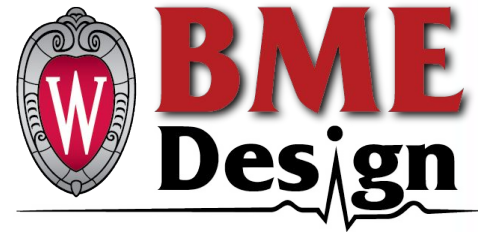


Improved Method of Securing Surgical Drains

Team Members: Dana Stumpfoll (Team Leader)
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Abdoulahi Bah (BWIG)
Oscar Zarneke (Communicator)

Client: Dr. Katie Kalscheur
Advisor: Dr. Tracy Jane Puccinelli



Overview of Presentation

1. Background
2. Problem Statement
3. Product Design Specification
4. Competing Designs
5. Design Ideas
6. Design Matrix
7. Future Work
8. Acknowledgements and References



Background

- Surgical Drain Use
 - Removal of blood, pus, or other fluids to prevent accumulation
 - Commonly used clinically
 - Estimated at 75.5 million pieces sold in 2020, projected to reach 95.5 million by 2030 [1]
 - Chest, Abdomen, Head, etc. applications
- Surgical Drain Care
 - Drain bulbs must be emptied for fluid measurement
 - Drain site is cleaned once daily, tubing is stripped twice daily [3]

Jackson-Pratt Drain

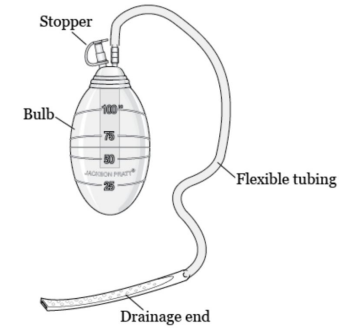


Figure 1: JP Surgical Drain [2]



Figure 2: Post-Operative recommendations for securing drain tubing [4]



Problem Statement

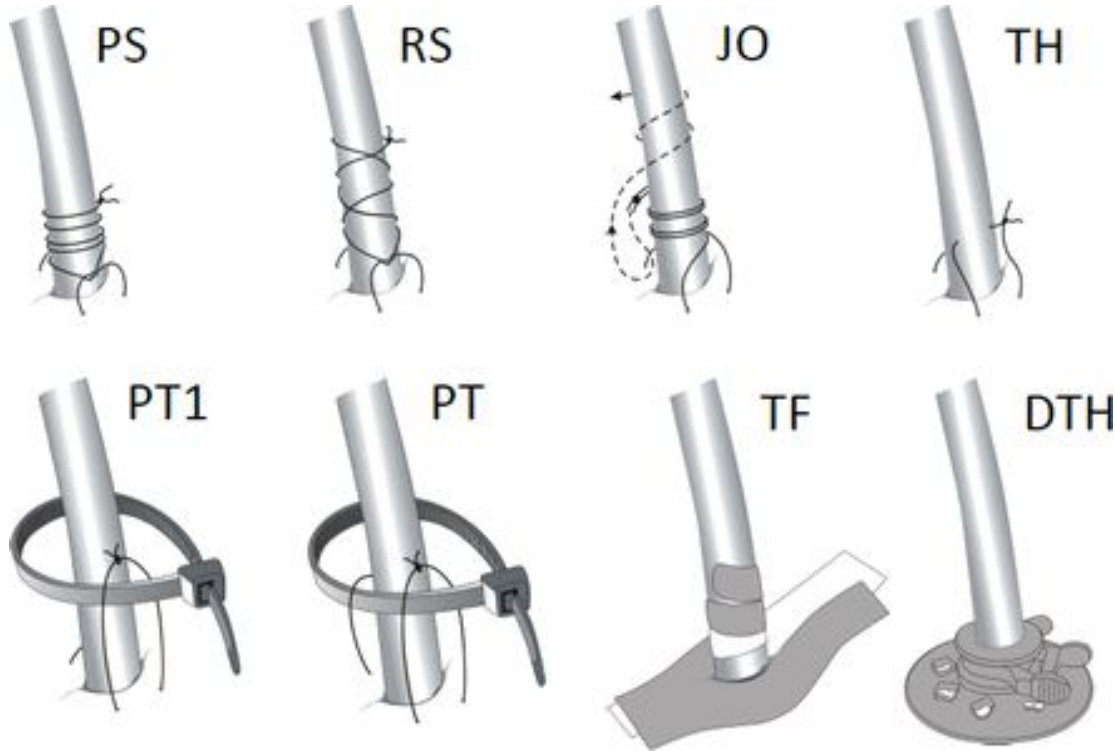
- Design a device that secures the surgical drain in place and develop a device that reduces the tension
 - Use in addition to sutures
 - Surgical drain care needs must be considered



Product Design Specifications

- Compatible with any type of surgical drain
- Accessible drainage site
- Operate effectively at body temperature 98.3 ± 4.0 °F
- Water resistant
- Materials used cannot interfere with natural wound healing

Competing Designs



- Purse string
- Roman sandal
- Jo'burg
- Through the tube
- One pass locking tie
- Two pass locking tie
- Tape fixation
- Drain tube holder

Figure 3: Surgical drain fixation techniques [5]

Competing Designs

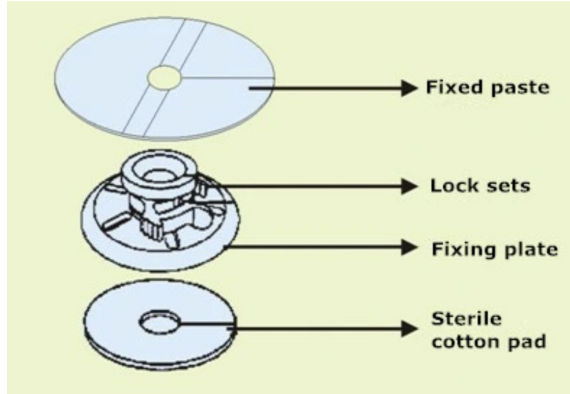


Figure 4: A disposable drain tube holder from Changzhou Haiers Medical Devices Co. Ltd. [6]

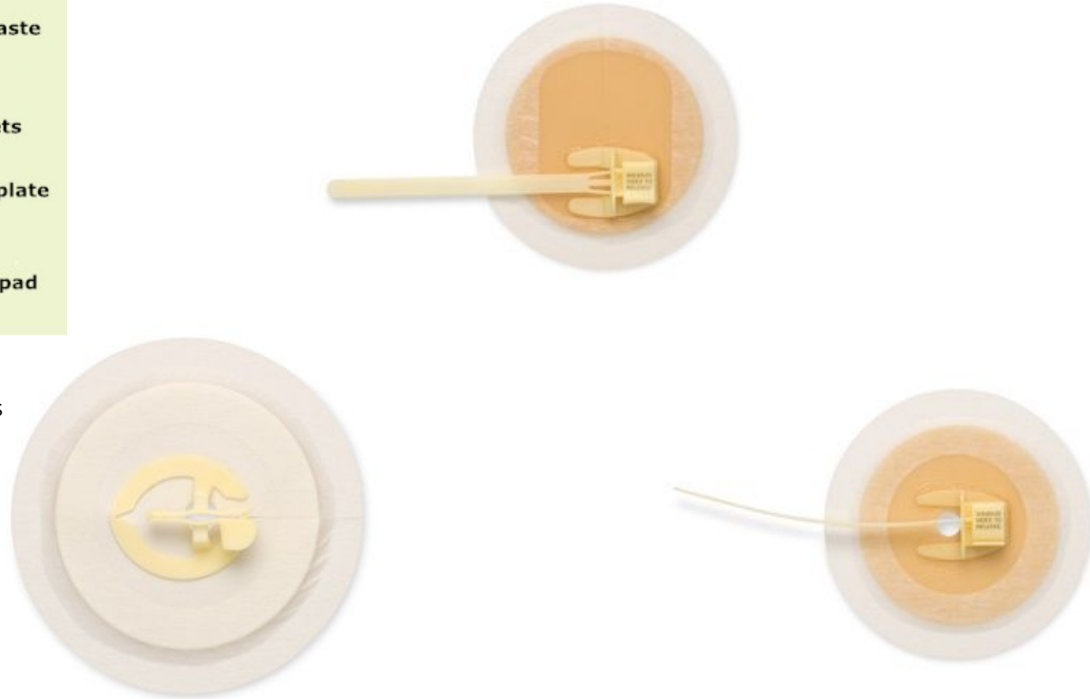
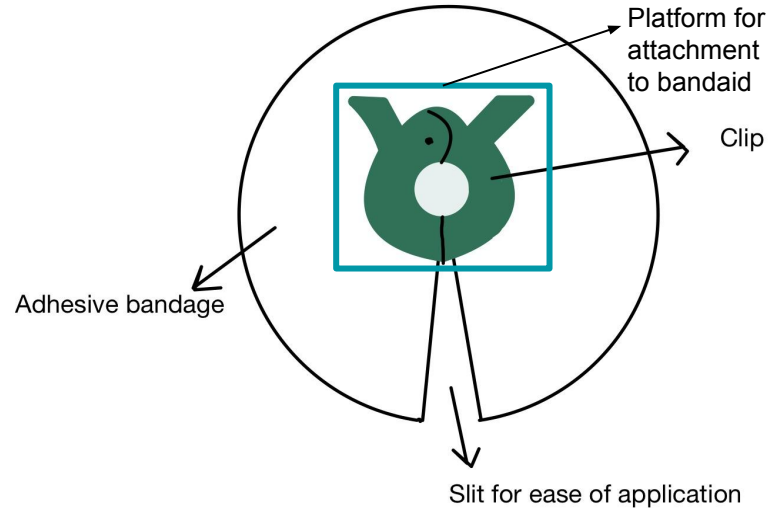


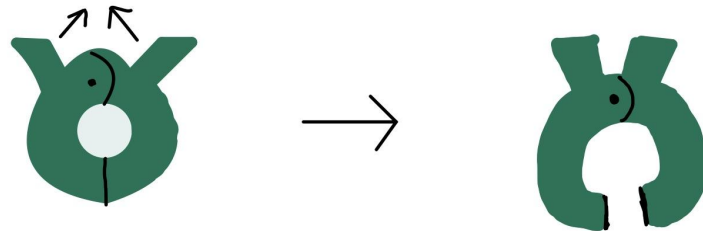
Figure 7: Drain tube attachment devices from Hollister Incorporated [7]

Design 1 : Adhesive Bandage with Clip

- Used with sutures
- Hydrocolloid bandage
- Clip made from high density polyethylene
- Attached to bandage by a glued platform
- Clip is adjustable for different sized surgical drain tubes

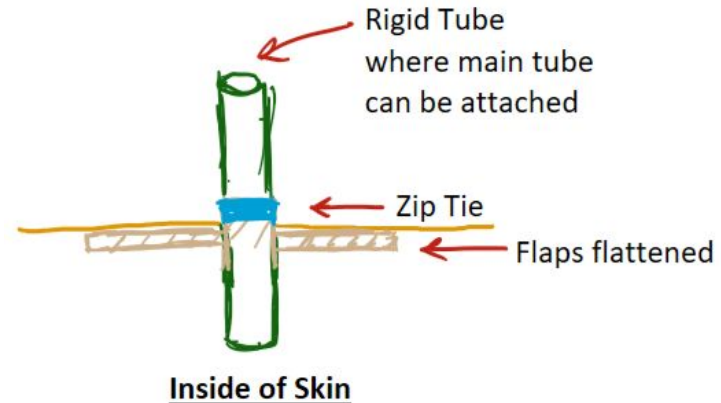
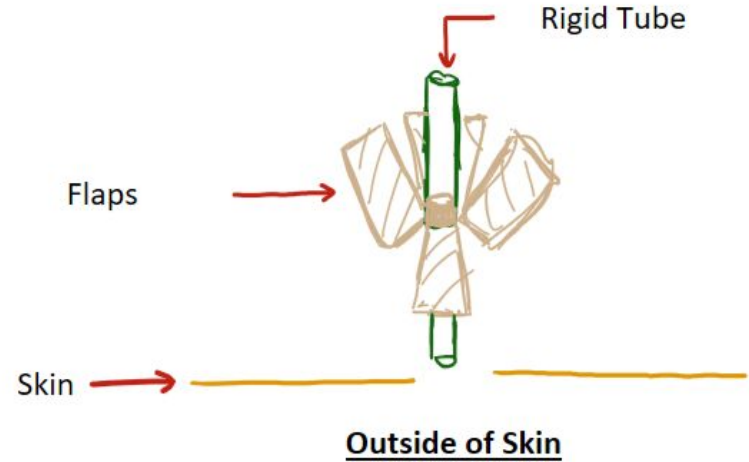


Clip mechanism



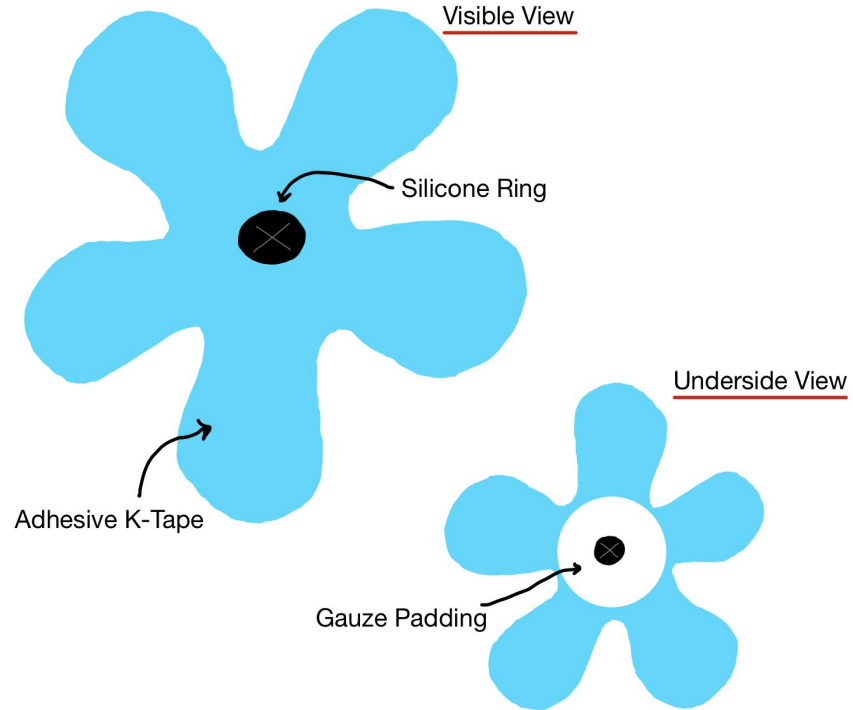
Design 2 : Interior Pressure Distributing Flaps

- No sutures
- Silicone flaps inserted under the skin
- When pulled up the flaps are flattened out under the skin
- Rigid tube would be made from high density polyethylene



Design 3 : Exterior Pressure Distributing Flaps

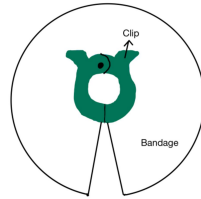
- Used with sutures
- Adhesive kinesiology tape design
- Pressure distribution
- Prevent adhesive irritation near suture
- The silicone ring holds the drain in place



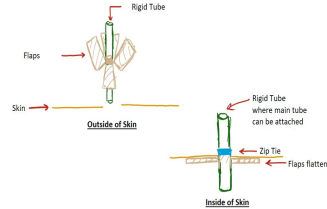
Design Matrix



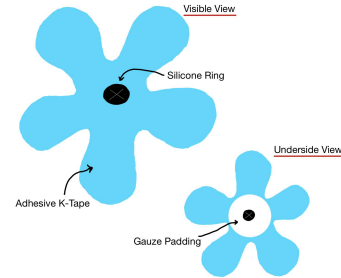
Criteria	Weight	Adhesive Bandage with Clip		Interior Pressure Distributing Flap		Exterior Pressure Distributing Flap	
		Score (10 max)	Weighted Score	Score (10 max)	Weighted Score	Score (10 max)	Weighted Score
Effectiveness	30	8	24	6	18	8	24
Patient Comfort	25	8	20	3	8	9	23
Ease of Use	20	7	14	9	18	6	12
Cost	15	8	12	9	14	6	9
Adaptability	10	10	10	7	7	8	8
Sum	100	Sum	80	Sum	66	Sum	76



Adhesive Bandage with Clip



Interior Pressure Distributing Flap



Exterior Pressure Distributing Flap



Future Work

- Meet with Dr. Russ Johnson - Cardinal Health R&D
- Meet with Dr. Wilke - UW Hospital
- Suture kit as model for fabrication & testing
- Research more on materials and begin fabrication

Acknowledgements

Dr. Tracy Jane Puccinelli

Dr. Katie Kalscheur

Dr. Lee Wilke

Dr. Russ Johnson

BME Department





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- [7] “Tube Attachment Devices | Critical Care Products | Hollister US,” *www.hollister.com*, 2022. <https://www.hollister.com/en/products/Critical-Care-Products/Tube-Securement/Tube-Attachment-Devices#>