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Probe-Placement Fixture for Microwave Ablation

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Outline

- Problem Statement
- Background
  - What is Microwave Ablation
  - Current Usage
- Product Design Specifications
- Designs
- Design Matrix
- Acknowledgements
- References

Problem Statement

- Trying to implement microwave ablation in breast cancer
- Want to use a probe-fixture for research
- Operation currently takes too much time and isn’t very consistent
- The sample must remain in good condition

Background

- What is microwave ablation?
- How can it be used for breast cancer
- What the current device looks like
- The procedure

Microwave Ablation

- Delivers electromagnetic energy to cancerous tumors
- Heats up and kills malignant cells
- Minimally invasive
- Different heating patterns treat different tumors

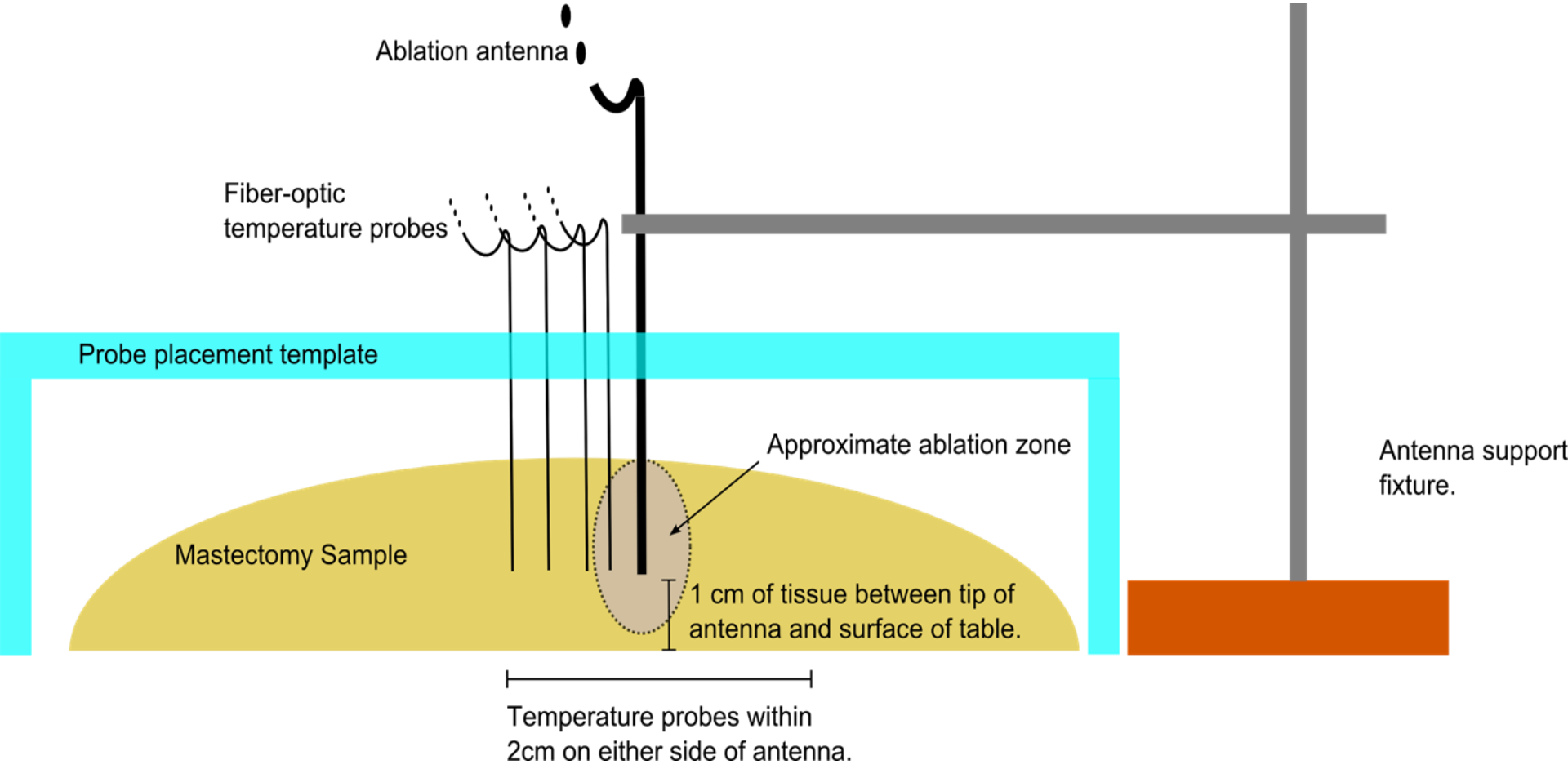
Microwave Ablation-Current Application

- Currently used to treat liver cancer
- Trying to implement in breast cancer
- Being used for research purposes
- Miniaturized antenna (shorter and narrower)
- High-frequency microwaves offer a comparable ablation area

Current Design

- 4 fiber optic temperature probes and 1 ablation antenna
- Clamp for ablation antenna
- Hollow needle used to insert temperature probes
- Temperature probes within 2 cm of antenna
- Each probe is spaced out at ~0.5 cm increments

The Current Procedure

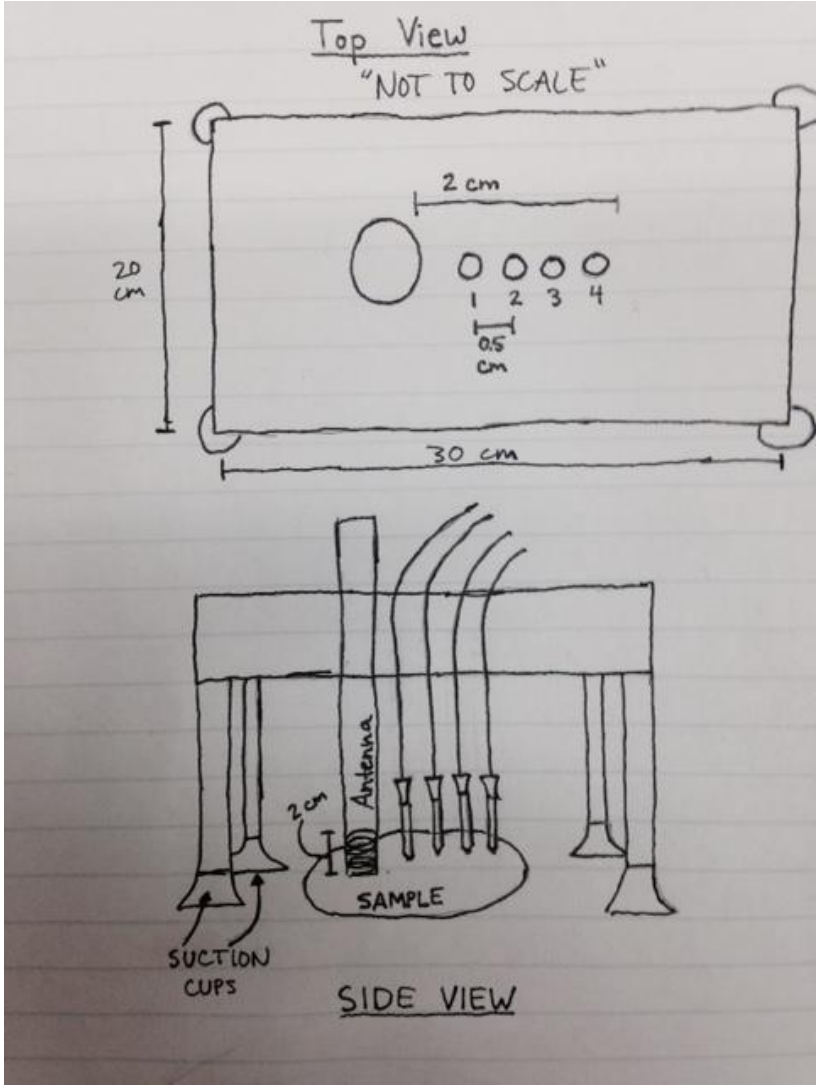


Product Design Specifications

1. Ablation procedure done in less than 15 minutes
2. Probes equidistant from each other and at proper depths
3. Cannot touch tissue
4. All probes parallel to the ablation antenna
5. Reusable

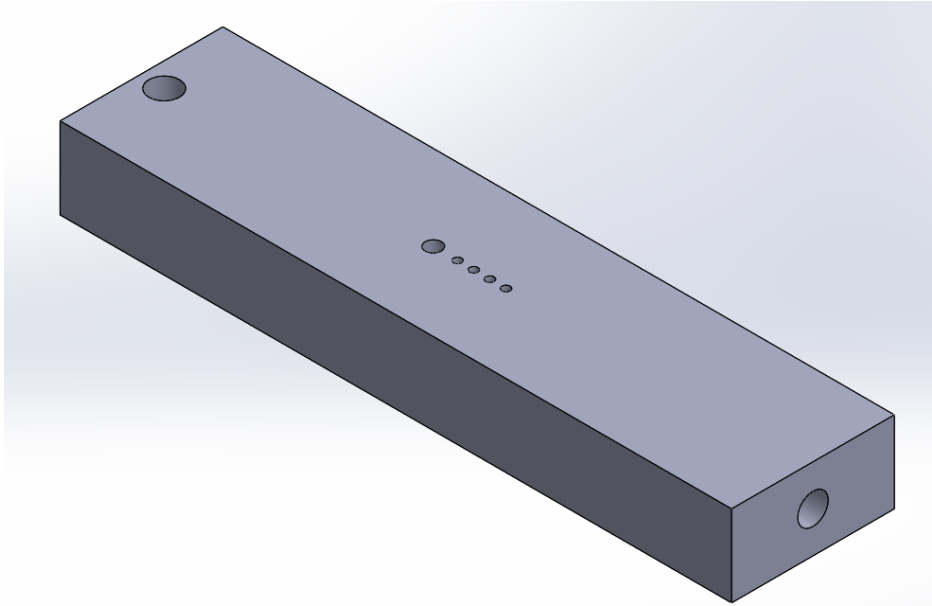
Design 1 – Table Top Probe Guide

- Feet anchored with suction cups
- Straddles the tissue sample
- Increments probe placement



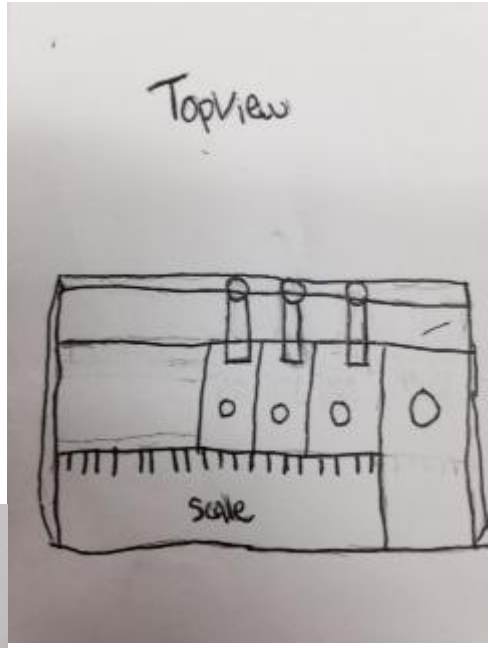
Design 2 – 3D Printed with Level-Bar

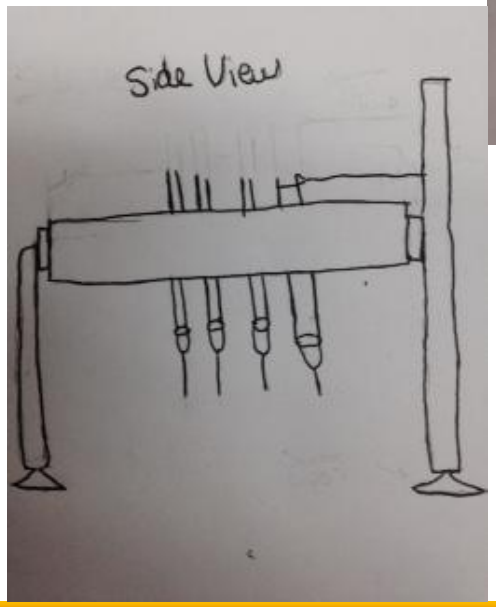
- Adjustable clamp stand
- Clamp will contain 3-D printed probe fixture
- Will be directly over tissue
- Equal distance of each probe
- Level bar will be used to maintain equidistant heights



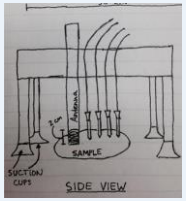
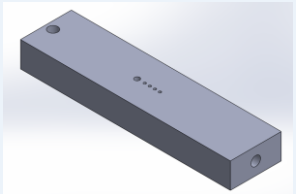
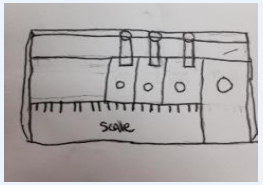
Design 3 – Bridge Probe Guide Fixture

- Variable distance
- Support for microwave rod
- Adjustable insertion angle
- Variable probe spacing
- Guided insertion





Design Matrix

Design Criteria	Table Top Support 	3D Probe 	Bridge Probe Guide 
Efficacy and Accuracy (30)	10	30	20
Safety of Tissue (20)	18	16	12
Ease of Use/Set Up Time (20)	20	14	16
Adjustability (15)	1	10	8
Ease of Fabrication (10)	6	8	2
Cost (5)	5	2	3
Totals (100)	60	80	61

Future Work

- Start prototyping and fabrication
  - Discuss and research 3D printing
- Make device usable in research labs on mastectomy samples
- Further the research of microwave ablation for breast cancer treatment

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References

H. Luyen, F. Gao, S. C. Hagness, and N. Behdad, "Microwave ablation at 10.0 GHz achieves comparable ablation zones to 1.9 GHz in ex vivo bovine liver," IEEE Transactions on Biomedical Engineering, vol. 61, no. 6, pp. 1702-1710, June 2014

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