Improving the precision of small human tissue biopsy processing

Date: 10/02/25-10/09/25

Client: Dr. Angela Gibson
Advisor: Dr. Tracy Jane Puccinelli
Team:
Ruhi Nagarkatte (Team Leader)
Ella Lang (Communicator)
Gianna Inga (BSAC)
Simon Nam (BWIG)
Sarah Raubenstine (BPAG)
Grace Spiegelhoff (Med Tech)

Problem Statement

In the treatment of extensive burns or wounds, patients rely on emerging treatment research in the field of tissue growth and healing. Currently, studies into the healing properties of porcine skin are conducted to visualize how viable epidermis cells migrate over the site of the wound to promote cell regrowth. However, once in a culture, the porcine tissue samples cannot remain viable unless all fat is removed and the cells are able to absorb the culture media. Additionally, this process of creating samples is not standardized, resulting in samples of varying sizes with jagged edges, which limits the efficiency of sample preparation. To solve this, fabricating a tool that incorporates multiple sample slots, with uniform sizing, and a fixed blade will help to streamline research efficiency and produce more viable samples that can be successfully imaged.

Brief Status Update

We met with the clients, Dr. Gibson and Grace from MedTECH virtually to discuss the final chosen design and received feedback from them about the design. Iterations were made for 3D printing of the final design to account for the adjustments provided by the clients. We also completed the preliminary report with all the relevant background details and design specifications for updating all the progress we have achieved so far. Fabrication and further testing will be initiated starting next week after we obtain more materials and samples directly from our clients.

More details on the meeting with clients:
During the meeting, we shared our preliminary presentation and the 3D-printed prototype of the Biopsy Press design in which the discussion focused on refining specific dimensions, especially the slot length for the blade and the diameter & depth of the biopsy wells. Dr. Gibson noted that if biopsies vary in thickness, the “Lego piece” press component may cause uneven compression across samples. Therefore she suggested to reduce the number of wells from four to two to improve uniform pressure. The slit for the blade was also considered too long, and shortening it would likely enhance precision along with safety factor.

Furthermore, Gianna and Grace both confirmed that current design accommodates a No. 22 surgical blade, which they liked for its accessibility and precision matter. This allowed more cost-alternative approaches such as standard razor blades commonly available in their lab. Ella proposed integrating a handle for easier manipulation of the razor blade, while Dr. Gibson emphasized on ensuring secure blade placement to maintain user's safety. Bailey suggested increasing the well diameter to approximately ~13 mm to better fit 12 mm biopsy punches and deepening the holes to around 10 mm to improve sample stabilization and consistent slicing.

After this meeting, we proceeded to coordinate with Bailey and Grace to pick up materials such as surgical blades and sample punches. Overall the meeting helped to clarify next steps for fabrication along with modification.

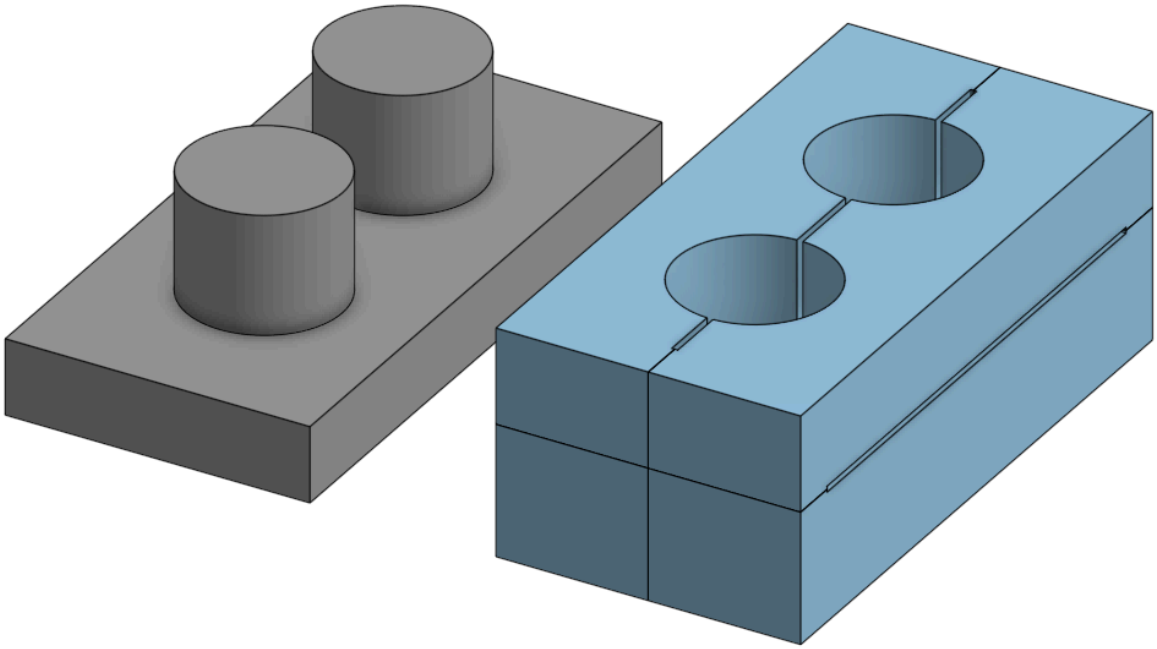

Figure 1: Updated biopsy press based on the feedback from the client. This new design has smaller base dimensions, only houses 2 samples to maximize the force of the press, and deeper and wider sample wells. After we receive and dimension the blades utilized by the lab, we will incorporate it into the design.

Summary of Weekly Team Member Design Accomplishments

- Team

    - Completed the preliminary design written report
    - Held a meeting with Dr. Gibson, Bailey, and Grace for discussing the final design
    - Continued on 3D printing revisions to be made based on feedback from clients
- Ruhi Nagarkatte
    - Completed assigned portion of preliminary report
    - Delivered presentation with the team
    - Met with client during team meeting to discuss feedback on designs
- Ella Lang
    - Completed sections of Preliminary Report
    - Coordinated a client meeting to get feedback on the current design
    - Coordinated supplies pick-up
- Gianna Inga
    - Completed individual parts of preliminary design
    - Met with client to further define product designs and expectations
    - Brainstorming ways to make the design more compatible to the client's desires
- Simon Nam
    - Wrote and finalized the preliminary design report
    - Submitted and uploaded deliverables for this week to the bme design webpage
    - Participated in the team meeting with the client
- Sarah Raubenstine
    - Conducted demographic research on burn patients and injury remedies
    - Completed assigned preliminary report sections
    - Attended and took meeting notes for client feedback meeting

Weekly/Ongoing Difficulties

There are no ongoing difficulties facing the team this week. The team must set up more meetings and available work times to initiate prototyping and testing phases. Specific blade products must be obtained as soon as possible for figuring out the feasibility of the design with its specifications.

Upcoming Team and Individual Goals

- Team
    - Plan on fabrication plan for the upcoming weeks
    - Initiate on the budget plan and estimated cost for gathering all necessary tools and materials for the final design
- Ruhi Nagarkatte
    - Brainstorm testing methods for porcine models and mechanical tests
    - Start 3D printing new iteration of the design
    - Continue research on ways to incorporate the clients' blades into the design
- Ella Lang
    - Test out different blade types available to us and given by the client
    - Refine dimensions of the device to meet the client's needs and suggestions
    - Start designing a handle to hold a razor blade
- Gianna Inga
    - Intricately dimension and document the blades available to the client

    - Document a couple design ideas on how to incorporate the blades
    - Communicate the designs with the team
    - Make updates to the biopsy press to address the concerns of the client
- Simon Nam
    - Begin fabrication procedure of the final design
    - Gather more information about the safety protocol of blades and research more about handle parts to implement into the design
    - Assist with 3D printing and mechanical/strength test of the tissue samples collected
- Sarah Raubenstine
    - Pick up blade and biopsy punch samples from client
    - Begin fabrication of next design iteration
    - Determine spending plan for any supplies we may need going forward

Project Timeline

Project Goal	Deadline	Team Assigned	Progress	Completed
Product Design Specification First Draft	Thursday, 09/18/2025	All	100%	X
Design Matrix Design Ideas	Friday, 09/26/2025	All	100%	X
Preliminary Presentations	Friday, 10/03/2025	All	100%	X
Preliminary Deliverables	Wednesday, 10/08/2025	All	100%	X
Show and Tell	Friday, 10/31/2025	All	0%	
Poster Presentations	Friday, 12/05/2025	All	0%	
Final Deliverables	Wednesday, 12/10/2025	All	0%	

Materials and Expenses

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	QTY	Cost Each	Total	Link
Prototype Prints										
PLA	3D printed polymer through BME design Makerspace budget	Makerspace	N/A	UW-Madison	N/A	9/26/25	1	$5.00	$5.00	N/A

								TOTAL:	$5.00	