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Approximating Surface Matrix Band

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Client: Dr. Donald Tipple

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Client Description

Client:

- Dr. Donald Tipple, DDS
- Owner of Nakoma Dental LLC
- Would like a product that can safely and effectively allow for filling of two adjacent cavities simultaneously



Figure 1: Dr. Donald Tipple.

Background Information

- Dental cavities are the most common non communicable disease (NCD) worldwide
- If left untreated, it can lead to tooth loss, pain, discomfort, chronic systemic infection, and trouble eating
- Currently, Class II cavities are first drilled out then filled sequentially



Figure 2: Class II cavity.



Figure 3: Circumferential matrix band.

Problem Statement

- Currently, Class II cavity restorations can only be filled one tooth at a time
- Procedures are time consuming and costly (\$191 on average per tooth with composite resin)
- These barriers make cavity treatment less accessible
- The proposed solution would allow for cavities on two adjacent teeth to be filled simultaneously

Competing Designs



Figure 4: Sectional Matrix Band in use



Figure 5: Coated Sectional Matrix Band



Figure 6: Circumferential Tofflemire Band



Figure 7: Tofflemire Matrix Band in use

Previous Design

Design Highlights

- Decreased procedure time
- Single piece
- Correct interproximal contact

Largest Pain Point

- Removal

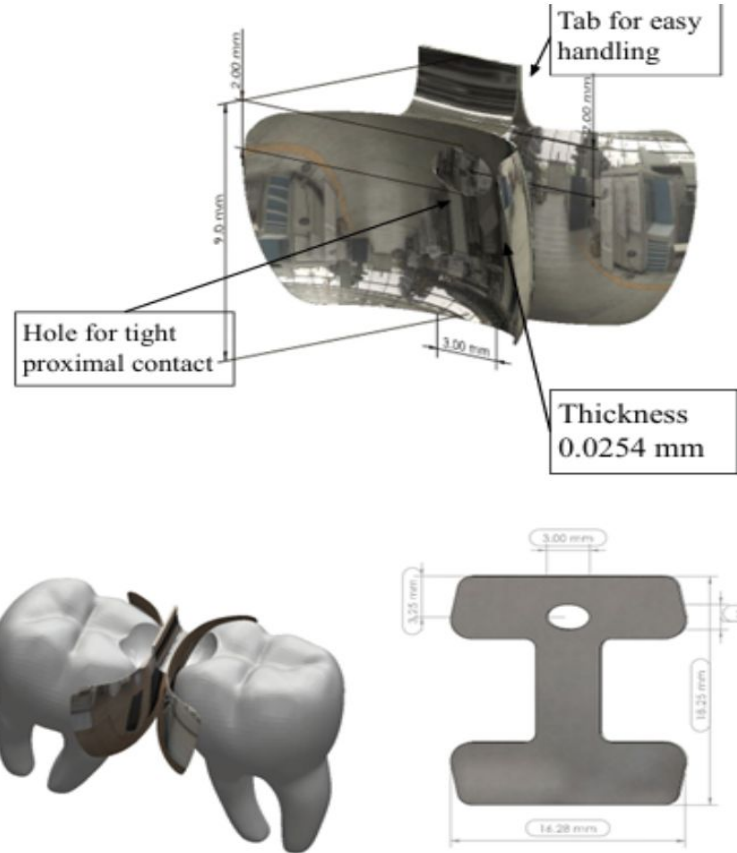


Figure 8: Image from Spring 2026 Final Report of their final design, modeled in SolidWorks.

Product Design Specification

Client requirements:

- Class II cavity restorations can be performed simultaneously
- Allows for proper contact between surfaces of the two adjacent teeth
- Minimizes gum irritation

Design Requirements:

- Maintains mechanical properties for full procedure
- Safe to use in the human mouth
- Stay within \$100 for development and testing

Design #1: S-Design

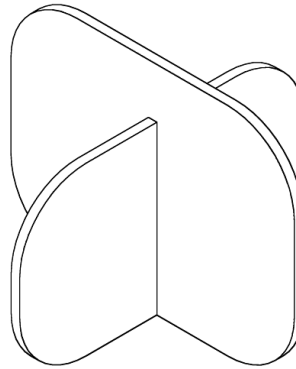
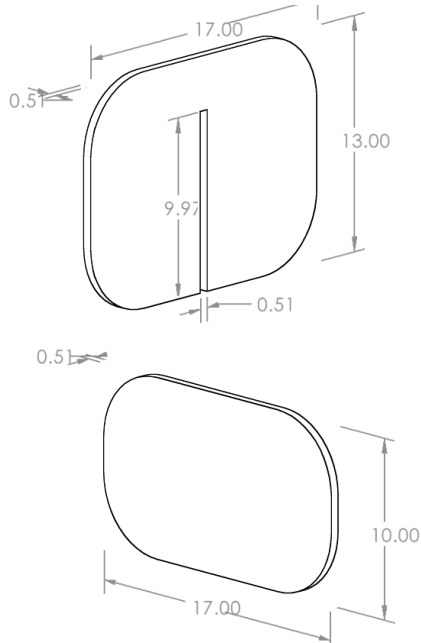


Figure 9: S-design modeled in SolidWorks with drawn on dimensions by Samuel Zakaib.

- Whole new approach
- Does not require folding but still has to be put together
- Simpler
- Thin thickness in middle where teeth meet
- Chamfered edges to minimize gum irritation

Design #2: Half-Oval

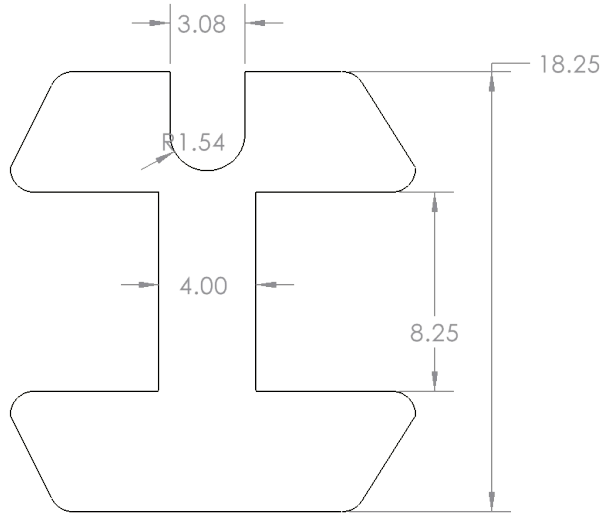


Figure 10: Half-Oval design modeled in SolidWorks with drawn on dimensions by May Kennelly.

- Folds into butterfly shape
- Cut out to ensure good contact
- Tapered wings to fit well within gums
- Chamfered edges to minimize gum irritation
- Cut-out goes to bottom to minimize catching
- Produces filling that mimics natural tooth shape

Design #2: Half-Oval

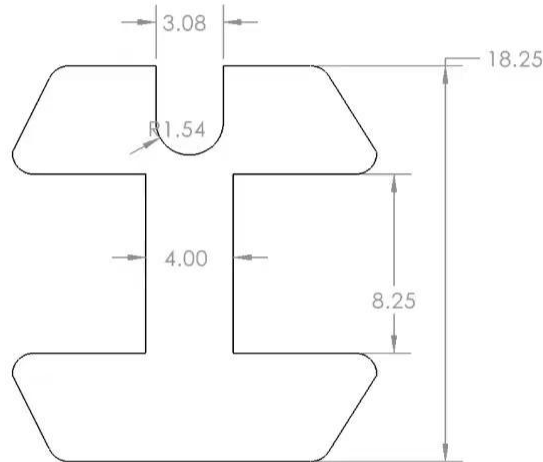
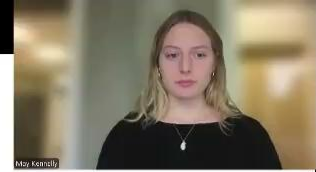


Figure X- Half-Oval design modeled in SolidWorks with drawn on dimensions by May Kennelly.

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Future Work

Prototyping

- Purchase 304 Steel materials
- Develop a machining plan
- Prototype model in SolidWorks

Testing

- FEA testing on future perforation design prototype

Conclusions

- Compare results with data from the previous design

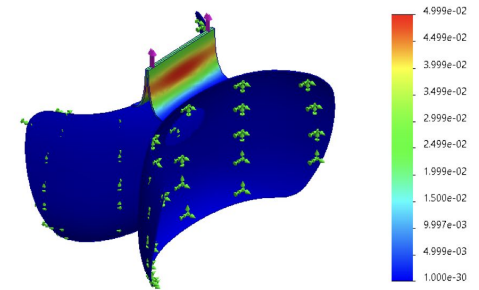


Figure 12: Image from the Spring 2026 Final Report from FEA tensile testing

Acknowledgements

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