BME 400

DEPARTMENT OF

Biomedical Engineering

UNIVERSITY OF WISCONSIN–MADISON

Dental Matrix Band

September 26th, 2025

Speaker: Tanya

Team Members

- Tatiana Predko (BWIG & Co-BPAG)
- Joseph Koch (BASC)
- Keleous Lange (Communicator & Co-BPAG)
- Roshan Patel (Leader)

Figure 1: Team picture.

Speaker: Tanya

Client Description

- **Client:**
  - Dr. Donald Tipple, DDS
  - Owner of Nakoma Dental LLC
  - Wants a product which allows for simultaneous filling of two adjacent interproximal cavities.

Figure 2: Dr. Donald Tipple.

Speaker: Tanya

Background Material

- Matrix bands are used to support the filling material and provide shape to the tooth during interproximal fillings [1].
- Large proximal contact area must be achieved to prevent food impaction [2].
- To ensure sufficient proximal contact, must use one sectional matrix per filling [2].
- Long process; involves pre-wedging, wedging, and matrix insertion [2].

Figure 3: Sectional matrix band with tension ring [3].

Speaker: Tanya

Problem Statement

- Surface matrix bands are devices used by dentists to separate adjacent teeth during restorations of interproximal cavities.
- Matrices support the restoration material, provide shape and contour to the tooth, and protect the adjacent tooth.
- In the case of two adjacent cavities, two separate matrices must be used, which is a tedious process.
- **Goal:** design a device which allows simultaneous filling of two adjacent cavities without compromising the proximal contact area.

Competing Designs

- **Triodent Tab Matrix:**
  - Single tooth
  - Stainless steel
  - Thin (30μm)

Figure 4: Triodent Tab Matrix [4].

- **Halo Sectional Matrix Band:**
  - Single tooth
  - Stainless steel
  - Teflon coated

Figure 5: Halo Sectional Matrix Band [5].

Previous Design

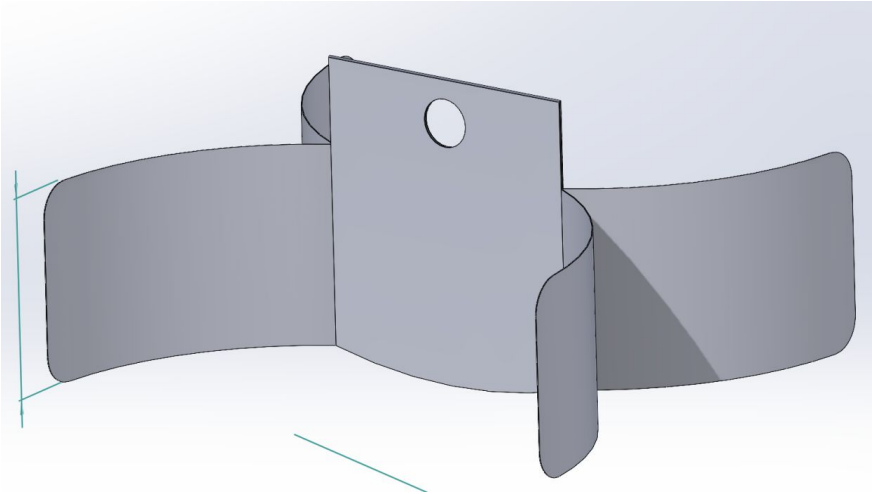

Figure 6: Solidworks Model of Prior Design [6].

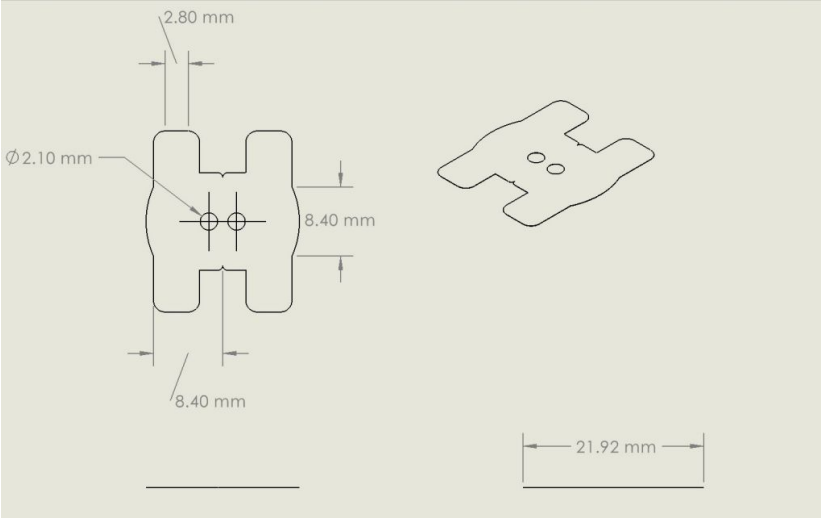

Figure 7: Solidworks Drawing of Prior Design [7].

Product Design Specifications

Speaker: Roshan

Product Design Specifications

- **Client Requirements**
  - A dental matrix that can be used to perform interproximal fillings
  - Quicker to install than two sectional fillings
  - Malleable to fit to various tooth contours
  - Minimize damage to gums

- **Design Requirements**
  - Device must maintain mechanical properties for at least one procedure (~1h)
  - Device and materials must be safe for use within the human mouth
  - Device must have a thickness of 0.038 mm to 0.05 mm (0.0015in-0.002in)
  - Price must be less than $5 per unit
  - Budget must be within $200

Preliminary Designs

Speaker: Joseph

Altered Butterfly

- Builds on past semesters' designs
- Rounded, concave to minimize gum interaction
- Allows for better use of wedges

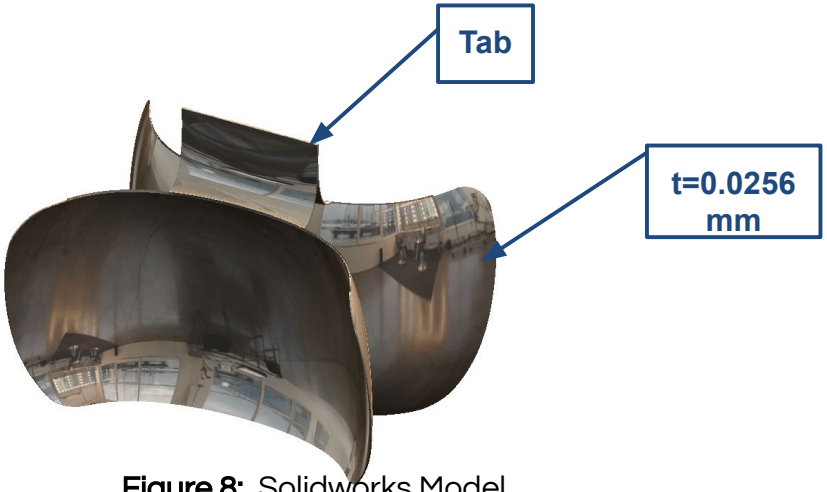

Figure 8: Solidworks Model

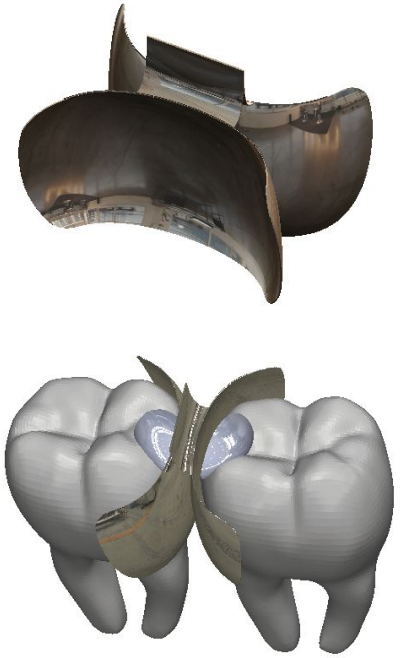

Figure 9: Solidworks model with teeth with cavity

Speaker: Joseph

Dimensioned Model

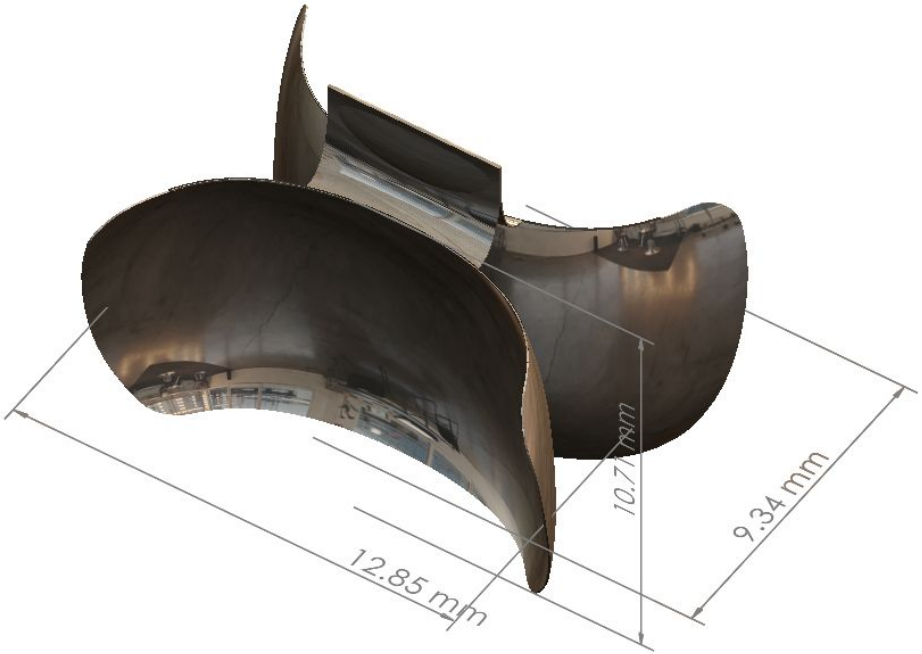

Figure 10: Solidworks Model with Dimension

Hole Design

- Similar concept to butterfly
- Void in one side
  - Allows for tighter interproximal gap
  - Burnishing

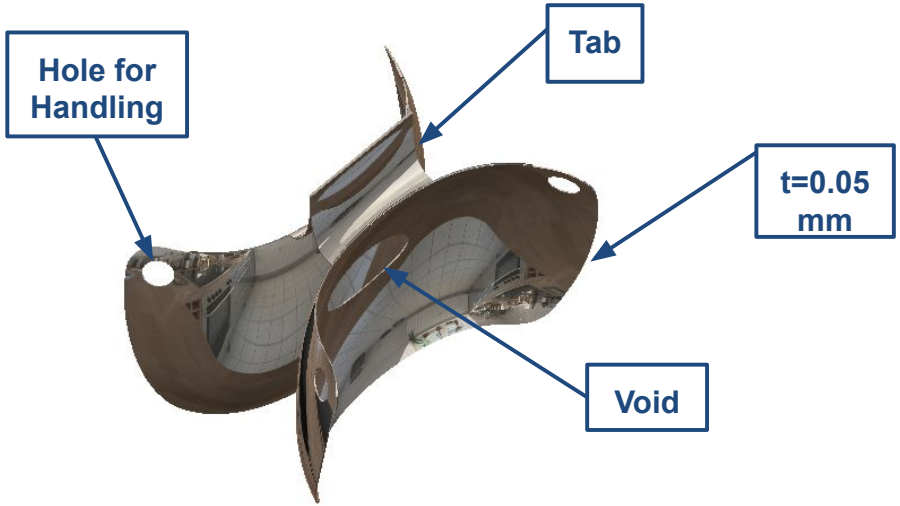

Figure 11: Solidworks Model

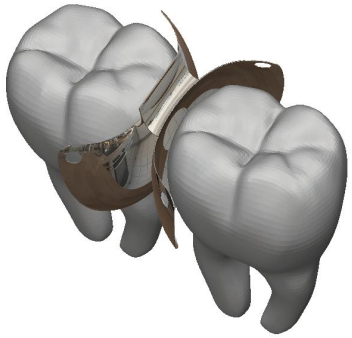

Figure 12: Solidworks model with teeth

Speaker: Joseph

Dimensioned Model

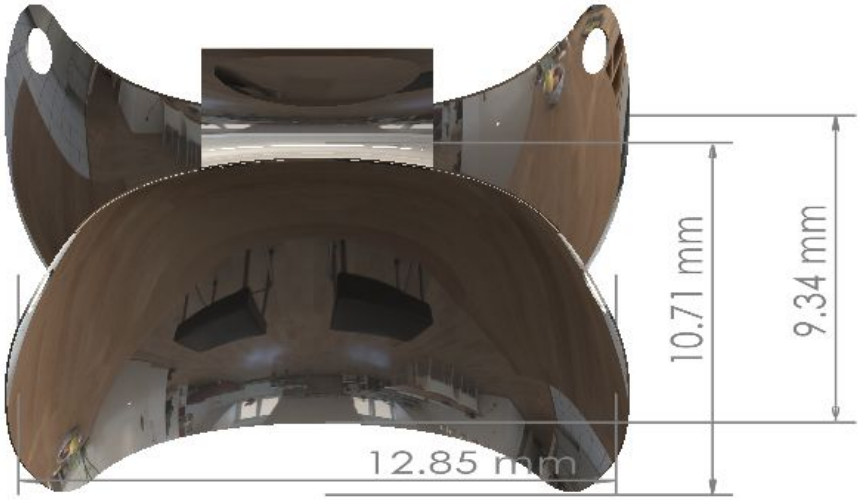

Figure 13: Solidworks Model with Dimension

Speaker: Joseph

Slot Design

- Slot allows for better interproximal contact
- Difficult forming top of filling
- Burnishing required

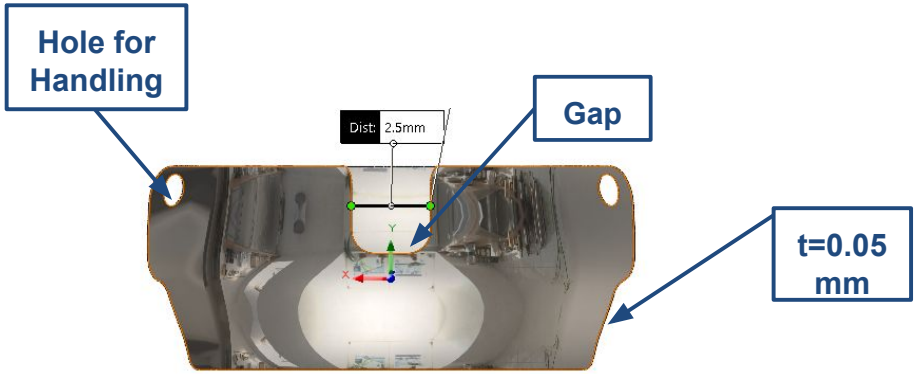

Figure 14: Solidworks Model with features

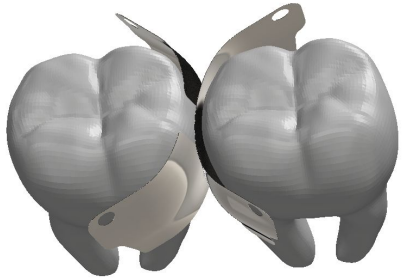

Figure 15: Solidworks Model with teeth

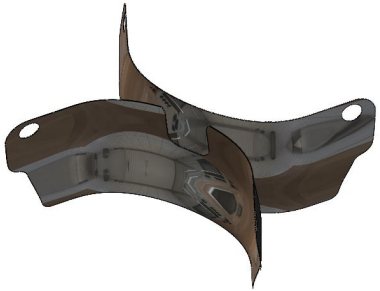

Figure16: Solidworks Model

Speaker: Joseph

Dimensioned Model

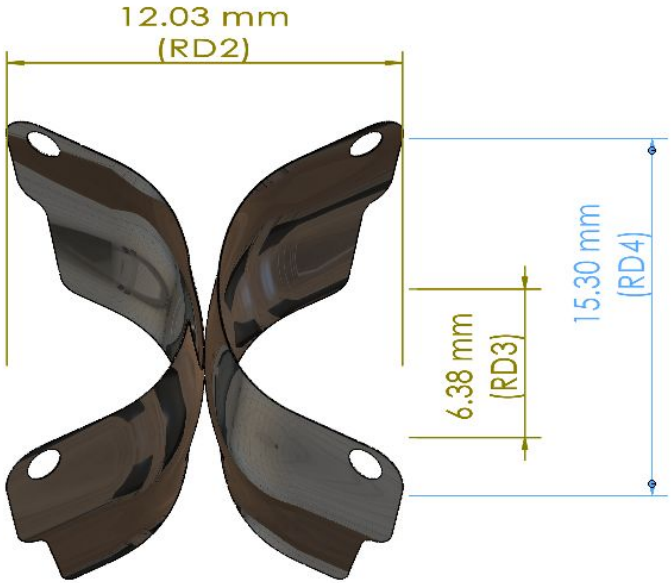

Figure 17: Solidworks Model with Dimension

Design Matrices

Design Matrix

Option 1: Altered Butterfly

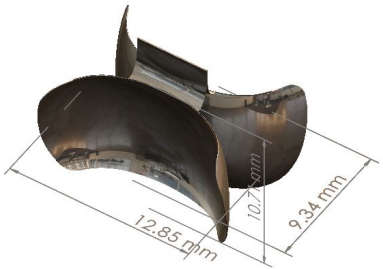

Figure 18: Dimensioned Altered Butterfly Model

Option 2: Hole Design

Figure 19: Hole Design.

Option 3: Slot Design

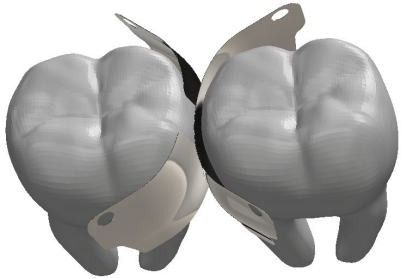

Figure 20: Slot Design with Model Teeth.

Speaker: Keleous

Design Matrix

Criteria	Weight	Altered Butterfly		Hole Design		Slot Design	
Efficacy	50	5/5	40	5/5	40	4/5	32
Ease of use	20	5/5	20	5/5	20	4/5	16
Efficiency	15	5/5	15	4/5	12	3/5	9
Ease Of Fabrication	5	2/5	6	5/5	15	3/5	9
Cost	5	2/5	2	5/5	5	3/5	3
Safety	5	5/5	5	4/5	4	4/5	4
Total	100	88		96		73	

Table 1: Design Matrix.

Future Work

Speaker: Keleous

Future Work

- Fabrication
  - Discuss fabrication techniques with client and Design Innovation Lab
  - Fabricate prototypes
- Testing and Validation
  - Perform mechanical testing on prototypes
  - Send survey to professionals in the client's network
  - Have the client fill model cavities with the matrix

Acknowledgements

Dr. Donald Tipple

Dr. Beth Meyerand

References

[1] D. Sadaf and M. Z. Ahmad, “Comparison of two different matrix band systems in restoring two surface cavities in posterior teeth done by senior undergraduate students at Qassim University, Saudi Arabia,” http://isrctn.com/, Sep. 2016. doi:10.1186/isrctn18179115

[2] V. A. de la Peña, R. P. García, and R. P. García, “Sectional matrix: Step-by-step directions for their clinical use,” British Dental Journal, vol. 220, no. 1, pp. 11–14, Jan. 2016. doi:10.1038/sj.bdj.2016.18

[3] Community, “How to use a sectorial matrix in order to achieve a functional proximal surface,” Styleitaliano.org, https://www.styleitaliano.org/how-to-use-a-sectorial-matrix-in-order-to-achieve-a-functional-proximal-surface/ (accessed Oct. 1, 2025).

[4] “TAB-matrix,” Triodent, https://triodent.com/product/tab-matrix/ (accessed Oct. 1, 2025).

[5] “HaloTM Sectional Matrix Band,” Ultradent Products, Inc., https://www.ultradent.eu/products/categories/direct-restorative/halo-sectional-matrix-system/halo-sectional-matrix-band (accessed Oct. 1, 2025).

[6] T. Boroumand, M. Fang, D. Marcoux, and T. Silber, Approximating Surface Matrix Band For Interproximal Cavity Tooth Restoration, https://bmedesign.engr.wisc.edu/projects/f20/easy_tooth_contact/file/view/685e6010-9ae8-40c0-a168-2bdd9a782fa4/Easy_Tooth_Contact-Final_Report.pdf (accessed Oct. 2, 2025).

[7] T. Boroumand, M. Fang, D. Marcoux, and T. Silber, Approximating Surface Matrix Band For Interproximal Cavity Tooth Restoration Poster, https://bmedesign.engr.wisc.edu/projects/s22/easy_tooth_contact/file/view/7faf0b98-9e8f-4ab0-a7f7-aa4456664c46/Surface%20Matrix%20Band%20Final%20Poster%202.pdf (accessed Oct. 2, 2025).