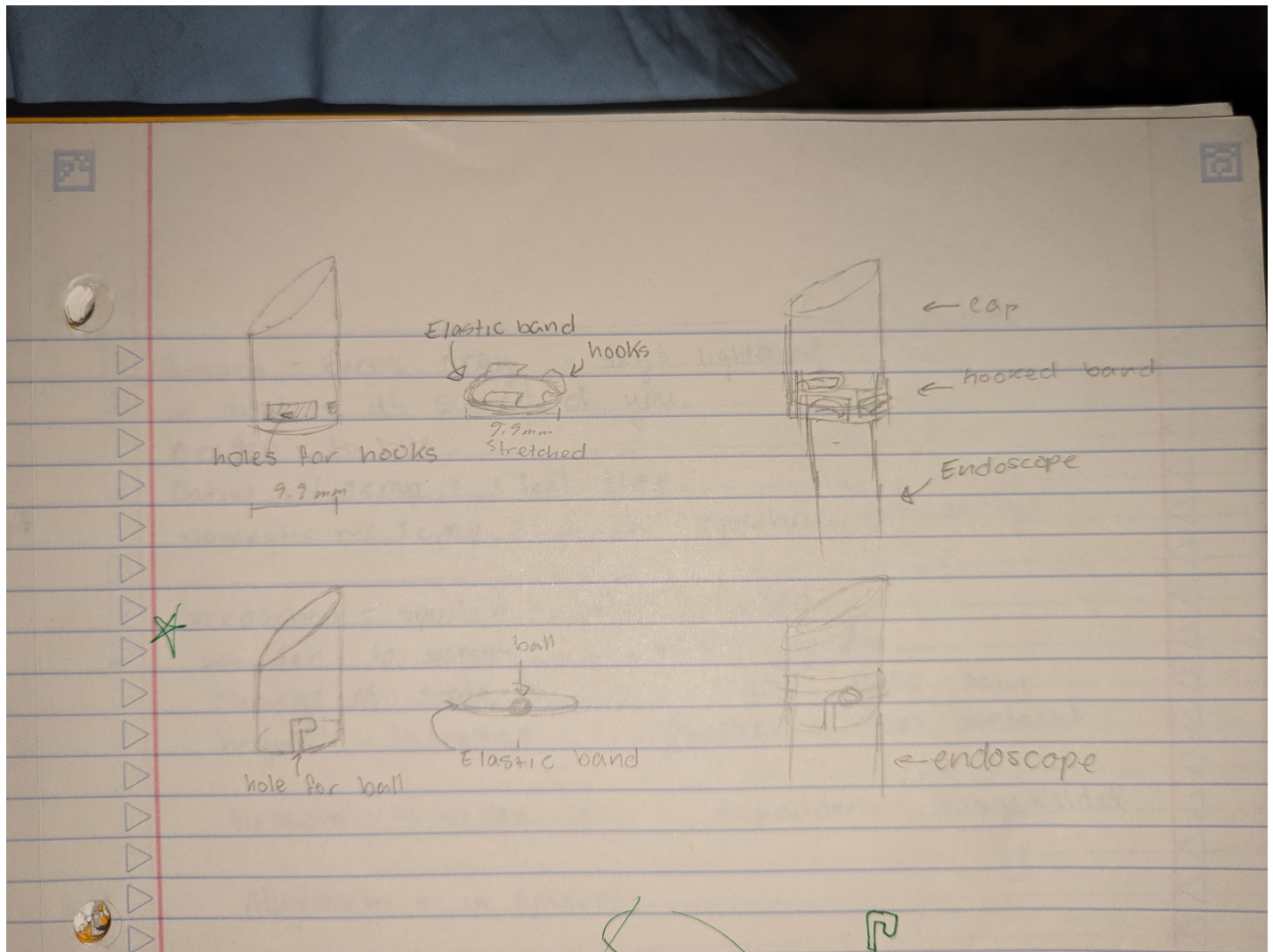
Content by: Helen Sargeant

Present:

Goals: Come up with at least one sketch

Content:

I did two sketches of possible cap designs.



Conclusions/action items:

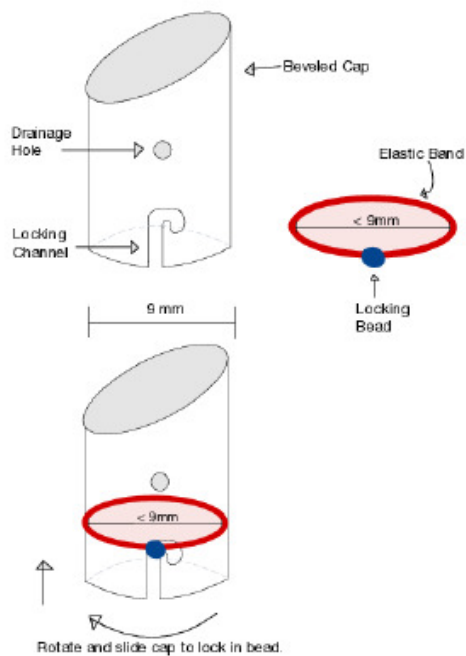
Go to team meeting about designs. Further refine designs.

**Title:** Refined Internal Band Design Sketch**Date:** 9/25/2023**Content by:** Helen Sargeant**Present:****Goals:** Refine internal band sketch**Content:**

Internal locking band sketch refined and uploaded to the shared drive.

Conclusions/action items:

Write about why we picked dislodgement resistance as a category.

[Download](#)

Internal_band_locking_cap_design_sketch.pdf (74.1 kB)



Preliminary Report Update

HELEN SARGEANT - Oct 08, 2023, 4:02 PM CDT

Title: Preliminary Report Update

Date: 10/8/2023

Content by: Helen Sargeant

Present:

Goals: Complete Preliminary Design Evaluation report section.

Content:

I summarized our design matrix, and added a section on our proposed final design.

Conclusions/action items:

Revise preliminary design evaluation section.



9/13 Endoscopic Overview

Aidan Brey - Sep 23, 2023, 2:34 AM CDT

Title: Endoscopic Overview

Date: 9/12/23

Content by: Aidan Brey

Present: Aidan Brey

Goals: To gain a basic understanding of our project and what any potential design problems may be.

Content:

Endoscopic caps are flexible transparent caps attached to distal end of endoscope, and are used for tissue samples and surgeries.

Caps are generally <10 mm in diameter and 12 mm in length.

A snare could be positioned around the lip of the cap in order to secure the cap.

Cap must be able to create a tight seal to prevent mucus and blood from interfering with the camera lens, responsible for 25% of failed operations

Caps are vital to help focus the camera during use, concentrating on a specific area rather than whole lens.

Caps are generally one-time use, with reusable caps being much more uncommon.

Conclusions/action items: Endoscopic caps are flexible, small, and transparent. For clients sake it would be much easier to modify the current caps, instead of designing new caps.

Citations:

<https://www.mobileaspects.com/the-problem-with-broken-endoscopes-and-how-to-avoid-them/>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3215503/>



10/13 Preliminary Report Research

Aidan Brey - Oct 13, 2023, 5:48 AM CDT

Title: Preliminary Report Research

Date: 10/13

Content by: Aidan

Present: Aidan

Goals: To conduct research for the Introduction section of the Preliminary Report

Content:

Around 1% of Americans are diagnosed with IBD, includes Crohn's Disease

12 million Americans are believe to have Barrett's esophagus, which affects daily consumption of food

In 2018 there were 41 million emergency room visits related to gastrointestinal disease

In 2019 there 472 thousand deaths primarily due to gastrointestinal disease

When internal tissues don't possess the expected properties digestion becomes exponentially difficult, leading to constant vomiting and diarrhea

Conclusions/action items: To finish writing the Preliminary Report after finding this research.

Citations: <https://www.crohnscolitisfoundation.org/what-is-crohns-disease/overview#:~:text=Who%20is%20Affected%3F,ages%20of%2020%20and%2030>.

<https://www.medtronic.com/me-en/your-health/conditions/reflux-disease/what-is-barretts.html>

[https://www.medrxiv.org/content/10.1101/2023.08.16.23294166v1#:~:text=In%20the%20U.S.%20population%2C%20digestive,472%2C000%20deaths%20\(2019\)%20annually](https://www.medrxiv.org/content/10.1101/2023.08.16.23294166v1#:~:text=In%20the%20U.S.%20population%2C%20digestive,472%2C000%20deaths%20(2019)%20annually).

<https://my.clevelandclinic.org/health/articles/7040-gastrointestinal-diseases>



10/24 Properties of Gastrointestinal Tract

Aidan Brey - Nov 12, 2023, 3:00 PM CST

Title: Properties of Gastrointestinal Tract

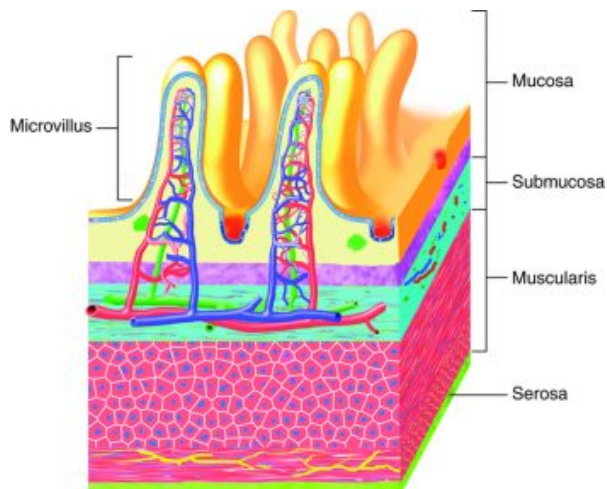
Date: 10/24

Content by: Aidan

Present: Aidan

Goals: To gain a better understanding of the GI tract and how we may adapt these properties into something we can test on.

Content:



At the bottom of the esophagus, there is a muscle called the lower esophageal sphincter, which is a ring like muscle which must relax to let food into the stomach.

The GI tract consists of a wide range of tissues, like mucosa, submucosa, muscularis, and serosa.

Mucosa is a soft tissue which is semi-malleable.

While submucosa is a thin and dense material placed under the mucosa

As you get towards the muscularis and serosa the material becomes increasingly more rigid.

Conclusions/action items: In order to make a realistic model, the model must contain a soft and malleable material at the most internal point. As you progress from the inside out the model must become more rigid and dense to match the GI tract.

Citations:

<https://my.clevelandclinic.org/health/body/7041-digestive-system>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7173558/>



11/1 Other Areas of Testing

Aidan Brey - Nov 12, 2023, 3:46 PM CST

Title: Other Areas of Testing

Date: 11/1

Content by: Aidan

Present: Aidan

Goals: To uncover any other factors which may influence the performance of our prototype.

Content:

Within the GI tract there is trace levels of bile salts, which at different concentrations could affect the how the prototype preforms.

One consideration to have is the differing levels in hydration and diets. Which affects how the GI tract may look and how soft the tissues are. This may require further testing to ensure that the cap preforms well for all diets and hydration levels.

A final consideration may be those with GI diseases, which alter to properties of the mucosa. This could cause the cap not to perform well on these affected tissues. Meaning we may need to test tissues similar to those in the GI tract that are affected by diseases.

Conclusions/action items: Some other areas that may require testing in levels of salt concentration, and differences in tissues properties from diet and disease.

Citations:

<https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/gastrointestinal-tract>

<https://www.sciencedirect.com/science/article/abs/pii/S0022354921002082#:~:text=The%20physiological%20properties%20of%20the,on%20its%20properties%20and%20formulation.>



9/19 Endoscopic Cap Electrode

Title: Endoscopic Cap Electrode

Date: 9/19/23

Content by: Aidan Brey

Present: Aidan Brey

Goals: To have a deeper understanding of competing designs for a endoscopic cap, and how they prevent slippage and dislodgement.

Content:

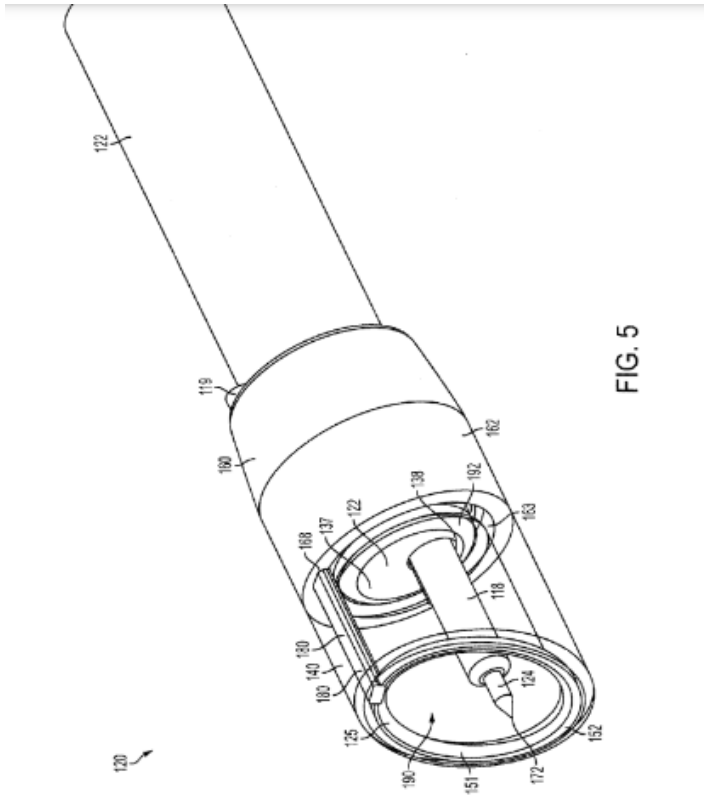


FIG. 5

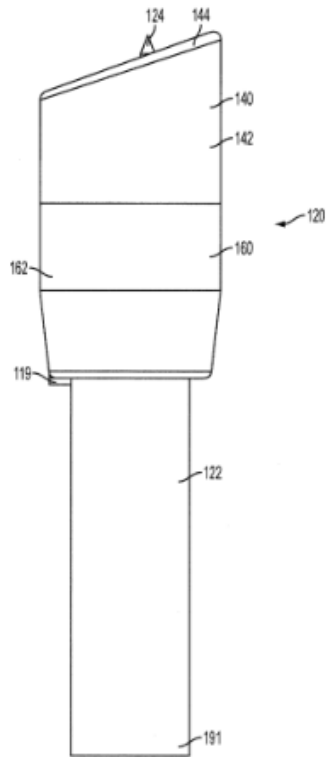


FIG. 8

Caps are held on using separate attachments, located below electrode and camera lens. May be a potential design concept?

The materials used are semi flexible, similar to our clients favorite reusable cap.

Separate rod helps hold on cap (Figure 5), potential source of stability

Conclusions/action items:

The endoscopic cap with the electrode has notable sources of stability which can be adapted to our project.

Citations:

<https://patents.google.com/patent/US9788888B2/en>



9/19 Endoscope Cap Grip

Title: Endoscope Cap Grip

Date: 9/19/23

Content by: Aidan Brey

Present: Aidan Brey

Goals: To further research competing designs in order to gain a better understanding of possible pathways to help prevent dislodgement.

Content:

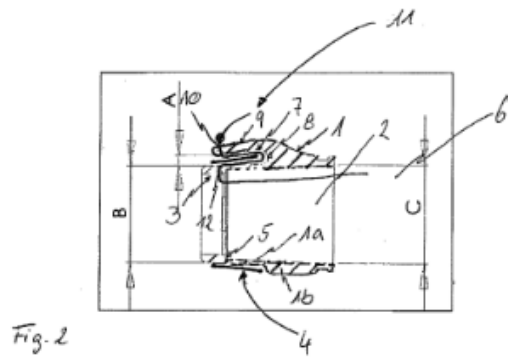


Fig. 2

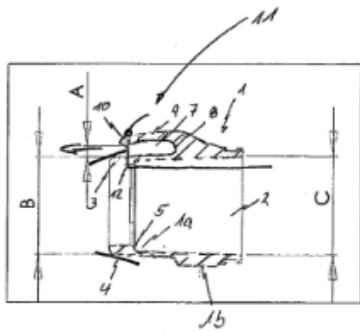
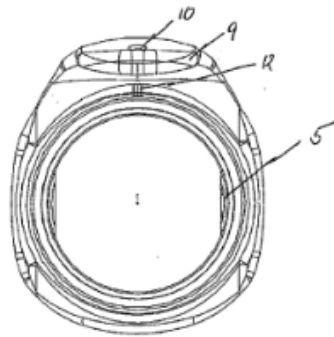
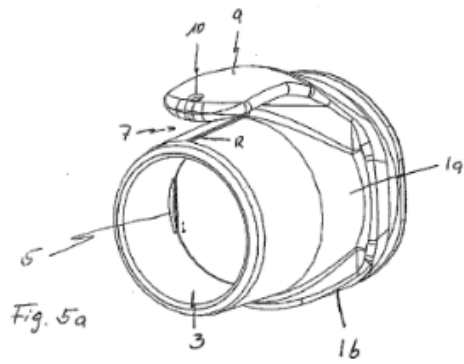


Fig. 3



Caps screw onto attachment placed onto the distal end of the endoscope

Uses rigid extension onto front end of the cap to ensure that cap is flush with end of endoscope

Utilizes flexible material to help prevent dislodgement

Conclusions/action items: Making a attachment may be more beneficial for more stability, however that is not what the client wants.

Citations: <https://patents.google.com/patent/US20110190578/en>



10/13 Preliminary Report Competing Designs

Aidan Brey - Oct 13, 2023, 5:51 AM CDT

Title: Preliminary Report Competing Designs

Date: 10/13

Content by: Aidan

Present: Aidan

Goals: To research competing designs for the Preliminary Report

Content:



Reveal Distal Attachment Cap

- Helps avoid "red out" by maintaining constant distance between the endoscope and mucosa
- Aids in maneuvering through difficult turns in the gastrointestinal tract
- Can be used in conjunction with accessories such as snares or needles

Conclusions/action items: To finish writing my sections of the Preliminary Report, by utilizing this research

Citations: <https://www.steris.com/healthcare/products/endoscopy-devices/polypectomy-and-tissue-acquisition-devices/reveal-distal-attachment-cap>



2014/11/03-Entry guidelines

John Puccinelli - Sep 05, 2016, 1:18 PM CDT

Use this as a guide for every entry

- Every text entry of your notebook should have the **bold titles** below.
- Every page/entry should be **named starting with the date** of the entry's first creation/activity. subsequent material from future dates can be added later.

You can create a copy of the blank template by first opening the desired folder, clicking on "New", selecting "Copy Existing Page...", and then select "2014/11/03-Template")

Title: Descriptive title (i.e. Client Meeting)

Date: 9/5/2016

Content by: The one person who wrote the content

Present: Names of those present if more than just you (not necessary for individual work)

Goals: Establish clear goals for all text entries (meetings, individual work, etc.).

Content:

Contains clear and organized notes (also includes any references used)

Conclusions/action items:

Recap only the most significant findings and/or action items resulting from the entry.



Title:

Date:

Content by:

Present:

Goals:

Content:

Conclusions/action items: