

Development of a Sterile and Automatic Biopsy Gun for Cell Retrieval

Lucas Frankle, Udit Gupta, Sehaj Hira, Ben Oteri, Neel Panchwagh, and Luke Zhao

Advisor(s): Dr. Catherine K. Kuo, Fischell Department of Bioengineering, University of Maryland & Dr. Anthony Sandler, Children's National Hospital

Motivation

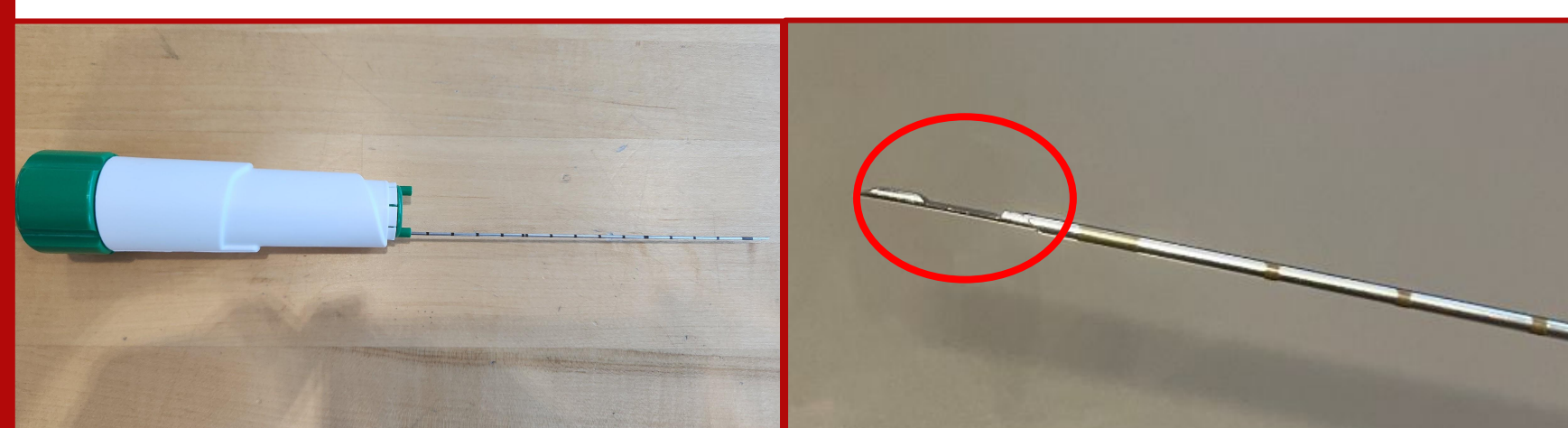
The current market biopsy gun requires multiple insertions into the patient to extract a sufficient sample mass. Multiple insertions and extractions leads to a lack of sterility and standardization that compromises the ability to develop autologous cell therapeutics.

Background

A biopsy gun collects tissue samples for:

- Diagnosis of cancer
- Generation of cell lines (research into autologous cell therapies)

Current market device:



Objectives

Develop a standardized biopsy device that enhances sterility and sample collection efficiency for pediatric tumors

Single insertion procedure	Shorter procedure times
Larger biopsy mass	Improved sample sterility

Methods

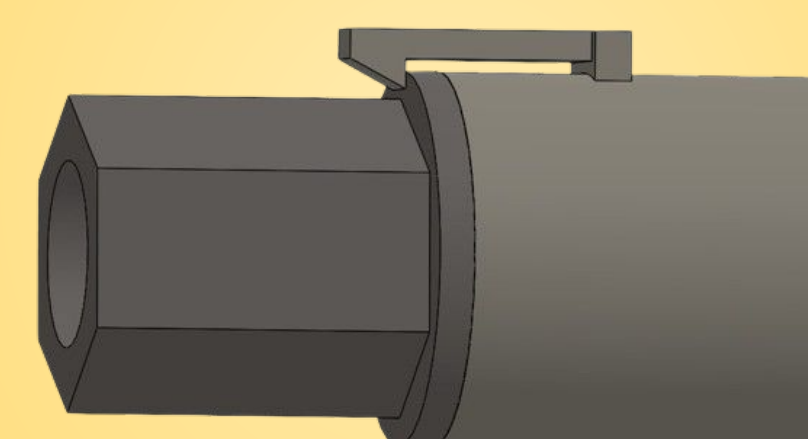
1. Device designed and fabricated using stereolithography resin
2. Device inserted into sample tissue phantom
3. Screw rotated once and retracted into collection chamber
4. Sample mass recorded



Device & Results

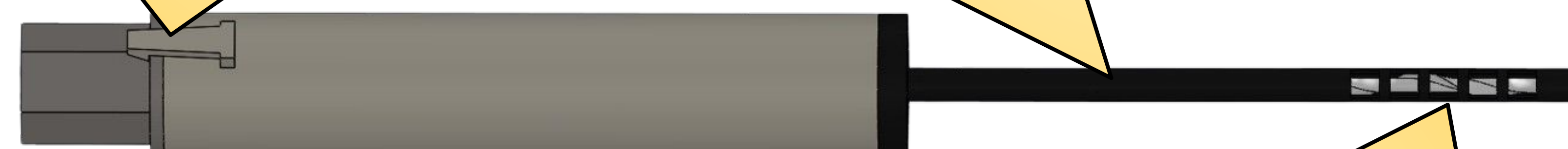
Interior Turning Mechanism

Latch apparatus for safe & proper physician use



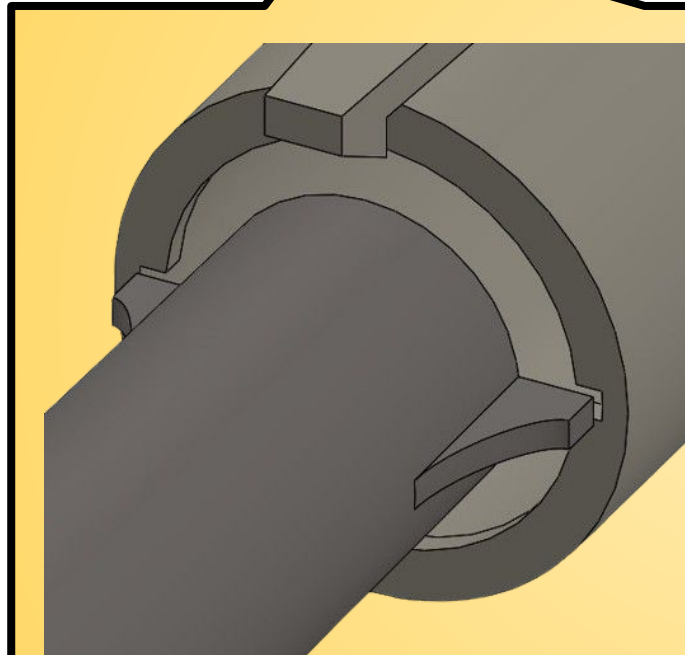
Outer Sheath

Multiple samples collected → more mass collected on single entry



Interior Turning Mechanism

Fall out lock allows sterile & single use



Cutting Edge

Contains multiple scarves for increased collection surface area

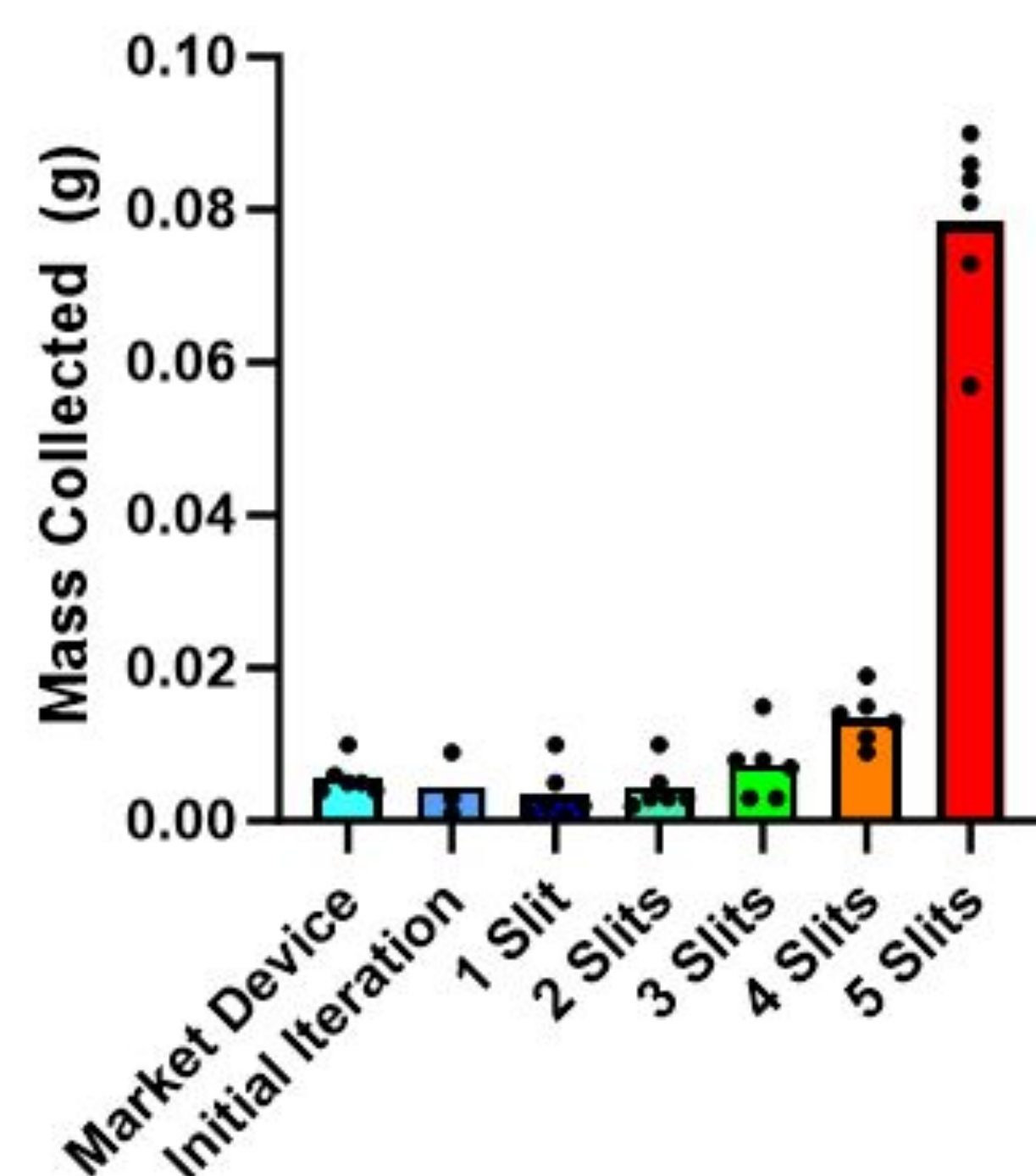


Figure 1: Mass Collection. The average mass (g) of ground turkey collected using the market device and variations of the prototype (n = 6).

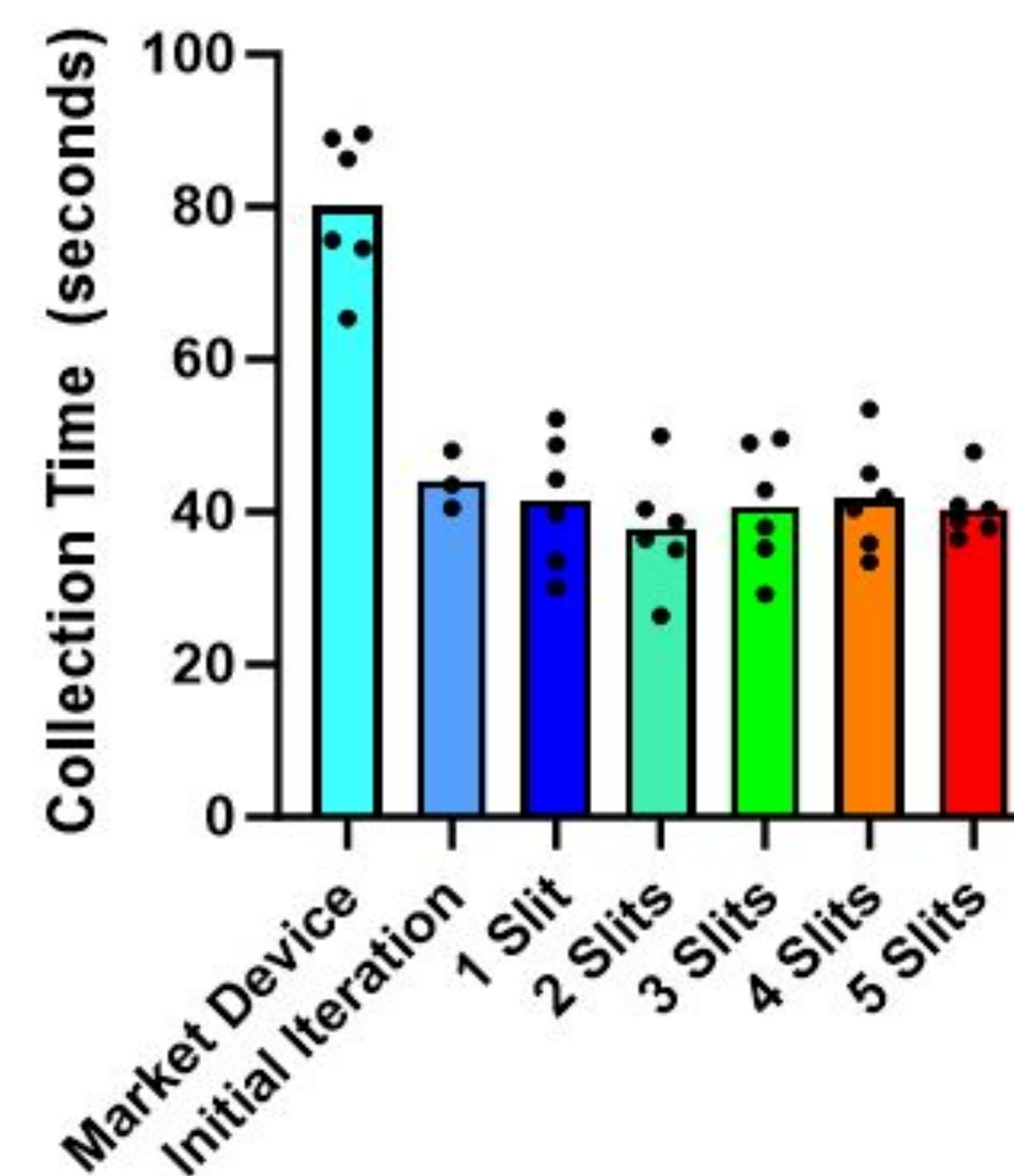


Figure 2: Collection Time. The average procedure time (in seconds) to collect samples of ground turkey collected using the market device and variations of the prototype (n = 6).

Conclusions

Development of **novel device** prototype with a screw mechanism is effective in cutting tissue and collecting sample

Device allows for **9x** more sample collection in 1/2 collection time than current market device

Single insertion procedure successfully achieved

Sample retraction mechanism allows seamless sample sterility and lab transportation

Device iteration with 5 slits collected more around 4x more sample mass than iterations with less slits



Bioethics

Patient Considerations: Other Considerations:

- | | |
|---|--|
| <ul style="list-style-type: none"> • Cost and availability of the device • Possibility to expand to adult tumors • Reduce bleeding | <ul style="list-style-type: none"> • Cost and availability of the therapeutics developed • Single use device • Development of more effective therapeutics |
|---|--|

Future Work

- Create a rotation mechanism that operates through the press of a single button to increase collection consistency
- Manufacture using steel and scale down to appropriate size
- Test using tumor samples

References

Dreznik, Y., Paran, M., Baazuv, A. et al. Percutaneous core needle biopsy of neuroblastoma in the pediatric population: what have we learned in the last decade. *Pediatr Surg Int* 40, 98 (2024). <https://doi.org/10.1007/s00383-024-05689-x>

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