DEPARTMENT OF

Biomedical Engineering

UNIVERSITY OF WISCONSIN–MADISON

Approximating Surface Matrix Band for Dentist to Use for Patients

Team: Spencer Stowell (Leader), Leah Gause (Communicator), Liam Granlund (BPAG/BSAC), Melanie Sona (BWIG)

Problem Statement

- Matrix bands provide a tooth contour for dentists to follow when performing restorative procedures (i.e cavity fillings)

- **Problem(s)**
  - Matrix bands are only capable of surrounding one tooth at a time
  - The thickness of two bands adjacent to one another exceeds the natural tooth contact gap
  - When restoring interproximal cavities, traditional matrix bands unnecessarily increase procedure time

- **Goal: Create a *dual* matrix band system which is ...**
  - Thin enough to fit in between the affected teeth and maintain the appropriate contact gap
  - Rigid enough to securely adapt to the shape of the tooth walls.

Background: Function & Use

- A matrix is defined as a properly contoured piece of metal used to support and give form to the material used in restoration during its and hardening.[1]
- Matrix bands are typically used to fill interproximal cavities (figure 1)

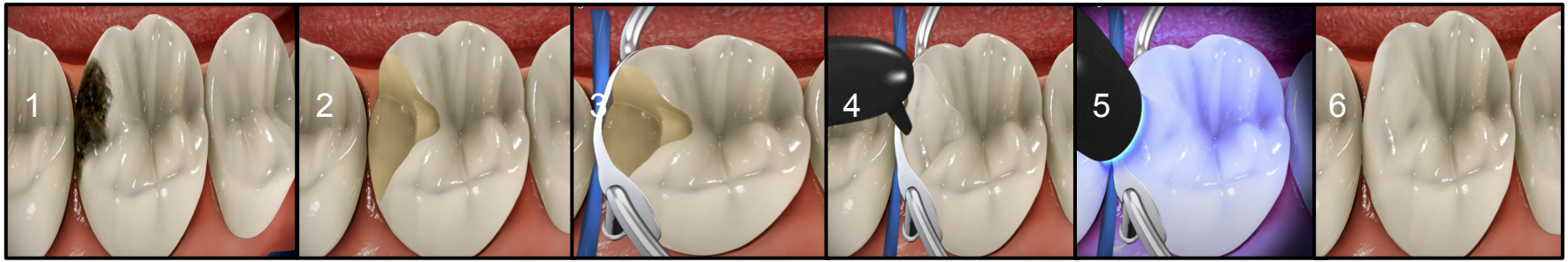


Figure 1: Process of restoring a decayed tooth

Background: Function & Use

- Our problem presents itself when dentists have to perform a **class II restoration** (figure 2)

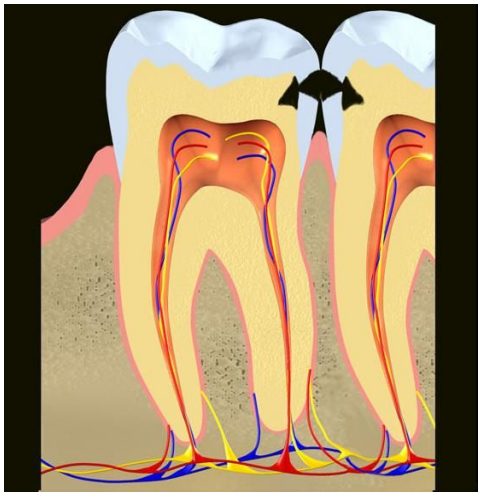


Figure 2: Depiction of an interproximal cavity
On two adjacent teeth

Background: Existing Products

- Tofflemire Matrix Band

Background: Existing Products

- Sectional Matrix Band

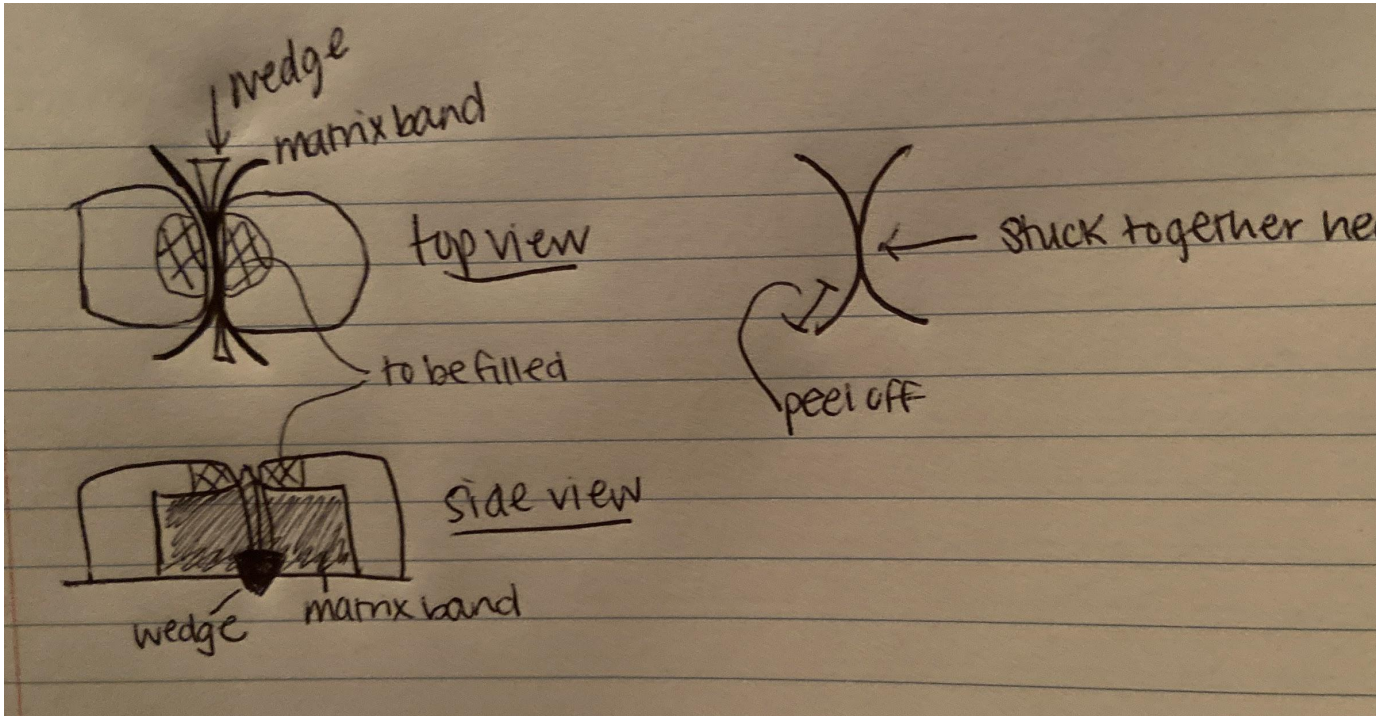
Client Requirements

- Device must be able to securely fit to the convex/concave contour of 2 adjacent teeth undergoing restoration
- Device material must be non-toxic
- Device should be equivalent or less costly to manufacture as compared to existing matrix bands
- Device must remain inert in the presence of filling materials (amalgam, ceramic, composite etc.)
- Device should not be obstructive or clash with other tools to be used (rotary instruments, mirrors, forceps, suction etc.)
- Device should be thin and have high tensile strength

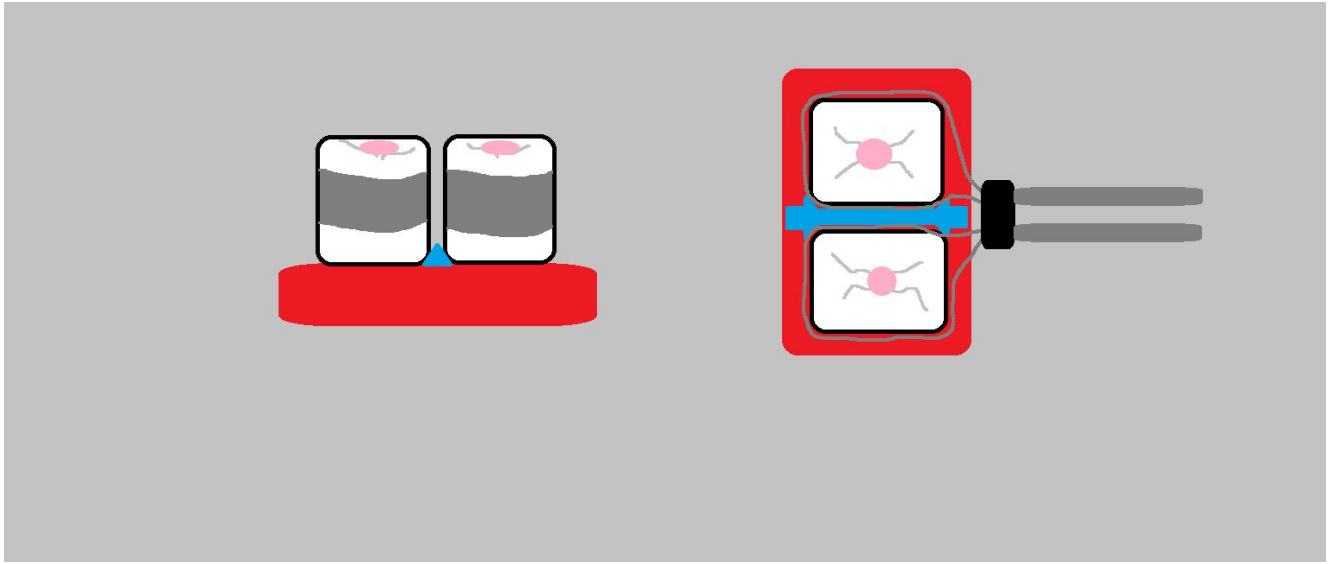
Product Design Specifications

- Normal range of thickness (0.0254 to 0.0508 mm)
- Structural stability for at least the length of the procedure (>30 min)
- Stable in temperatures between 20°C to 37°C, high humidity and high moisture
- One-time use
- Need FDA approval (Class I device)
- Adjustable

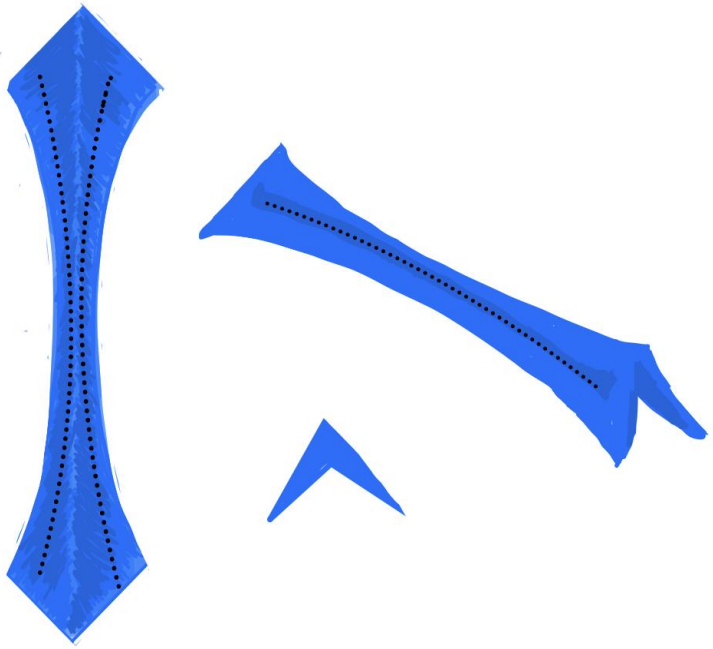
Design 1:

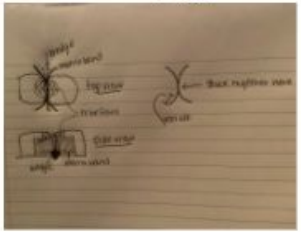
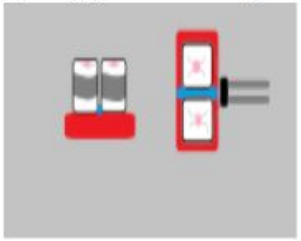
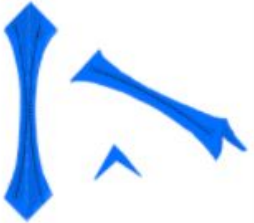

wedge
matrix band
top view
to be filled
side view
wedge
matrix band
stuck together he
peel off

Design 2:



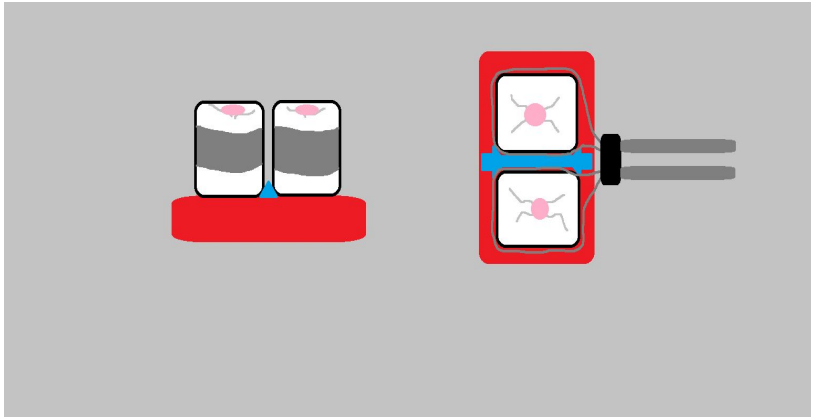
Design 3:



	The Butterfly!	(Doug) DoubleHug	The Potato Wedge
			
Safety (30)	24 (4)	30 (5)	18 (3)
Effectiveness (20)	16 (4)	20 (5)	16 (4)
Cost (20)	16 (4)	20 (5)	12 (3)
Adjustability (15)	12 (4)	15 (5)	6 (2)
Patient Comfort (10)	8 (4)	6 (3)	10 (5)
Ergonomics (5)	5 (5)	4 (4)	5 (5)
Total	81	95	67

Final Design

- Final Design Choice: Doug (Double Hug)
- Simplicity
- Ability to articulate both bands
- Would require thin matrix bands



Future Work

- Start collecting materials for fabrication of prototype
- Check in with client to make sure the bands and equipment we are using are viable.
- Testing of the bands and how the articulation works and feels on practice model
- Iteration on our design idea until final prototype.

Acknowledgements

Dr. Justin Williams

Dr. Donald Tipple

References

1. The art and science of operative dentistry,1995: Mosby-Year Book,Inc
2. Ryzvee, M., 2015. Matrix Bands. [online] Slideshare.net. Available at: <https://www.slideshare.net/masurizvi/matrix-bands> [Accessed 18 September 2020].
3. 2009. Slicks Matrix Bands And Sectional Matrix Bands. [ebook] FDA. Available at: <https://www.accessdata.fda.gov/> [Accessed 18 September 2020].
4. re-invent Dental Products. 2020. Re-Invent Dental Products. [online] Available at: <https://re-inventdental.de/en/sterilization-guideline> [Accessed 18 September 2020].
5. Henry Schein, I., 2020. Tofflemire Matrix Band 1 Adult Universal 0.002 In 144/Pk - Henry Schein Dental. [online] Henryschein.com. Available at: <https://www.henryschein.com/us-en/dental/p/restorative-cosmetic/matrix-materials/tofflemire-bands-1-002/9532378> [Accessed 18 September 2020].
6. Mitchell, J., 2020. How Long Does It Take To Fill A Cavity? | Colgate®. [online] Colgate.com. Available at: <https://www.colgate.com/en-us/oral-health/procedures/fillings/how-long-does-it-take-to-fill-a-cavity--> [Accessed 18 September 2020].
7. Net32.com. 2020. *Palodent Matrix System Refill - Standard Matrices 100/Bx. Contoured Sectional | Dental Supplies*. [online] Available at: <https://www.net32.com/ec/palodent-matrix-system-refill-standard-matrices-100-d-77427?utm_source=google&utm_medium=cpc&adpos=&scid=scplp77427&sc_intid=77427&gclid=Cj0KCQjwtZH7BRDzARIsAGjbK2bnuqW_k7VFN1nRmUme2oW0O9T5wxNlyAT5yByZzzOrArFVFeDcz0saAnM4EALw_wcB> [Accessed 18 September 2020]
8. Accessdata.fda.gov. 2020. *CFR - Code Of Federal Regulations Title 21*. [online] Available at: <https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=872.4565>
9. U.S. Food and Drug Administration. 2020. *Overview Of Device Regulation*. [online] Available at: <https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/overview-device-regulation#ide>
10. Jeffrey M. Rosenberg, D., 2020. *Making Contact: A Method For Restoring Adjacent Posterior Direct Resin | Dentistry Today*. [online] Dentistrytoday.com. Available at: <https://www.dentistrytoday.com/restorative/8821-making-contact-a-method-for-restoring-adjacent-posterior-direct-resin>