Improved Colonoscopy Polyp Retrieval Device

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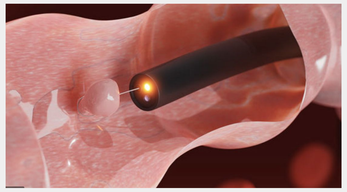
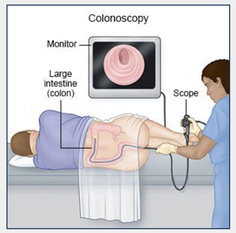
Colonoscopy Procedure

Colonoscopic Polypectomy:

- During routine colonoscopies, endoscopists must identify and remove adenomas in order to test for cancer. More than 15 million colonoscopy procedures are performed annually [1].





Colonoscopy procedure

1. *Polyp identification with camera*
2. *Insertion of cold snare and resection of polyp*
3. *Removal of cold snare and insertion of vacuum*
4. *Suction of polyp and delivery to pathology unit*

Polyp Retrieval Concern:

- Up to 5% of polyps are lost during routine colonoscopy procedures. [2]
- Failure to retrieve polyps results in patients requiring future colonoscopy after 7 years as oppose to 10 years
- **Need:** A surgical device to remove the need for two instruments to be used colonoscopy and limit flyaway polyps

Design Criteria

The improved polyp retrieval device must:

- Does not obstruct endoscopist field of view
- 1 Ressects and collects polyp in a single step
- Fit existing endoscope tube diameter (≤1cm)
- ✓ ≤2% polyp fly away rate

Standards

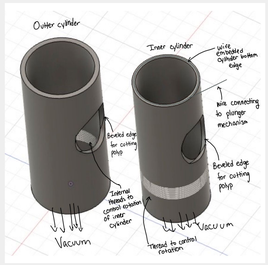
Code of Federal Regulations Title 21, ISO 13485, NSPE Code of Ethics for Engineers

Resection and Retrieval Device

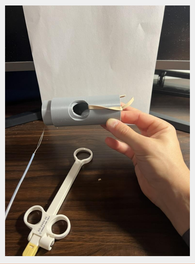
Prototype V1: Concentric cylinder vacuum tube

- The concentric cylinders are positioned such that polyp enters open hole
- Horizontal rotation of cylinders closes hole and ressects polyp from colon wall
- Vacuum suction removes polyp from inside of sealed cylinders
- Preliminary prototype can be 3D printed using PLA

Prototypes V2: Cylinder Tube + Cold Snare Vacuum Tube

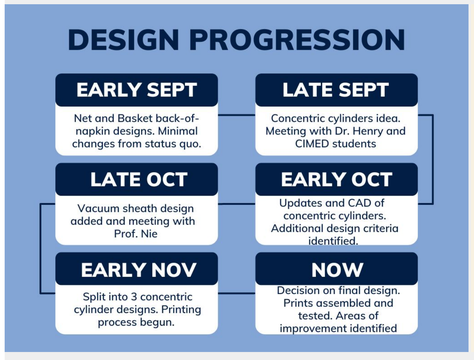


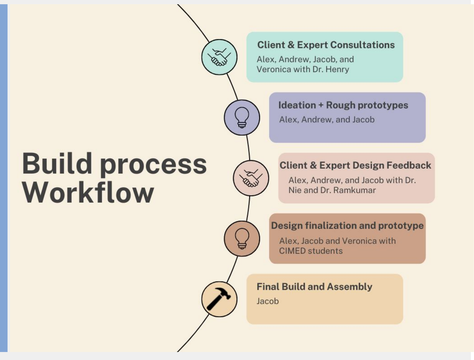
Prototypes V3:



Uses elastic to rebound guillotine mechanism following cold snare actuation

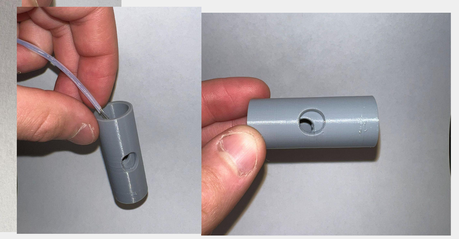
Design Process





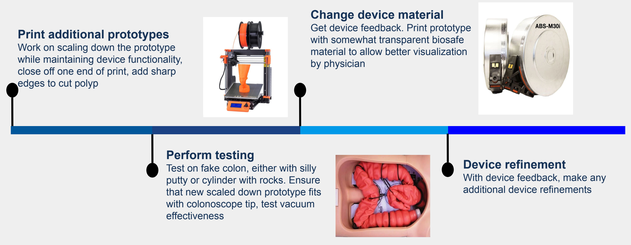
Final Prototypes

- Rebound force provided by elastic between outer and inner cylinder
- Actuated by cold snare "plunger" mechanism
- Rests in the open position to allow suction
- 2 cm diameter
- PLA material, IDEA Lab



FUTURE DIRECTIONS

1. Replace PLA with biosafe ABS-M30i filament
2. Replace elastic mechanism with microfabricated expansion spring
3. Downscale current prototype by factor of 8
4. Test design fit on Carle endoscopes
5. Verify vacuum suction using Carle Simulation Center resources
6. Quantify polyp resection ability using cylindrical test colon



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REFERENCES

[1]"Let's Get Screened, Part 1: Colon Cancer Screening." Penn Medicine, Dec. 2019.
[2]Fernandes, Carlos, et al. "Risk Factors for Polyp Retrieval Failure in Colonoscopy." *United European Gastroenterology Journal*, vol. 3, no. 4, Aug. 2015, pp. 387–92. *PubMed Central*, https://doi.org/10.1177/2050640615572041.