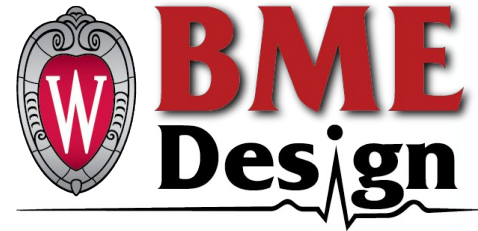


Radiologic Pathologic Correlation in Renal Cell Carcinoma

Team Members: Ellie Steger (Team Leader)
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Client: Dr. Meghan Lubner

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Client

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Department of Radiology

UNIVERSITY OF WISCONSIN

SCHOOL OF MEDICINE AND PUBLIC HEALTH

Problem Statement

- Most common type of kidney cancer
- From the body biopsies are too risky
 - Entire kidney removed
- Spatial heterogeneity complicates imaging
- Coring biopsy device
 - Single sample
 - 10mm diameter



Figure 1: Image of unique shape and placement of a renal cell carcinoma on the kidney [1].

Motivation

- Current Method: Stainless steel blade cuts tissue from patient specific 3D printed box
 - Causes too much external tissue trauma
- Tissue trauma tolerance of 3mm

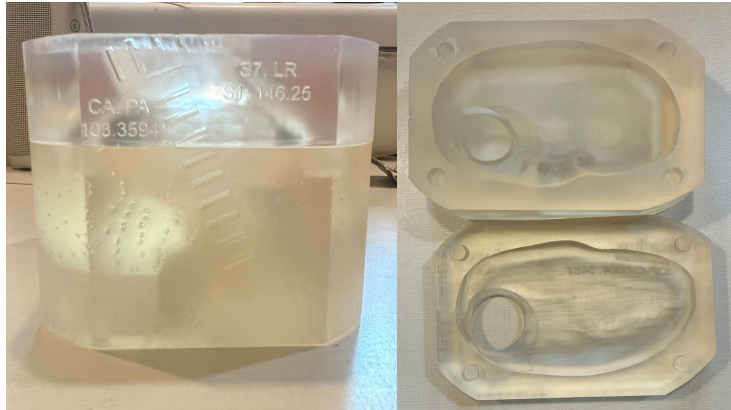


Figure 2: 3D printed acrylic box of patient's kidney with tumor.



Figure 3: Current coring device prototype with a delrin plastic tube and 304 stainless steel blade.

Current Designs

- Biopsy punches used to collect small samples
 - Used to diagnose varying types of cancers including melanoma skin cancer and oral cavities
 - Many manufacturers, common medical device
 - Does not reach adequate depths for tumor sampling
- Blunt, circular blade from previous group
 - Stainless steel material
 - Too much tissue trauma, currently unusable

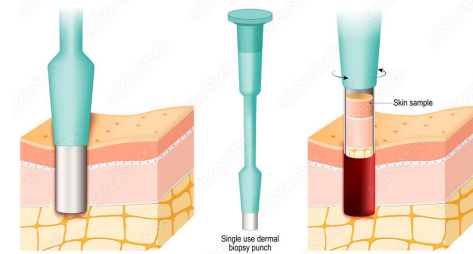


Figure 4: An upclose depiction of a push biopsy procedure. [2]



Figure 5: Previous group's prototype. [3]

Product Design Specifications

The device must:

- Resect 10 mm diameter sample
- Cause minimal tissue trauma
- Be easily sterilized
- Detachable from corer
- Comfortable for pathologist
- Reusable and long lasting (50 resections per blade)
- Cost: \$500



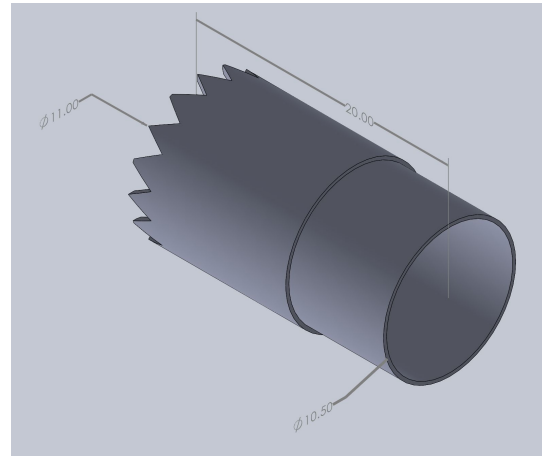
Figure 6: A view of a pathologist performing an analysis of a tissue sample. [4].

Design 1: Pineapple Corer

- Twist device, not push
- Contains handle for easy of use
- Small rigid teeth at the end
- Smooth corners



Figure 7: Pineapple coring slicing tool [5]



Olivia Jaekle

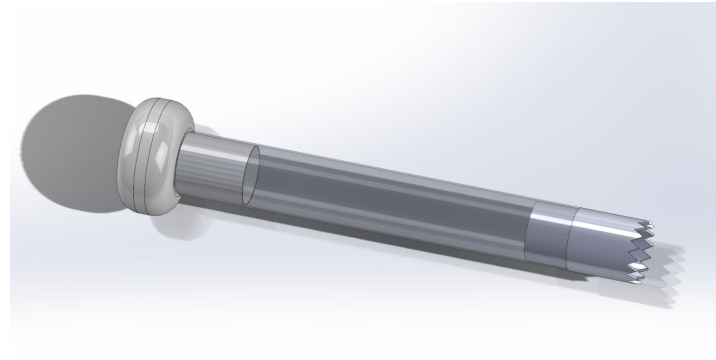


Figure 8,9: SOLIDWORKS Pineapple Corer Blade which includes toothed, rounded tip; Full Assembly

Design 2: Recorder Blade

- Mimics side profile of surgical scalpel
- Pointed end to apply pressure to seamlessly cut the tissue
- Complete with a rounded half to sculpt a sample



Figure 10: Surgical scalpel [6]

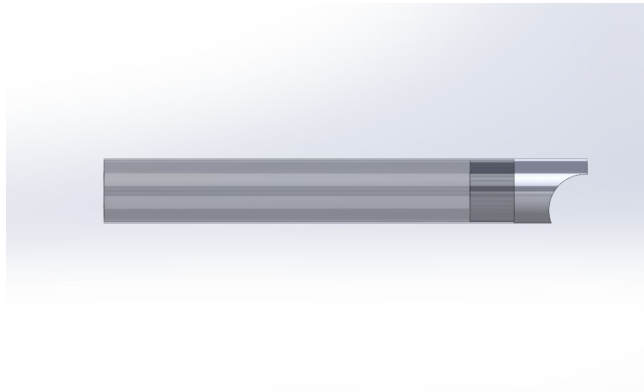
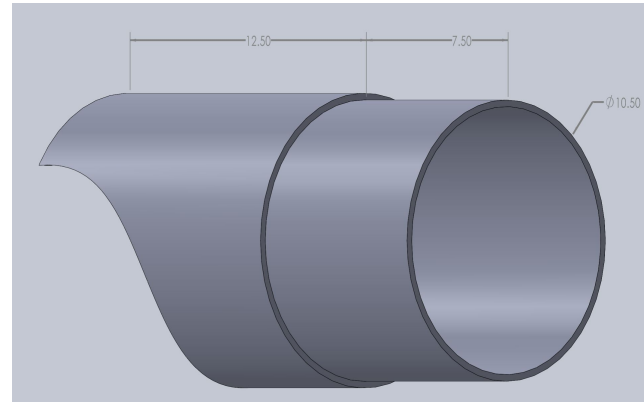


Figure 11, 12: SOLIDWORKS Recorder Blade which includes pointed pressure application at the tip; Full Assembly

Design 3: Punch Biopsy Design

- Based on the push biopsy used in skin biopsy but deeper
- Circular blade that narrows to slide through tissue
- Similar to current prototype but thinner



Figure 13: A MedGyn disposable punch biopsy device [7]

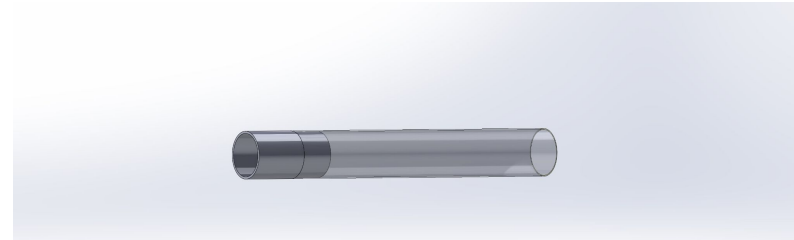
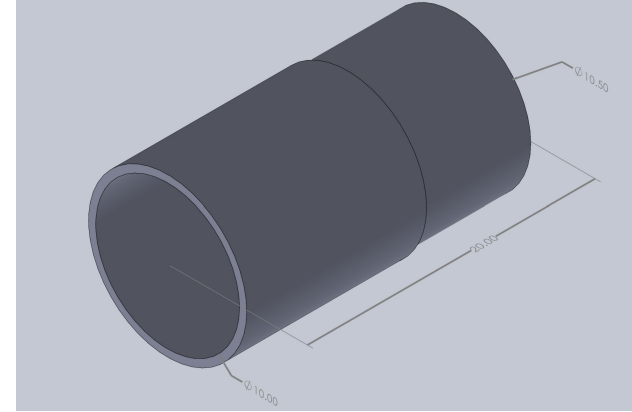
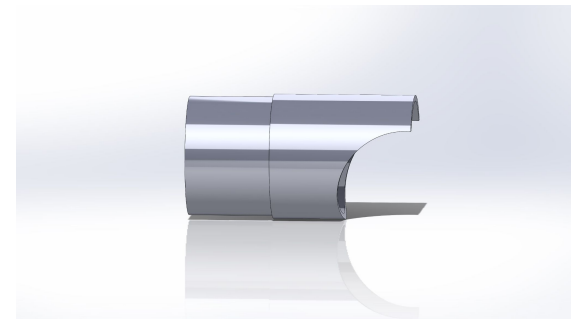
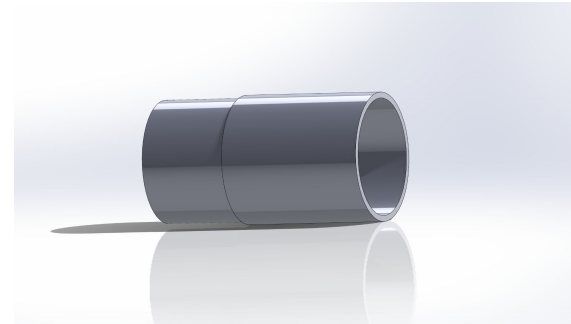
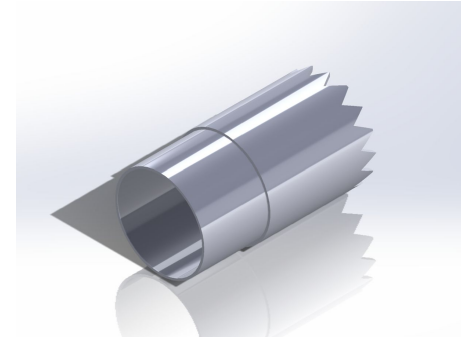


Figure 14,15: SolidWorks model punch biopsy which includes circular tip; Full assembly

Design Matrix Evaluation Criteria

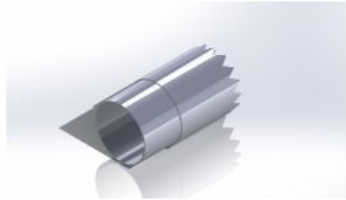
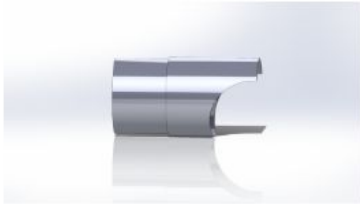

- Precision- external tissue damage
- Durability- longevity of the blade
- Feasibility- ease of fabrication
- Ease of Use- ergonomics and efficiency
- Cost- cost of fabrication



Design Matrix Results

Ellie Steger



Criteria	Pineapple Corer		Recorder Blade		Punch Biopsy Blade	
						
Precision (30)	2/5	12	4/5	24	5/5	30
Durability (20)	2/5	8	3/5	12	5/5	20
Feasibility (20)	3/5	12	3/5	12	4/5	16
Ease of Use (20)	5/5	20	4/5	16	4/5	16
Cost (10)	3/5	6	4/5	8	4/5	8
Score (100)	58		72		90	

Winning Design

Aleks Skutnik



- Highest ranked: Punch Biopsy Blade Design
- Scored best on Precision, Durability, Feasibility, and Cost

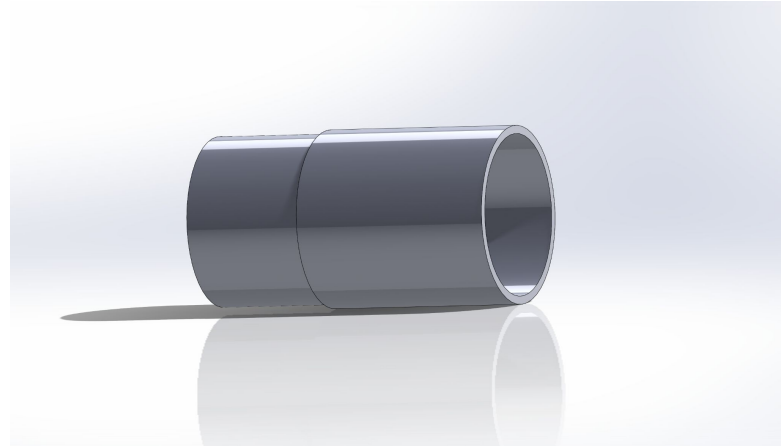


Figure 16: SolidWorks model of the Punch Biopsy Blade Design attachment

Future Work

- Prototyping
 - Detachable aspect
- Testing
 - Kidney/RCC phantom for durability testing
- Possible Considerations
 - Easy to use
 - Preserve surrounding tissue

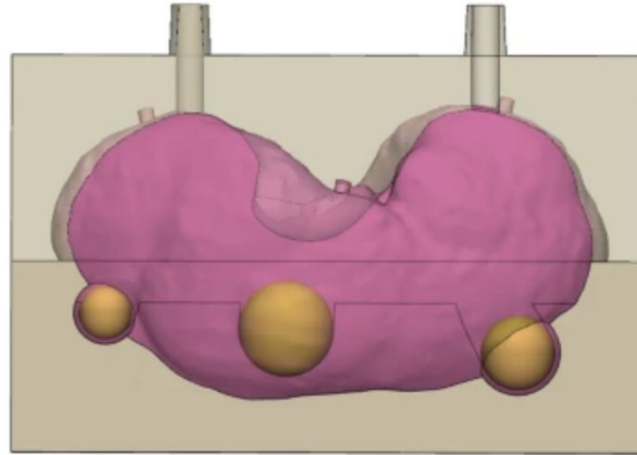


Figure 17: Kidney Phantom Model [8].



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BME Department

UW Department of Radiology



References

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Questions?

