



Approximating Surface Matrix Band for Dentist to Use for Patients

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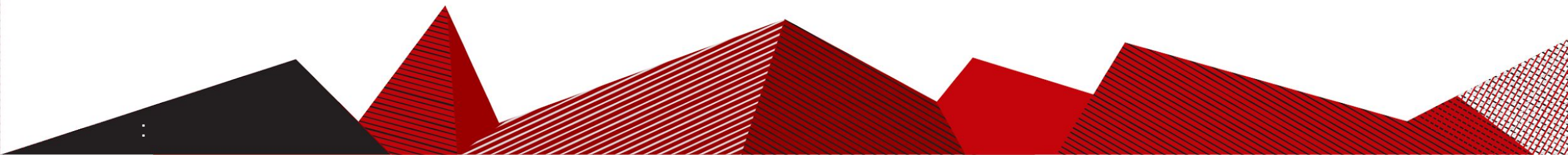
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Overview

- Problem Statement
 - Impact
- Last Semesters Design
- Testing Feedback
- Design Modifications
 - Fabrication Plan
- Testing Plan
- Packaging and Documentation
- Budget



Problem Statement

- During procedures involving cavities on adjacent teeth, dentists must one tooth at a time
 - Difficult and time inefficient
- Matrix band could allow for both teeth to be operated on simultaneously
 - Comparable mechanical and practical properties



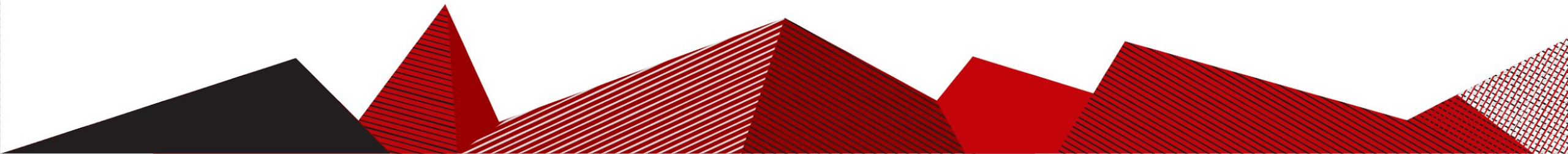
Untreated cavity requiring attention



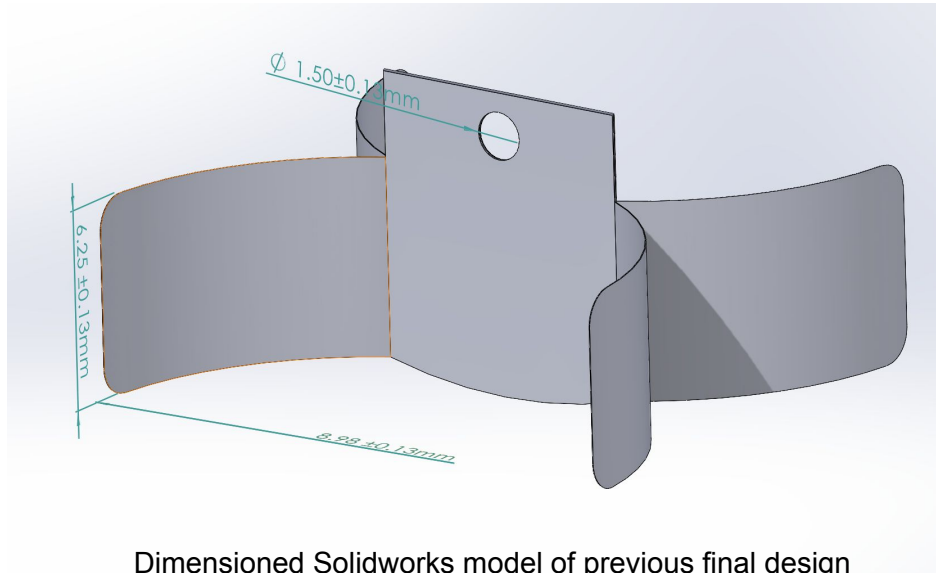
Current matrix bands in use for cavity filling

Impact

- Continue advancements in dental research [1]
- Simplifying procedure could improve
 - Efficiency
 - Convenience
 - Cost Effectiveness
- 9% of world population affected by untreated dental caries [2]
 - More enticing of a procedure
 - Free up more time for dentist



Last Semester's Design



Dimensions

- Height: 6.25 mm
- Thickness: 0.0254 mm

Features

- Tab with hole
- Rounded corners

Material

- 1008-1010 Grade Stainless Steel

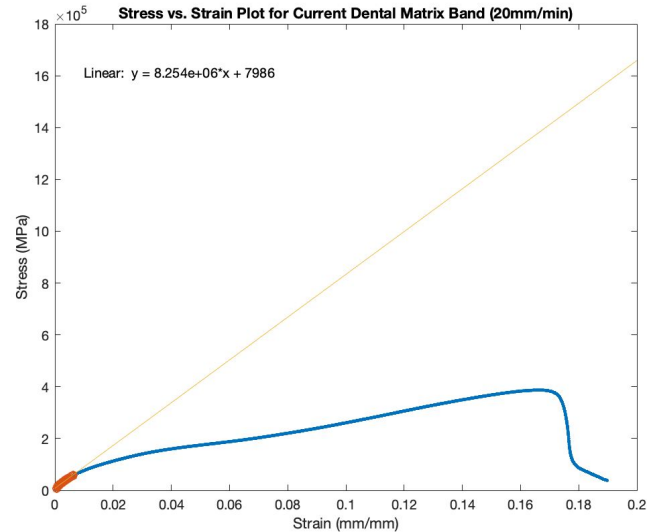
Installation/removal

- Goes in interproximal space
- Carefully insert and stabilize with rings and wedge

Testing and Feedback



Sample being loaded into the MTS machine for tensile testing



Sample plotted Stress-Strain curves from tensile testing on an MTS machine to determine Young's Modulus for 1008 steel alloy.

Preliminary mechanical testing successful

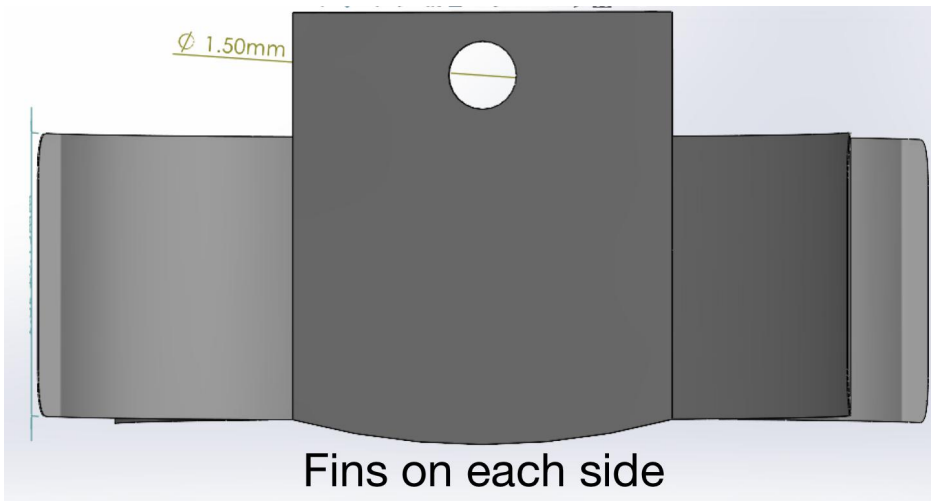
- Solidworks showed steel compositions were comparable during stress test simulations
- MTS testing had difficulties but showed evidence of similar Young's Modulus values between materials

Looking Forward

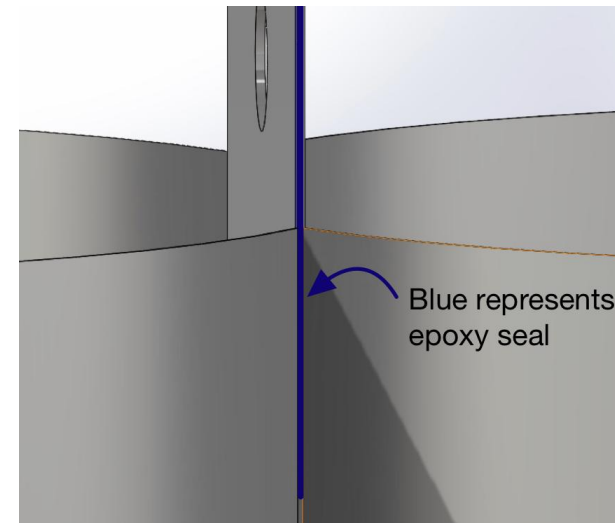
- Quantitative testing
 - Manufacture prototype

Design Modifications

- Addition of Fins
- Bonding of upper 70% of proximal space
 - Permatex 84109 PermaPoxy 4 Minute Multi-Metal Epoxy
- Variety of sizes - 5mm, 6mm, 7mm



Solidworks of modified design displaying "fins" addition



Solidworks of modified design displaying epoxy seal in interproximal space pictured in blue

Semester Timeline

February

- Order adhesive
- Finalize Design Modifications
- Submit CAD file to 3rd party manufacturer

March

- Test adhesive
- Preliminary Deliverables
- Receive prototype
- Client testing and feedback

April

- Begin iterative Process
- Focus on executive summary and poster presentation
- Final Deliverables

Fabrication & Testing Plan

1. Submit fabrication request to Big Blue Saw manufacturing company
 - independent online source
 - other 3rd party manufacturers
 - die casting and punch die
2. Filing to round edges*
3. Application of sealing epoxy

Evaluation Criteria	Score (1-5)	Comments:
Ease of Use		
Tooth Contour		
Protective Coverage		
Restoration Contact		
Efficiency		
Compatibility with existing tools & Procedures		
Total Score (out of 30)		

Packaging and Documentation

- Packaging
 - Self-Sealing Sterilization Pouch
 - Kit containing multiple sizes
 - Unfolded and stacked together
- Documentation
 - User manual
 - Installation
 - Assembly
 - Safety warnings
 - Size specification



Common packaging (left) and sterilization pouches (right) that are the current standard in dentistry

Budget

- Fall 2021
 - Tooth Model: \$28.42
 - Stainless Steel: \$35.96
 - Reimbursed
- Spring 2022
 - Approved to make “reasonable“ purchases
 - Estimated \$50 - \$200 for prototype
 - Possibly free
 - \$10 - \$20 for packaging
 - Client will reimburse at end of semester



References & Acknowledgments

- [1] R. S. King, "A Closer Look at Teeth May Mean More Fillings," The New York Times, 28-Nov-2011. [Online]. Available: <https://www.nytimes.com/2011/11/29/health/a-closer-look-at-teeth-may-mean-more-fillings-by-dentists.html>. [Accessed: 19-Oct-2021].
- [2] K. Watson, "Hardest substance in the human body: All about tooth enamel," Healthline, 22-Sep-2020. [Online]. Available: <https://www.healthline.com/health/hardest-substance-in-the-human-body#:~:text=According%20to%20the%20Mohs%20Hardness,10%20on%20the%20Mohs%20scale.> [Accessed: 23-Sep-2021].

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