

Arterial Coupler Re-Design: Adjustable Stent/Cuff Anastomosis

Progress Report 6: 10/16/2025

Client: Dr. Jasmine Craig

Advisor: Prof. Darilis Suarez-Gonzalez

Team:

- Leader: Allison (Ally) Rausch
- Communicator: Jacqueline (Jackie) Behring
- BWIG: Sofia Decicco
- BPAG: Arshiya (Ria) Chugh
- BSAC: Daniel Pies

Problem Statement: Microsurgical arterial anastomosis is a cornerstone of reconstructive surgery, enabling tissue transfer and limb salvage. Current techniques are highly time consuming, technically demanding, and are highly dependent on surgeon expertise. Suturing vessels as small as 1 mm can take even the most experienced surgeons 30-60 minutes, extending operating times and jeopardizing tissue viability. Existing stent-based approaches introduce complications by contracting the vessel lumen and lack adaptability across the wide range of vessel diameters encountered in clinical practice. There is a critical need for a biocompatible, adjustable, and easy-to-use device that can reliably reduce operative time while maintaining vessel integrity and minimizing complications.

Brief Team Status Update: This week, the team transitioned from documentation-heavy work into early design development. The team reviewed feedback from the preliminary presentation and discussed how it impacts the design direction. The team revisited the design matrix, narrowed down the most promising coupler concepts, and began outlining SolidWorks modeling requirements. The team researched Nitinol elements to best evaluate feasibility before modeling.

Summary of Weekly Individual Design Accomplishments:

- Allison (Ally) Rausch:
 - Helped develop and refine design concepts for the arterial coupler, focusing on expandability and securing mechanisms
 - Began outlining SolidWorks modeling parameters and researched potential materials for prototyping
 - Assisted in organizing team tasks and starting the transition from documentation to design development
- Jacqueline (Jackie) Behring:
 - Researched potential Nitinol vendors and fabrication methods suitable for microsurgical coupler prototypes
 - Began modeling the prototype in SolidWorks using correct arterial dimensions
 - Started investigating alternative biocompatible materials (316L stainless steel, polymers) to compare cost, manufacturability, and ISO 10993 compliance
- Sofia Decicco:
 - Researched the impact of nitinol stent geometry on stent mechanical strength
 - Started drafting testing protocols for future testing and report writing
- Arshiya (Ria) Chugh:

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- Researched sourcing options and suppliers for nitinol tubing and wire suitable for microscale vascular applications.
 - Investigated fabrication methods for nitinol, including laser cutting, shape-setting heat treatment, and micro-machining techniques.
 - Reviewed literature and vendor resources on 3D printing approaches for metallic and polymeric stents.
- Daniel Pies:
 - Researched design and testing requirements for self-expanding nitinol stents
 - Investigate methods for controlling expansion diameter as per client's request

Weekly/Ongoing Difficulties: No notable difficulties.

Upcoming Team Goals: Next week, the team will begin the prototyping phase. We plan to develop initial CAD models for the preliminary design concept. We will create a preliminary prototyping and testing plan, including material selection, vessel analogs, and performance criteria such as expansion, seal, and stability. The team will also create a project timeline for modeling, fabrication, and validation, and schedule a brief client meeting to share our design direction and confirm alignment before prototyping begins.

Upcoming Individual Goals:

- Allison (Ally) Rausch:
 - Start building initial SolidWorks models of the top 1-2 design concepts
 - Contribute to defining a preliminary testing plan
 - Help create a prototyping timeline to align with mid-semester goals
 - Prepare questions and visuals for the upcoming client check-in
- Jacqueline (Jackie) Behring:
 - 3D print the initial SolidWorks prototype to evaluate scale, fit, and overall geometry
 - Contact potential Nitinol and stainless steel vendors to compare fabrication feasibility, lead time, and cost
- Sofia Decicco:
 - Print nitinol stent design with Makerspace materials to present geometry and functionality to client
 - Finalize vendor to source nitinol stent and PTFE tubing
- Arshiya (Ria) Chugh:
 - Finalize the selected fabrication method with the team and determine material ordering logistics.
 - Confirm material choices based on manufacturability, biocompatibility, and availability.
 - Finalize the SolidWorks design and prepare files for fabrication.
- Daniel Pies:
 - Contribute to defining testing protocols for preliminary prototypes
 - Continue investigating manual diameter-limiting methods for stent device
 - Prepare for and execute initial fabrication steps

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Project Goal	Deadline	Team Assigned	State of Completion
Initial Research	9/8	All	The team will continuously research throughout the semester.
Product Design Specification (PDS) Draft	9/19	All	Completed
Design Matrix Criteria and Design Ideas	9/26	All	Completed
Preliminary Oral Presentation	10/3	All	Completed
Preliminary Report	10/9	All	Completed
Final Design Selection	10/10	All	Completed
Fabrication and Prototyping	10/16	All	In Progress
Poster Presentations	12/5	All	

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TOTAL:	\$0.00
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