Universal Surgical Drain

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Client:

- Ramzi Shehadi, MD

Presentation Outline

- Client Background
- Problem Definition
- Existing Technology
- Client Requirements
- Design Alternatives
- Design Matrix
- Prototype Fabrication
- Future Work
- Acknowledgements
- Questions

Client Background

- Ramzi Shehadi, MD
  - Plastic Surgeon for Dean Clinic
  - Specializes in breast reconstruction surgery

Fig 1

- Currently treats abscesses using the Penrose surgical drain
  - Frequency of ~10 cases/yr
  - Interested in creating a more efficient and patient friendly surgical drain

Problem Definition

- Boils and abscesses are localized infections under the skin that result in pus accumulation
  - Local infection can lead to systemic infections
  - Pressure from pus build-up inhibits tissue perfusion
  - Healing time ranges from 2 weeks to 3 months
- Current method is painful, requires suturing and specialized nursing care

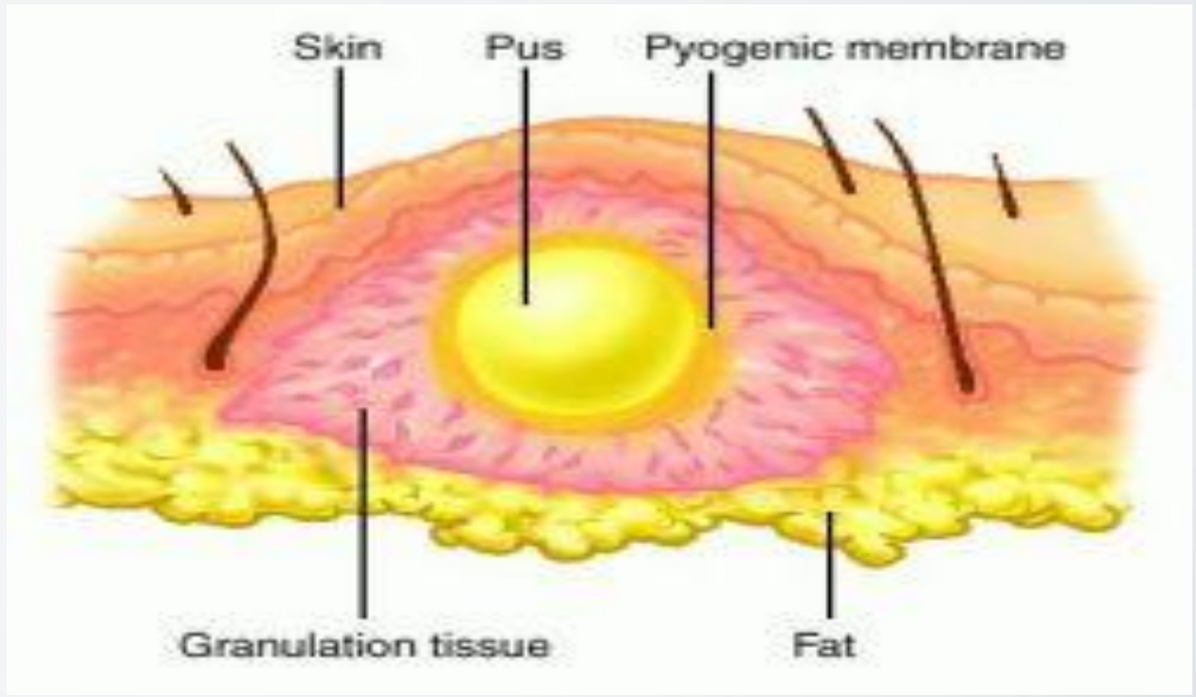


Fig 2

Existing Technology

- Penrose Drain – natural rubber (latex) tube packed into incised abscess
- Variations on surgical tubes (US 3957054, 3860008)
- Method and device for draining abscesses (US 5232440)
- KCI VAC foam dressing with continuous negative pressure

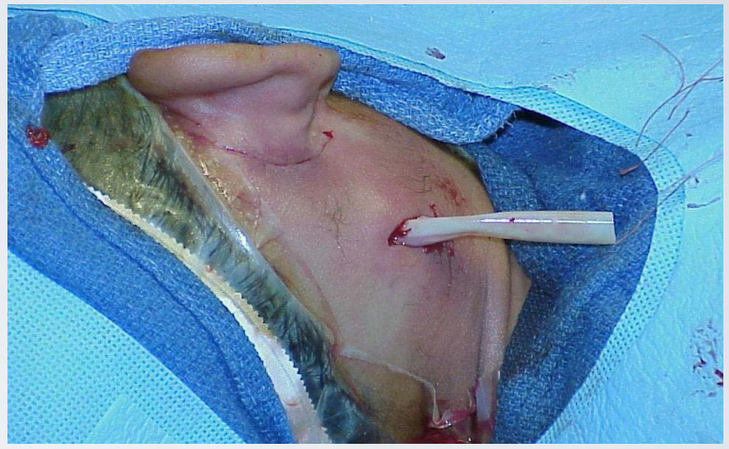


Fig 3

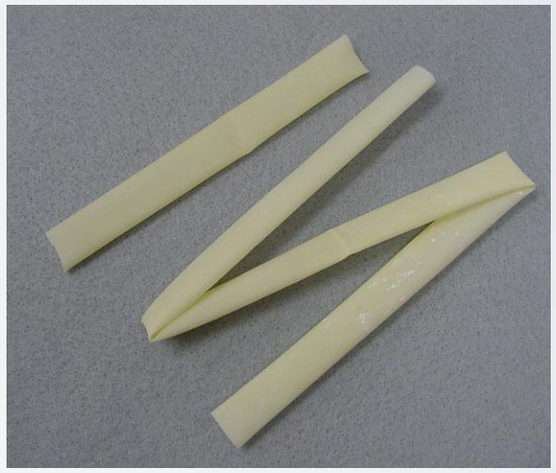


Fig 4

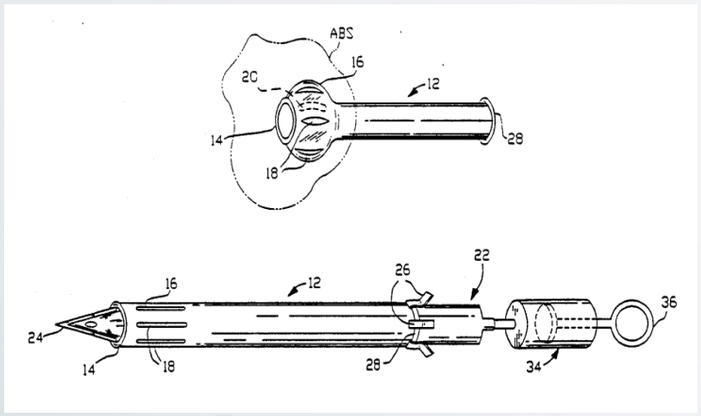


Fig 5

Fig 6

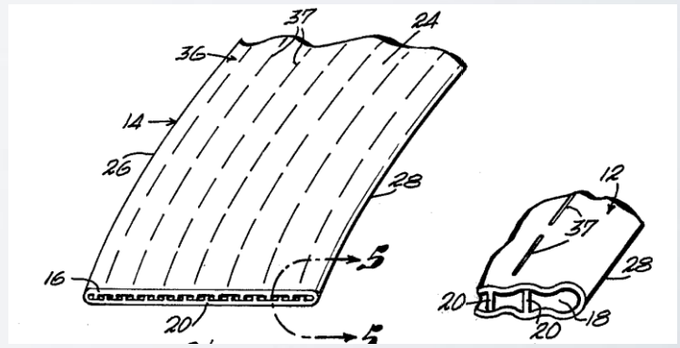


Fig 7

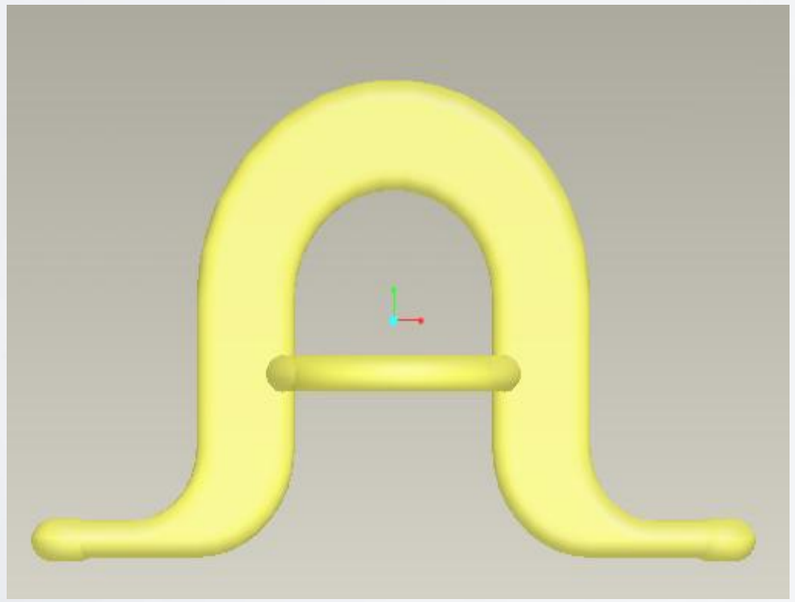
Client Requirements

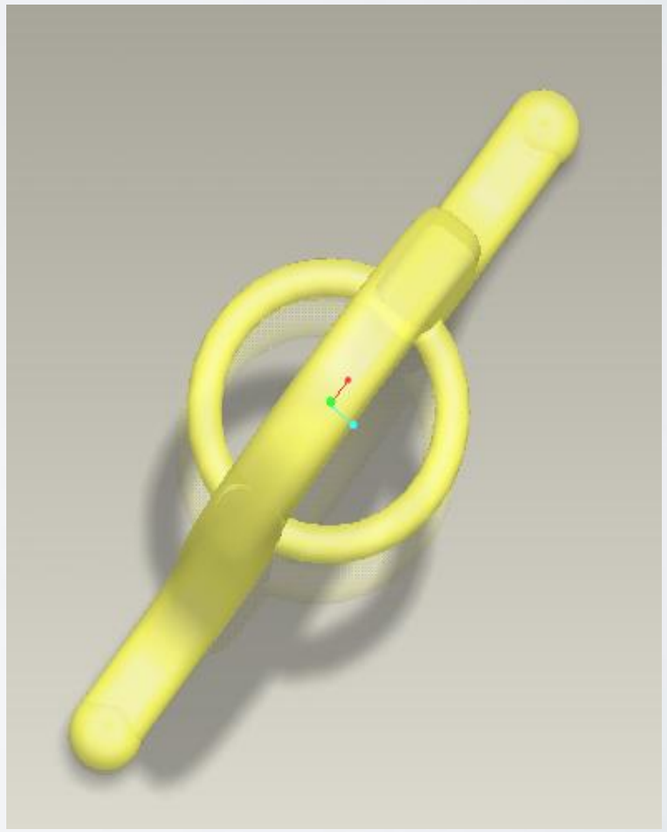
- Develop a surgical drain that passively drains subcutaneous abscesses
- Reduce the cost, time and pain associated with the current treatment method
- Specific requirements:
  - Drain must be compatible with various sizes of abscesses
  - Patient must be able to insert and remove drain as needed
  - Material should be non-latex medical grade silicone rubber

Alternative #1: The ‘A’ Drain

- Advantages
  - Adaptable to different incision depths
  - Circular spring eliminates high stress points

- Disadvantages
  - Compressed from bottom during insertion and removal
  - Removal of drain could be painful
  - High profile above wound

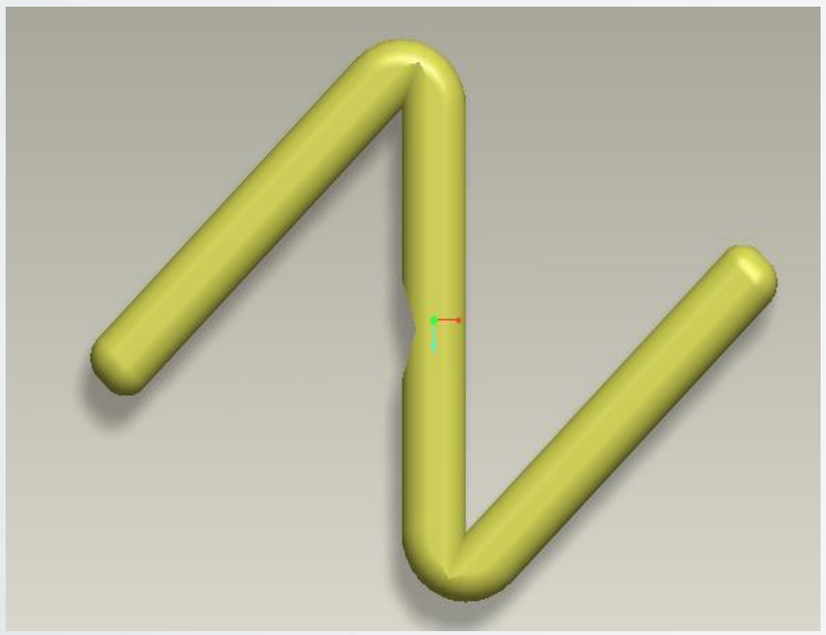


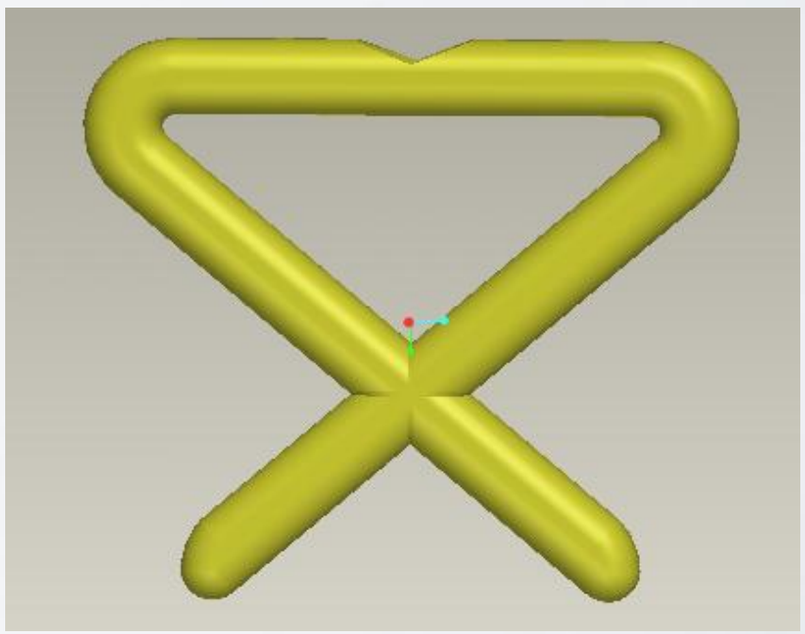


Alternative #2: Scissor Frame

- Advantages
  - Pinched at top of drain during insertion and removal
  - Low profile, rests securely on skin surface
  - Middle cross prevents premature incision closure

- Disadvantages
  - Possible pain from compression inside abscess cavity
  - More intricate design; requires material tension, stress on notch

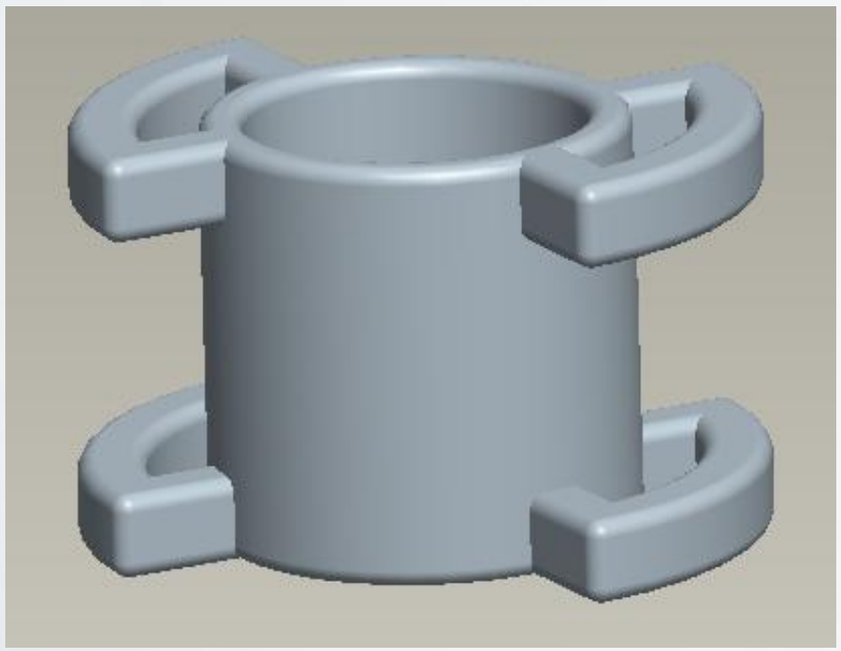


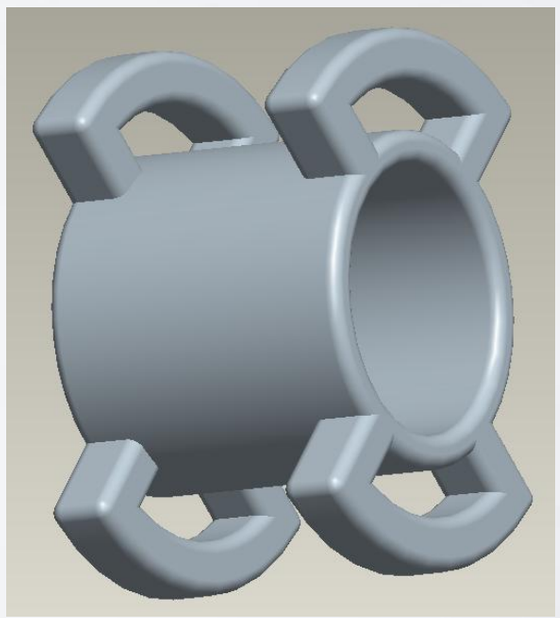


Alternative #3: Spool

- Advantages
  - Held snugly in place
  - Hollow center provides access for irrigation, wound draining

- Disadvantages
  - Relatively difficult to insert, painful to remove
  - Not universal due to different abscess depths



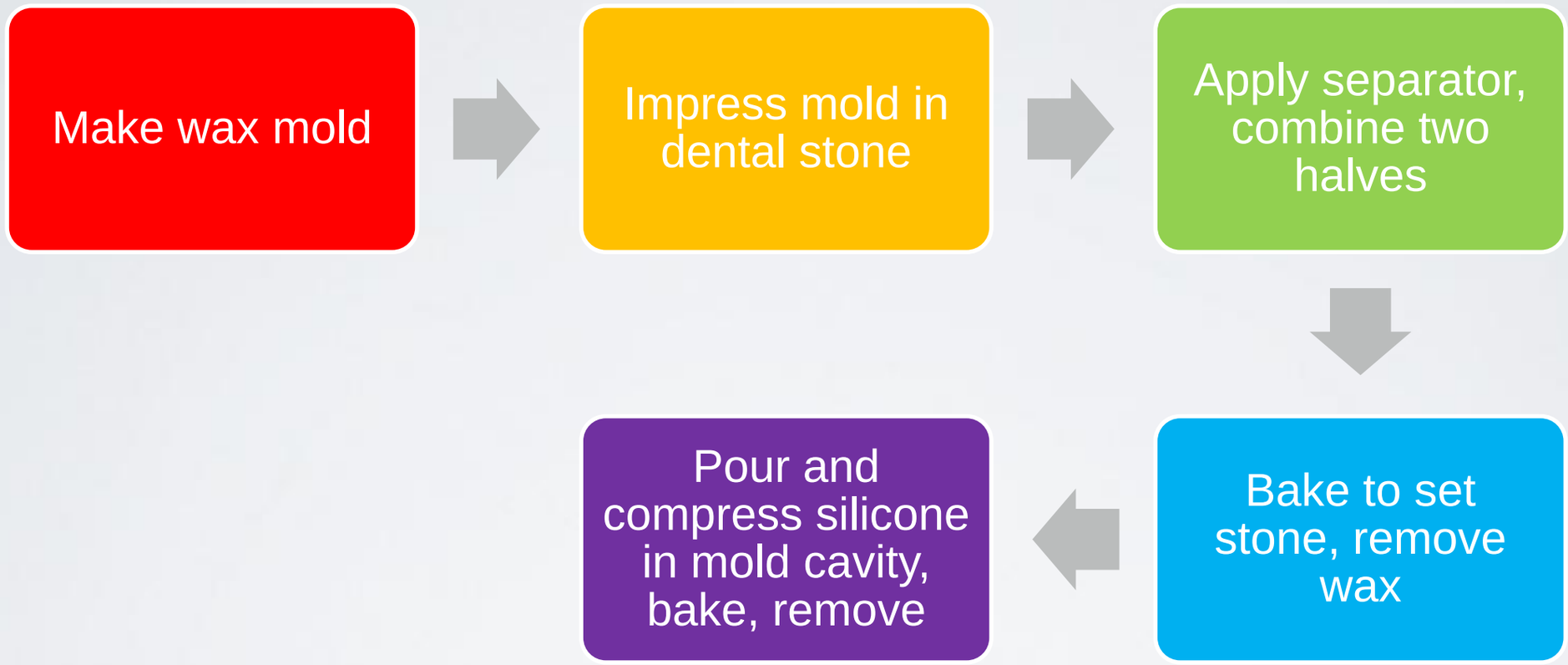


Design Matrix

	Fabrication 0.2	Ease of Use/ Patient Comfort 0.3	Efficacy 0.35	Universality 0.15	Total 1.0
The ‘A’ drain	**7**	**8**	**7**	**9**	**7.6**
Scissor Frame	**8**	**9**	**8**	**6**	**8.0**
Spool	**5**	**6**	**8**	**7**	**6.65**

Prototype Fabrication

- Create mold using lost-wax casting method



- 10A and 30A two-part silicone mix from NuSil

Future Work

- Fabricate all design concept prototypes using lost wax casting method
- Preliminary evaluation of prototypes, redesign as necessary
- Test with cadavers, animals and/ or bench-top models

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- Ramzi Shehadi, MD
- Willis Tompkins, PhD
- Sarah Gong, PhD
- John Kao, PhD
- Greg Gion, MMS, CCA
- Julie Harber – NuSil Technical Sales

References

Figures

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Questions?

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