

Democratizing Placement of Endoluminal Negative Pressure Devices for Gastrointestinal Leaks

Client: Dr. Amber Shada
General Surgery
UW School of Medicine and Public Health
shada@surgery.wisc.edu
(608) 263-1036

Advisor: Prof. John Puccinelli

Team: Simon Fetherston (Leader)
Mariah Smeeding (Communicator)
Evelyn Mikkelson (BSAC)
Yeanne Hwang (BPAG, BWIG)

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Problem statement

Currently, large defects in the GI tract (often caused by surgical complications) are treated with surgery. For external wounds, the use of negative pressure wound therapy has become widely used. This therapy, colloquially called VAC therapy, leads to improved healing of superficial wounds. For the past few years, some surgeons have been placing similar VAC devices into the GI tract through the mouth or anus to treat defects in the GI tract. The success of this therapy has been outstanding, with some studies finding that 90% of wounds that would have otherwise required surgery can be closed without making any additional incisions at all. The process of VAC placement is currently labor intensive and requires some skill in manipulating an endoscope, which has limited its widespread use. Development of a streamlined way to deploy VAC therapy into the GI tract would allow more surgeons to use this therapy to heal anastomotic leaks.

Brief status update

This week the team continued research on materials for creating the degradable biomaterial. After the advisor meeting, the team will purchase any required materials. The team has also begun to gather materials for the fabrication phase. Dr. Shada will be able to provide various components like polyurethane sponges, NG tubes, and a suture kit. While gathering the materials, the team will finalize the biomaterial and write fabrication protocols to allow for efficient prototyping.

Difficulties / advice requests

The team would like some advice on the proposed biomaterials. Currently, PVA and gelatin based coatings are the top options. The team would like to discuss the feasibility of fabricating the biomaterials in the lab. The team is also concerned about the mechanical properties of the biomaterials and if they could work as intended. After answering these questions, the team will be able to order any additional materials and fabricate one or both of the biomaterials.

Current design

The degradable coating design scored the most points in the design matrix and is now the current design. The team is conducting research into the materials needed to develop a film and create fabrication protocols. This research is expected to be completed next week to allow for materials to be ordered and begin fabrication

Materials and expenses

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
Category 1										
									\$0.00	
									\$0.00	
Category 2										
									\$0.00	
									\$0.00	
								TOTAL:	\$0.00	

Major team goals for the next week

1. Finalize a material for the degradable coating
2. Order materials that are not available in the lab or that the team currently has
3. Develop fabrication protocol
4. Begin prototyping

Next week's individual goals

- Simon Fetherston
 - Develop fabrication protocols for chosen material
 - Divide team fabrication roles and begin prototyping

- Research potential improvements that could be made to the biomaterial if the prototype lacks necessary specifications
- Evelyn Mikkelson
 - Research degradable coatings containing PVA and gelatin
 - Meet with team to begin prototyping
 - Research ways to compress the sponge
- Mariah Smeeding
 - Speak with Dr. P about material choices and potential liquid nitrogen access
 - Order any needed materials that the teaching lab does not have.
 - Research gelatin methacrylation process with photoinitiation instead of glutaraldehyde
 - Research how we could make a PVA composite with either PEG or PLGA
- Yeanne Hwang
 - Research how to make degradable coating material stronger
 - Meet with team to plan fabrication

Timeline

Task	Jan	Feb				March					April				May	
	26	2	9	16	23	1	8	15	22	29	5	12	19	26	3	10
Project R&D																
Empathize	X	X	X													
Background	X	X	X	X	X	X										
Material Fabrication																
Mold Fabrication																
Prototyping				X	X	X										
Testings																
Deliverables																
Progress Reports	X	X	X	X	X	X										
Prelim presentation				X												
Final Poster																
Meetings																
Client		X		X		X										
Advisor	X	X	X	X	X	X										
Website																
Update	X	X	X	X	X	X										

Filled boxes = projected timeline

X = task was worked on or completed

Previous week's goals and accomplishments

- Individual:

- Evelyn Mikkelson
 - Continue researching potential coating materials and fabrication
 - Research on cavity environment that could cue degradation
 - Meet with client to discuss options and ideas for materials and ordering them
- Simon Fetherston
 - Researched pullulan as a potential coating material
 - Researched various types of gelatin and their mechanical properties
 - Began researching fabrication plans to develop protocols
- Mariah Smeeding
 - Meet with client to get up to date with material options and ask for prototyping supplies (Sponges, NG tubes, suturing kit)
 - Material research
- Yeanne Hwang
 - Research biocompatible degradable material and pre-existing cases
 - Meet with client to discuss material choices and financial management
 - Research manufacturing methods to compress sponge and coat with degradable material
- Team :
 - Researched and discussed degradable coating materials that could maintain sponge compression
 - Brainstormed materials needed for prototyping
 - Created a plan to gather materials

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Evelyn M	02/27/2026 03/02/2026 03/03/2026	Research shape memory foams Research infection responsive drug delivery Research specific materials that degrade due to infection conditions	1 1 3	5	21
Simon F	03/02/2026 03/03/2026 03/04/2026	Research pullulan films Research Type A and Type B gelatin Explore vendors for purchasing materials	1 1.5 0.5	3	21
Yeanne H	03/01/2026 02/28/2026	Research biocompatible degradable material and pre-existing cases Research manufacturing methods to compress sponge and coat with degradable material	2 1	3	19
Mariah S	03/03/26 03/05/26	Research materials/polymer composite options Team meeting/ additional research	2 1	3	19.6