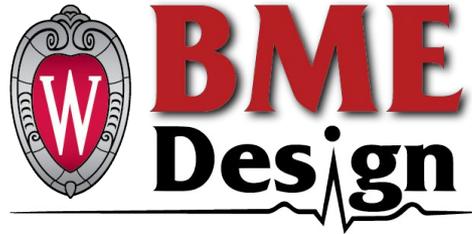


# EarVac

**Negative Pressure Wound Therapy Device for Improved Microtia  
Reconstruction Surgery Recovery**

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# Overall Timeline

## February

- 8th - end: Preliminary testing
- 18th: Client meeting
- 22nd: Outreach
- 25th: Preliminary Report

## March

- Reach out to WARF
- Investigate invention disclosure
- 20th: Show and tell

## April

- Final deliverables



# Current Project Status

## Dressing & Attachment Stage

- Ensure secure connection methods to attach the dressing to the conformal ear interface
- Maintain seal integrity over complex ear geometry without compromising comfort

## Prototype Progress

- 3D print fitted onto a head model
- Overall geometry and alignment with the reconstructed ear region solid

## Logistics Progress

- Target Annals of Biomedical Engineering for publication; clinical journals may require trials.
- Long-term goal includes patenting via a WARF invention disclosure, with initial draft paper and IP discussion beginning in March and revisions completed by early April.



*Figure 1. 3D printed model of headband and earmuff attachment*

# End of Semester Goals

- Finalized prototype
  - Comfort of the headphone emphasized by client
  - No leaks in the seal
  - Equal negative pressure distribution (50 mmHg)
  - Adaptability
    - Headphone strap
      - Fit many head sizes
    - Modular
      - Adaptable for both stage 1 and stage 2 microtia reconstruction
      - Stage 1 utilizes NPWT
      - Stage 2 simply requires protective cover
- Publish in Annals of Biomedical Engineering
  - If testing is substantial
- Submit an invention disclosure and pursue patent protection, if applicable

# Prototype Finalizations

- Adjusted locking mechanism
  - Increase male connection margins
- Nylon PA12 used for headband component
- Thermoplastic polyurethane (TPU) used for the ear muff component
- Padding along the edges of the earmuff and headband to provide comfort
- Elastic straps to secure the device around the circumference of the head
- Small dimension changes to accommodate a smaller head



Figure 3. SolidWorks model of earmuff piece and headband



Figure 4. SolidWorks model of headband

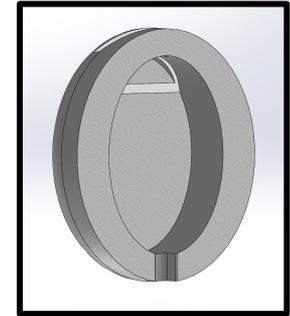


Figure 5. SolidWorks model of earmuff piece

# Prototype Finalizations Continued

- NPWT dressing layer applied in surgery
- Materials used in dressing are DuoDerm, Polyurethane foam, and adhesive layer
- Y-connector used to attach fluid drainage from the wound drain and NPWT dressing tubing



Figure 6. NPWT dressing



Figure 7. DuoDerm and Polyurethane foam



Figure 8. Y-Connector

# Testing Plans

## Negative Pressure Transmission Test

- Applied Pressures (25 mmHg to 150 mmHg) on NPWT dressing
- Duration: 1 Hour → Chosen Pressures Ran 3 Times
- Measurement Metric 1: Quantitative information regarding potential tears
- Measurement Metric 2: Deviations from theoretical pressures via transducer

## Strength of Seal Test

- Tensile testing on an assembled NPWT dressing (with vacuum)
- Tensile testing → In tension, pulling apart the seal
  - Upper grip on tubing (will be moving up)
  - Lower grip on adhesive part of seal
- Ran at varying speeds and gauge distances
- Measurement Metric 1: Max Force at which seal broke

# Testing Plans

## Fluid Testing - Removal Rate

- Flowmeter → Measure rate of flow coming in and out of the y connector
- Measurement Metric 1: Consistency of fluid flow (rate determined by flowmeter)

## Fluid Testing - Retrograde

- Simultaneously ran with removal rate → Monitor backflow
- Flowmeter will be situated by the tubing in NPWT dressing → Reverse Direction

## Comfortability Test

- Will be conducted on a person
- 25 to 50 mmHg pressure applied → verbal feedback regarding comfort