



Approximating Surface Matrix Band for Dentist to Use for Patients

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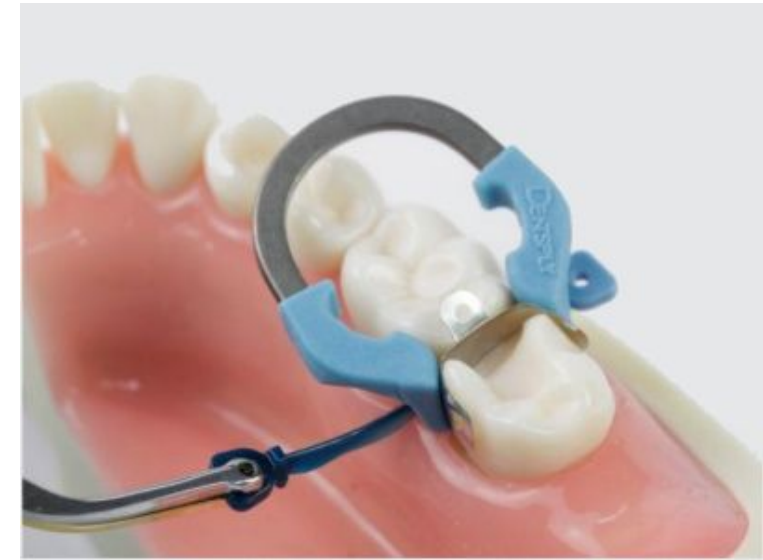
Speaker: Grace

Overview

- Background
- Problem Statement
- Product Design Specifications
- Design Alternatives
- Design Matrix
- Future Work

Dental Matrix Bands

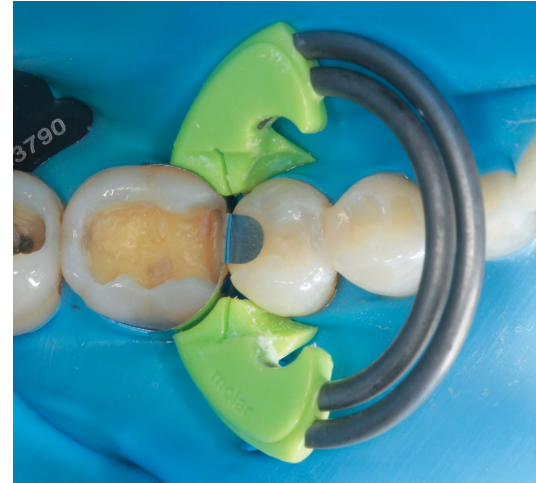
- Dental matrix bands create outside contour of tooth during restorative procedures
 - Most made from stainless steel, malleable
 - Thickness of 0.0015 - 0.002 inches [1]
 - Effective bands are rigid and maximize tooth contact [2]
 - Require use of retainers, clips, rings, or wedges [3]
 - Crowds the patient's mouth
- No existing devices allow for simultaneous interproximal cavity filling
 - Dentists must fill each cavity separately



Matrix band held in place by a ring and wedge [3].

Problem Statement

- Matrix band that can be used on two adjacent teeth
 - Less inefficient and ergonomically difficult
- Sectional vs Circumferential
- Must have good tensile strength, be malleable, and not cause irritation to the patient



Sectional dental matrix band example



Circumferential dental matrix band example.

Product Design Specifications

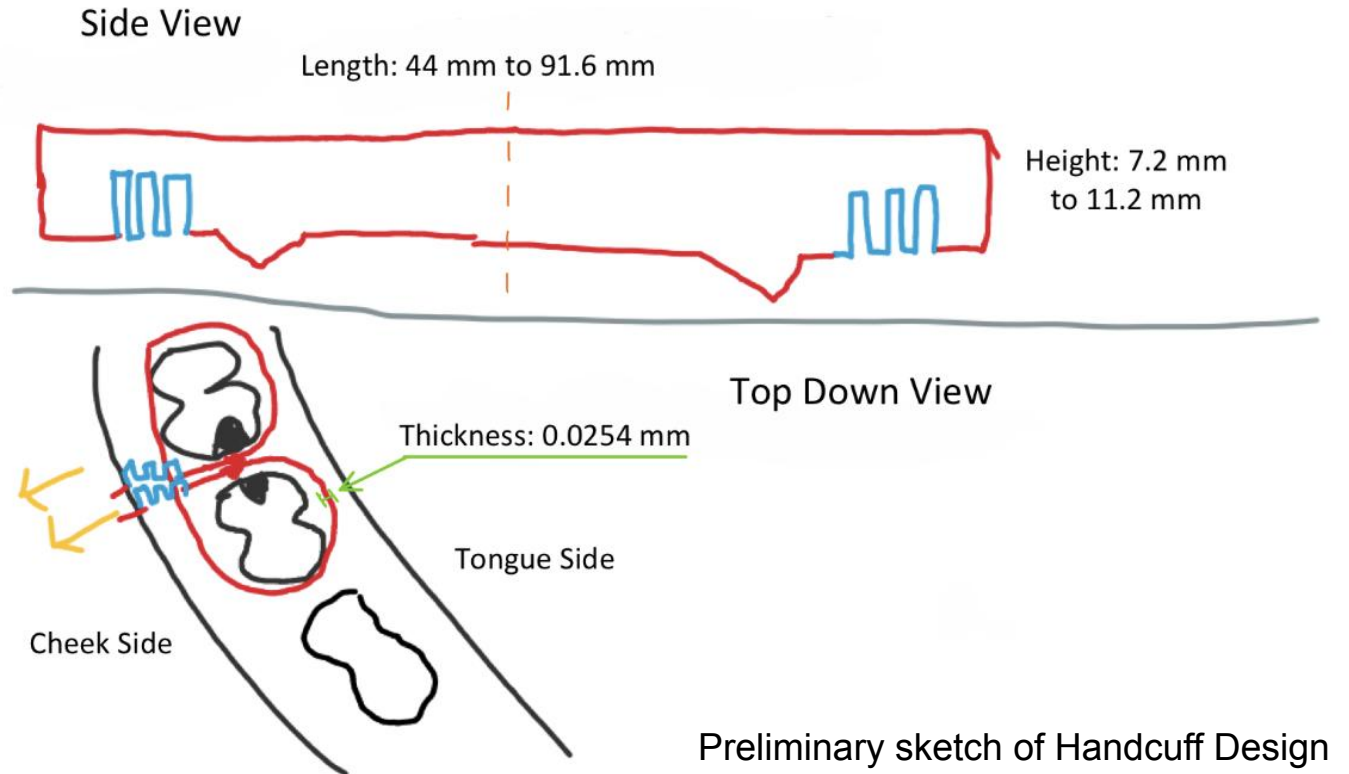
- Matrix Band Size/Shape
 - 10 thou to 20 thou width
 - ~10 mm height
 - Shape around any tooth size
 - (22mm to 48.5mm)[4]
- Matrix Band Material
 - Dead soft metal [5]
 - 400MPa
 - Non-toxic
- Production Plan
 - One time use/Sanitizable
 - 3-5\$ per (400\$ for testing)



Matrix bands and tofflemire retainer

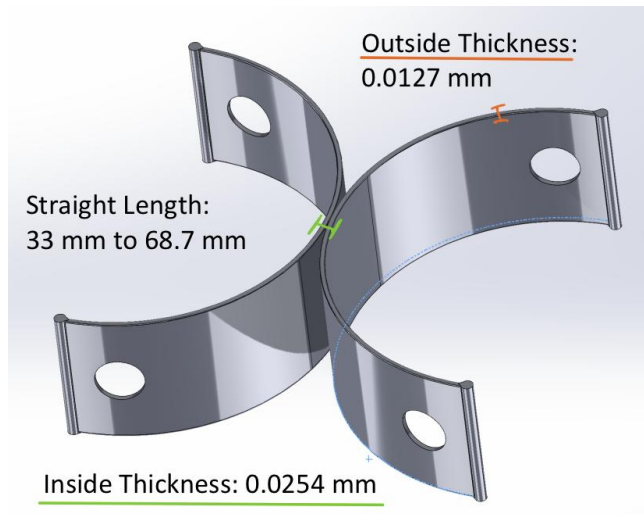
Design 1: Handcuff Design

- Circumferential Matrix Band
- Easy fabrication
- Spikes and slits
- Dead soft metal



Design 2: Butterfly Design

- Sectional Matrix Band
- Wedges
- Wing to tooth contact



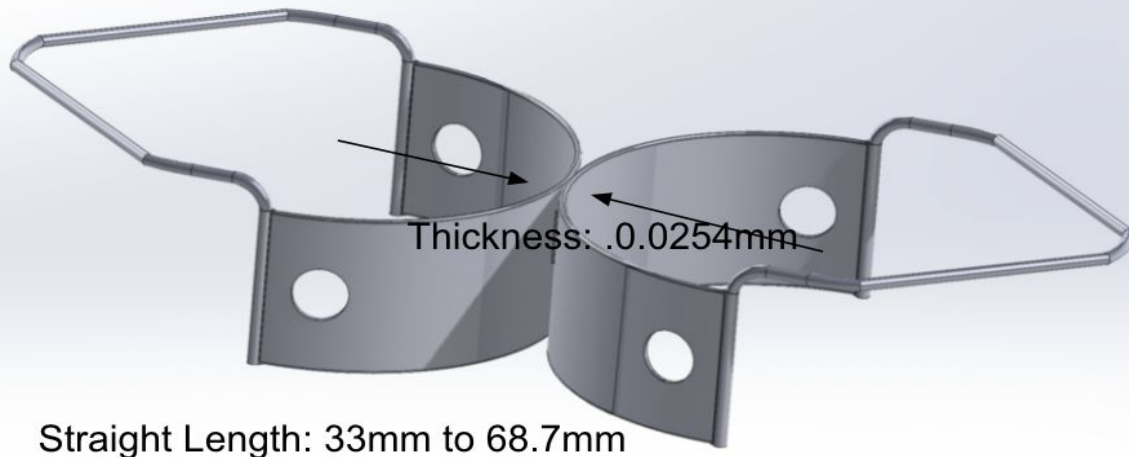
SolidWorks depiction of proposed Butterfly Design



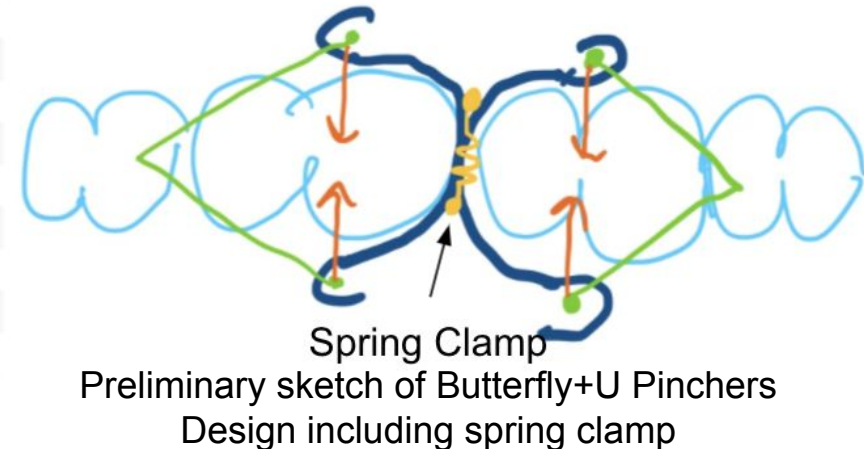
Preliminary sketch of Butterfly Design including wedges

Design 3: Butterfly + U Pinchers Design

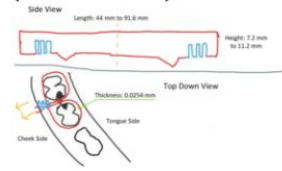


- Sectional matrix band
- Pinchers allow for close contact via inward force
- Portion of the band that contacts both teeth being half the width of the rest of the band
- Spring clamp will widen the gap between teeth during filling



SolidWorks depiction of proposed Butterfly + U Pinchers Design



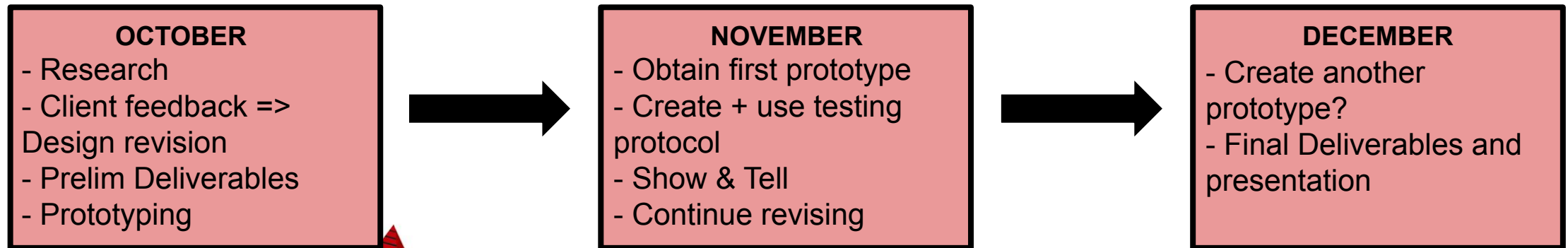
Design Matrix

Dental Matrix Band Design Matrix							
Win 2-Way Tie 3-Way Tie Lost	Design Criteria (Weight)	Design 1 (Handcuff)		Design 2 (Butterfly)		Design 3 (Butterfly + U pinchers)	
							
	Functionality (30)*	3/5	18	2/5	12	5/5	30
	Ease of Use (20)	2/5	8	4/5	16	4/5	16
Fabrication (15)	4/5	12	3/5	9	3/5	9	
Ease of Sterilization (15)	3/5	9	3/5	9	3/5	9	
Safety (10)	4/5	8	5/5	10	5/5	10	
Cost (10)	4/5	8	3/5	6	2/5	4	
Total (100)		63		62		78	

*The functionality criteria was based on the design's ability to allow the dentist to complete the procedure with both quality and time efficiency

Future Work

- Client feedback on proposed final design
 - Obtain mouth model
- Finalize CAD model
 - dimensions, materials, features
- Research potential manufacturing options
- Create testing protocol
 - Mechanical (Solidworks + MTS machine)
 - Qualitative (Dr. Tipple and colleagues)



References & Acknowledgments

- [1] U. F. O. Themes, “Principles of tooth preparation,” *Pocket Dentistry*, 12-Feb-2015. [Online]. Available: <https://pocketdentistry.com/principles-of-tooth-preparation-2/>. [Accessed: 23-Sep-2021].
- [2] M. Ahmad, “A Historical Review of Dental Matrices,” *Malaysian Dental Journal*, vol. 33, no. 2, pp. 1–7, 2011.
- [3] “Dental Matrix Systems,” *Dentalcompare*. [Online]. Available: <https://www.dentalcompare.com/Restorative-Dentistry/4630-Dental-Matrices/>. [Accessed: 20-Sep-2021].
- [4] Celebi, A. A., Lee, S. H., & Kau, C. H. (2017). Size discrepancies in molars and first key to optimal occlusion. *European journal of dentistry*, 11(2), 250–252. https://doi.org/10.4103/ejd.ejd_339_16
- [5] Bell, Eddie. “Understanding Metal Hardness.” *Rio Grande*, 29 Oct. 2020, www.riogrande.com/article?name=UnderstandingMetalHardness.

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