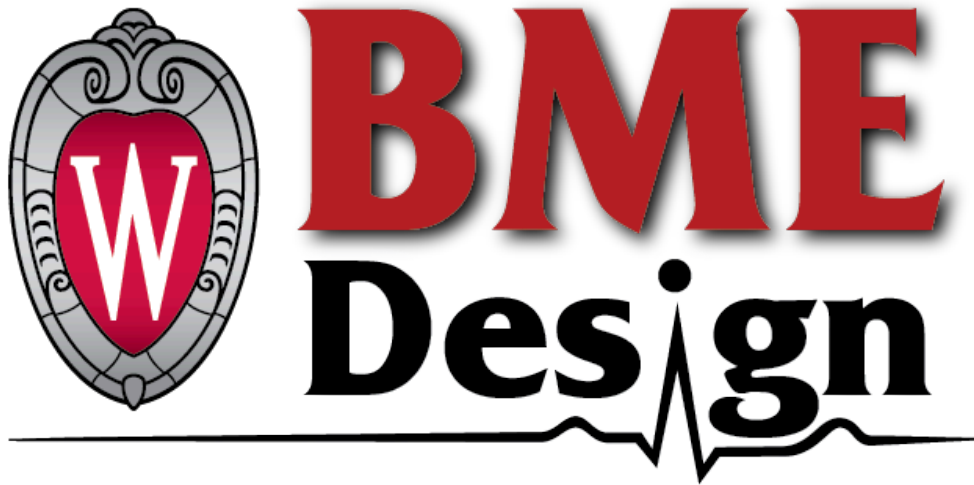




**Approximating Surface Matrix Band
Progress report #4**

BME 200/300

Team Name: Dual Matrix

Fall 2026

10/02/2026

Client: Dr. Donald Tipple

Advisor: John Puccinelli

Team Members:

Leader: May Kennelly

Communicator: Olivia Kallas

BSAC: Nicholas Miles

BPAG: Luca Benedetto

BWIG: Samuel Zakaib

BWIG: Justin Schwartz

Problem statement

Surface matrix bands are devices used by dentists to separate adjacent teeth during restorations of inter-proximal cavities (cavities found in-between two teeth). The matrix band serves to support the restoration material, to provide shape and contour to the tooth being restored, and to protect the adjacent tooth. Ideally, the width of the space between the two adjacent teeth is just large enough to fit one matrix band in order to ensure close proximal contact area, which prevents food impaction and decay. In the case of two cavities on two adjacent teeth, this process is tedious, as the dentist must complete the process from start to finish for each adjacent tooth individually. The goal of this project is to create a dental matrix band that effectively partitions adjacent teeth for more efficient tooth restoration procedures on interproximal cavities by making it possible to complete two adjacent restorations simultaneously.

Brief status update

The Fall 2026 team is working to review past work and research the topic of dental matrices to understand the project and points of improvement. Additionally, the team is formulating potential designs to move forward with fabrication.

Current design

The current design is from spring semester 2026. It successfully reduces procedure time, but the manufacturing methods and testing need to be improved and expanded upon to increase quality and ease of use. The current design is 0.0254 mm thick fully annealed 316 SS with a hole for tight proximal contact and a tab for easy handling. To cut the flats a template was used and then the flat was molded with a 3D printed mold.

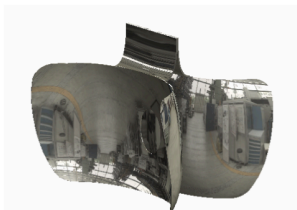


Figure 1. SolidWorks model of Dual Matrix courtesy of the Spring 2026 team.

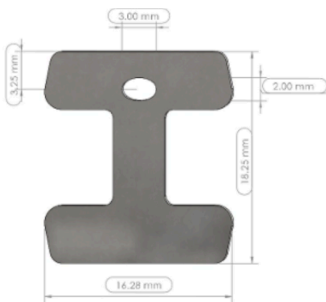


Figure 2. Flat cutout of matrix courtesy of the Spring 2026 Team.



Figure 3. Dual Matrix with filling in tooth model courtesy of the Spring 2026 team.

Materials and expenses

Item	Description	Manufac-turer	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	
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Goals

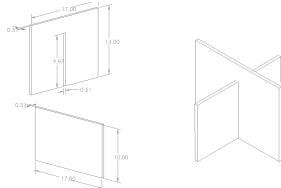
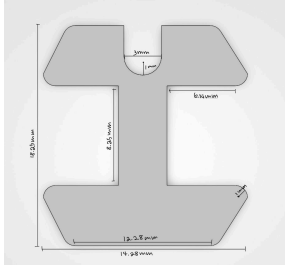
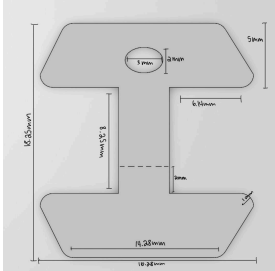
Major team goals for the next week

1. Continue researching pertinent information.
2. Complete the preliminary report

Next week's individual goals

- May...
 -
- Olivia...
 - Complete and submit the preliminary report
 - Work on notebook and adding entries
 - Set up a client meeting
- Nicholas...
 - Complete my section and other sections of the preliminary report
 - Continue to conduct research for the project
 - Begin prototyping or thinking of ways to prototype the design that we are moving forward with
- Sam...
 - Complete prelim report and review for prelim presentation
 - Begin experimenting with other materials
- Justin...
 - Complete my section for the preliminary report
 - Add more to the notebook
 - Think about future work for our design
- Luca...
 -

Design Matrix

Design Criteria:	Design 1: S-Design		Design 2: Half-Oval		Design 3: Perforation	
						
Filling Quality (25)	4/5	20	2/5	10	5/5	25
Ease of Removal (25)	3/5	15	5/5	25	4/5	20
Ease of Use (20)	3/5	12	4/5	16	5/5	20
Ease of Fabrication (10)	5/5	10	4/5	8	3/5	6
Safety (5)	4/5	4	5/5	5	5/5	5
Cost (5)	4/5	4	5/5	5	5/5	5
Total (100)	65		69		81	

Category Definitions:

Filling Quality: Expected filling quality describes the ability of the device to replicate the natural tooth shape. To successfully replicate the natural tooth shape and protect the gums, there must be proper interproximal contact and wedging. Proper interproximal contact prevents food packing, which can lead to gingivitis, tartar, and tooth decay. Adequate wedging prevents gingival margin leakage, protecting the gums.

Ease of removal: Ease of removal is integral to the success of the project because the device aims to be as efficient as possible. Less time removing the device results in the overall restoration time decreasing. The objective of the device is to reduce procedure time. If the dentist must take extra time to remove the matrix, there will be no time saving effect and dentists will continue using two matrices back to back.

Ease of Use: It is crucial that the design is easy for the dentist to use. The design aims to replace the standard of interproximal cavity restorations, and to do this, the design must be user-friendly. A design that is only one piece will be easiest to use because the oral cavity is small and accounting for several pieces would require the dentist to take more steps. Furthermore, the device will arrive flat, and the dentist will fold it into the butterfly shape. It will be more difficult to contour the matrix band if it is made of more than one piece.

Ease of Fabrication: A design that is easy to fabricate will consistently produce accurate dimensions, which is crucial to device functionality. Easier fabrication also reduces the time and cost needed to produce the device. A quick, easy manufacturing process allows the team to spend more time on quality checking, smoothing edges, and testing performance. Together, these benefits make the matrix more practical for dentists to use.

Safety: Safety is of the utmost importance to ensure patient comfort during and following the restoration. Thin metal bands can easily slice gingival tissue, so it is important to choose a design that fits snug to the contour of the tooth without needing to force it into the gumline. Additionally, the metal needs to be burnished carefully to avoid sharp edges or burrs which can also cut the soft tissue during placement or removal. Removing the device in the least amount of pieces possible will also ensure no metal components are left in the oral cavity.

Cost: The cost is imperative as the design requires functionality but also must remain at a competitive price relative to competitors in order to sell. Despite this importance, it does not take precedence over other categories as the primary function of the device is to save time and not money.

Ranking Explanations:

Filling Quality: Expected filling quality is weighted 25 because filling quality is integral to the device. This is because the purpose of the device is to reduce restoration times by performing two restorations at once. The device must produce a quality filling otherwise it will not replace current devices. The Perforation design is ranked 5/5 for quality because it provides good tooth contact with a tooth-like shape while allowing for proper

wedging. The S-design is ranked 4/5 because it allows for mostly good contact and wedging; however, its use would not result in a tooth-like shape. The Half-Oval design is ranked 2/5 because although its contact on the upper part of the tooth is good, the opening on the bottom will result in the composite resin leaking into the gum area and onto the wedge.

Ease of Removal: Ease of removal is weighted 25 because the client indicated removal difficulties as the largest issue with previous design iterations. The Half-Oval design earned a score of 5/5 because there is no bottom to the circle, allowing the matrix to slide straight up and out of between the teeth. It also has a tab. The Perforation design is ranked 4/5 because breaking the matrix into two pieces should allow the dentist to remove one side after the other. However, the side with the circle cutout could still get stuck on filling. The S-Design is ranked 3/5 because there could be a gap between the two metal sheets either causing a lip or one filling to connect to another which would make it difficult to remove. It also has no tab to grab.

Ease of Use: Ease of use is weighted 20 because the device must be easy to shape, otherwise dentists will likely not adopt its use. The Perforation design is the easiest to use because the dentist can simply fold the piece in half to create the butterfly shape, which is why it has a score of 5/5. The wings are also easy to mold because they are connected throughout the bottom. The Half-Oval design is similar to the Perforation design in that the user can simply fold it to create the butterfly shape. However, the Half-Oval design will be more difficult to contour than the Perforation design because the bottom is not connected on one side. So, it earned a score of 4/5. The S-Design is more difficult to use compared to the others because it is made of two pieces, rather than one. This requires more assembly. Additionally, it will be more difficult to contour because it does not taper in towards the gums, resulting in an ease of use score of 3/5.

Ease of Fabrication: Ease of fabrication is weighted 10 because easier fabrication reduces production time and cost, which in turn reduces device cost. A cheaper device is more desirable to dental offices. The Perforation design is rated a 3/5 for ease of fabrication because there are several small pieces that must be cut out and be smoothed. Similarly, the Half-Oval design has several small cut-outs; however, there is no perforation which means fabrication will be easier. So, it is rated a 4/5. The S-Design only requires one slit to be extruded and a chamfering of edges, which is why it is rated a 5/5 for ease of fabrication.

Safety: Safety is weighted 5 because the patient's health and safety is our first priority and as such all designs that are on the matrix are already highly safe. The perforation design was ranked 5/5 for safety because the perforated section allows for a lower risk of tearing into 3 or more pieces, which reduces the likelihood of metal being swallowed by the patient. The half oval design is also 5/5 because there is no lower lip for the matrix to get caught on, so there is minimal tearing likely. The S-design is ranked slightly lower than the others because the 2 pieces sliding together in the middle could pose a higher risk of accidentally cutting the gums.

Cost: The Perforation and the Half Oval designs were rated 5/5 as their material and fabrication costs are relatively low as they are composed of a single piece of metal. For the S-Design however, it is rated a 4/5 because it is composed of two separate pieces and would require more cutting and material costs compared to the other two designs.

Timeline

Task	September				October					November	December		
	10	11	18	25	2	7	9	16	23	6	4	9	11
Project R&D													
Empathize													
Background...													
Prototyping													
Testings													
Deliverables													
Progress Reports	X	X	X	X	X	X	X	X	X	X	X	X	
PDS			X										
Design				X			X						
Presentations					X						X		
Report						X						X	
Final Poster												X	
Meetings													
Client		X											
Advisor													
Website													
Update	X	X	X	X	X	X	X	X	X	X	X	X	
Course Requirements													
								LDR	Training Show + tell	Tong			Schedule advisor meeting

Filled boxes = projected timeline

X = task was worked on or completed

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
May Kennelly	2026/09/07	Did general research about cavities and their causes/treatments Organized team materials and inputted future assignments into group calendar Created the team notebook and added several required documents for upcoming meetings	3.5	3.5	3.5

		Messaged group members to coordinate work			
May Kennelly	09/16/2026 09/17/2026	- Completed function, performance requirements, and safety portions of the PDS - Researched across standards and articles for pertinent information - Messaged 200 students with specific feedback on their completed sections which they edited - Completed final edits on the overall PDS, compiled sources, and formatted the PDS	2 2	4	7.5
May Kennelly	9/23/2026 9/24/2026	- Did research and took notes in lab archives - Did my sections of the design matrix and edited all design matrix sections, made two of the designs on solidworks and labeled them with dimensions	1 3.5	4.5	12
May Kennelly	9/30/2026	- Edited design matrix from Dr. P's comments - Created my slides for the preliminary presentation - Practiced slides with the team - Recorded and inserted video of my slides as I will be absent for the presentation - Added competing designs to my labarchives, also edited team sections of labarchives	2.5	2.5	14.5
Olivia Kallas	09/11/2026 09/20/2026	- Completed lab archives research entries. - Completed personal sections of the PDS - Client meeting	2 1	3	6
Olivia Kallas	09/24/2026	2 more research entries - Emails with client - Zoom design meeting	1 20min 2	3.25	11.25
Olivia Kallas	10/01/2026	- Research entries - Team rehearsal - Video watching	1 2 1	2	14.25
Sam Zakaib	09/10/2026	Researched different types of matrices	2	2	2

		○ Sectional ○ Tofflemire ● Researched 2 different research articles about class II cavities and how they form ○ Current treatments ● Completed 4 research entries in LabArchives (2 competing, 2 Bio/Phys sources) ● Updated team website to display group picture, names, roles			
Sam Zakaib	09/16/2026	● Worked on sections of PDS ○ Materials ○ Accuracy and Reliability ○ Operating Environment ● Found 2 new sources	3	3	5
Sam Zakaib	09/25/2026	● Developed 2 creative designs for the design matrix ● Researched Sector 67 for potential manufacturing ● Uploaded Design Matrix to website	3	3	8
Sam Zakaib	10/02/2026	Worked through prelim presentation Practiced presenting Edited SolidWorks parts and made them into drawings	3	3	11
Nicholas Miles	09/07/2026 09/15/2026 09/24/2026	-Completed lab archives research to learn more about the topic -Attended the first BSAC meeting to learn more about my role and started thinking about ways to improve the course and the overall BME program -Met with the client to learn more about the project and the project requirements -Completed personal sections of the PDS -Prototyped a design for the project and met with team to create the design matrix	10	10	10
Nicholas Miles	10/02/2026	-Contributed to the preliminary report and preliminary presentation -Conducted research to fill in the gaps	3	3	13

		for the preliminary report and presentation Attended BSAC with faculty to discuss the BME program			
Justin Schwartz	9/07/2026 9/15/2026	- Did research on competing designs - Watched a video on one way to do back-to-back class II fillings - Worked on PDS\ - Shelf life - Appearance and aesthetics - Competing design	2 1	3	5
Justin Schwartz	9/24/2026	- Met to discuss Design matrix - Filled out Ease of removal description and ranking explanation - Researched how matrices are removed	1.5	1.5	6.5
Justin Schwartz	01/02/2026	- Came up with two design ideas - Practiced presenting - Worked on preliminary report - Met to decide final design	1 1 2	4	10.5
Luca Benedetto	09/07/2026	Completed research entries to better understand the subject matter of the project	2	2	2
Luca Benedetto	09/16/2026	- Found sources for research - Worked on PDS sections - Life in Service - Production Characteristics	2	2	4
Luca Benedetto	09/24/26	- Brainstormed 3 different design ideas - Researched possible production options as well as societal impact. - Added to the Design Matrix	2 2 0.5	4.5	8.5

Previous week's individual goals

- May...
 - Research material differences
 - Contact outside lab to use a metal laser cutter for fabrication
 - Prepare preliminary presentation
- Olivia...
 - Research target demographics of device

- Go through deliverables with client
 - Look at possible fabrication methods
- Nicholas...
 - Complete more focused research now that we have met with the client and better understand the project goals and requirements
 - Think about things to bring to the next BSAC meeting for discussion
- Sam... Research more about biocompatible materials
 - Find 2 more meaningful sources
 - Touch base with team and finalize materials/specs
- Justin...
 - More research entries
- Luca...
 - Do more research about various production methods as well as their associated costs.
 - Meet with client
 - Work on Preliminary Presentation

The team has continued researching and has learned more about the project. A design matrix was created and then edited and it is inserted above. This week the team also put together the preliminary presentation and practiced it.