GWDISC: A GUIDEWIRE ORGANIZER FOR ENDOVASCULAR PROCEDURES

Team: Tatum Rubald, Addison Dupies, Victoria Heiligenthal, Rachel Krueger, Ben Smith, and Lily Gallagher
Client: Dr. Dai Yamanouchi, MD, PhD – UW Health, Department of Surgery
Advisor: Dr. Suarez-Gonzalez– Department of Biomedical Engineering
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ABSTRACT Endovascular procedures require multiple GWs to be used then stored. GWs must be stored neatly, which is a difficult task due to their spring-like nature. The team tested the prototype against 3 competing designs to solve the issue of organizing GWs. The team's design had comparable storage times to the competitors and offers additional desired characteristics. The stand was modified to be compatible with the final wheel, and an FDA approved material will be chosen for the market device.

Problem Statement

During an endovascular procedure, numerous guidewires (GWs) of varying stiffnesses and diameters are used to navigate the vascular system and position catheters. After GWs are removed, they easily become tangled and disorganized, risking contamination and increasing time in the operating room (OR). To address this problem, the team created a system to store and dispense GWs during an endovascular procedures.

Figure 1: Various guidewire styles and sizes. [1]

Background and Motivation

Figure 2: Unorganized GWs. [2]

Currently, most doctors store used GWs under a wet towel. However, these towels shed fibers onto the wire have the potential to be displaced into the body, at risk for lint contamination complications [3]. Additionally, due to the excessive length of the GW and lack of dispensing mechanism, once the GW is inserted in the body, the remaining length is fully exposed and poses the risk of entanglement. A study about endoscopic procedures found that 13% of procedure errors were due to GW failure including knotting and tangling [4]. In a preliminary survey about GW storage, 75% of residents indicated that they would prefer a new storage method. Due to this demand, the team developed a device that will allow for better organization of GWs and function as a dispensing mechanism, overall decreasing the time spent to manage GWs and reducing contamination risk.

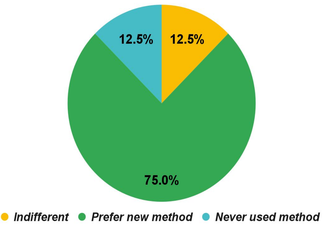

Figure 3: Survey results from residents when asked if they would prefer a new GW organizer.

Design Criteria

- Efficient GW loading and dispensing comparable to competing designs
- Little to no learning curve for GW loading
- Stand design is able to hold up to 3 wheels with 1 GW in each
- GWs stay organized and untangled while stored on wheel
- GWs are dispensable if the wheel is on or off stand
- Device able to hold GWs with diameters of 0.014, 0.018, and 0.035 inches with varying stiffnesses
- Ability to remove wheel from stand once the GW is removed
- Final market device should be biocompatible, single use, and injection molded

Competing Designs

Figure 4 (left): Cath Clip competing design.

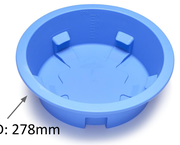

Figure 5 (right): Medline Bowl competing design.

Figure 6 (left): Wet Towel competing design.

Final Design

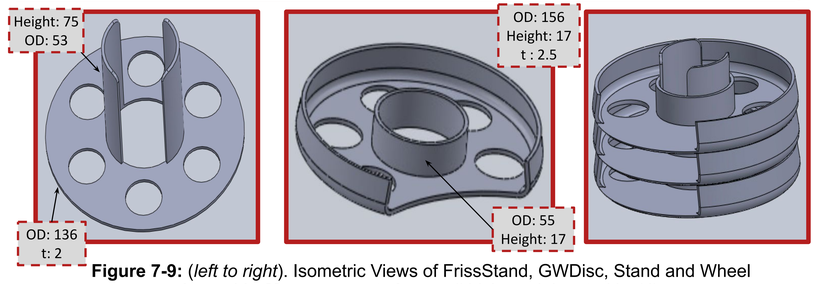

Figure 7-9: (*left to right*). Isometric Views of FrissStand, GWDisc, Stand and Wheel Assembly. **Measurements in mm** ('thickness' denoted by 't').

Testing and Results

- **Goal:** Testing by all team members to compare the team's design to competing designs
- **User Ratings:**
  - Cath Clip: highest quantity of a 3 graded loading
  - 75% of residents claimed towel method causes disorganization in OR half the time

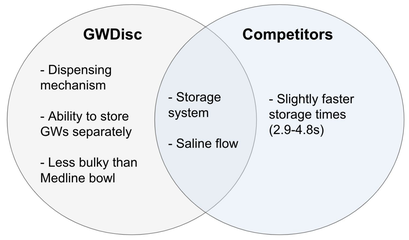

Figure 10: Comparison of GWDisc to competitors.

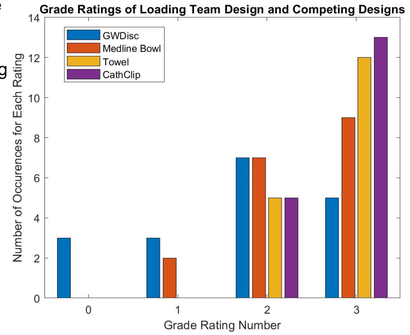

Figure 11: Data distribution of load ratings comparing the GWDisc to competing designs. All designs were rated on a scale from 0-3 (with 3 being the highest/best rating) based on the ability and efficiency of loading the guidewire. All group members performed three trials of loading for each device.

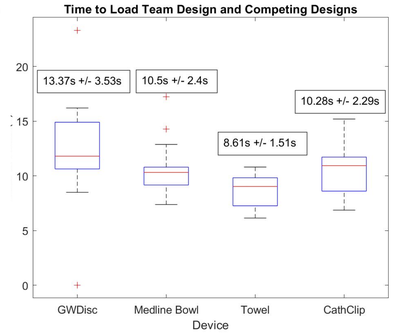

Figure 12: Data distribution of loading times comparing all devices. Significant difference between GWDisc and all competing designs. However, no clinical significance in the extra 2.9-4.8s to load GWDisc*.

Future Work

- **Design:**
  - Finalize intellectual property for wheel design
  - Increase overhang to reduce loading times to be more consistent with competing designs
- **Manufacturing:**
  - Identify a cost-effective mass manufacturer and establish a working relationship with them
  - Mass produce the wheel using collapsible injection molding
  - Use polypropylene to produce product
- **Market:**
  - Compile more data from residents and physicians showing need for guidewire organizer in endovascular procedures
  - Market wheel to physicians and hospitals

Conclusion

With the growing endovascular device market that is currently valued at $2.05B USD and is expected to gain market growth from 2022 to 2028 at a compound annual growth rate (CAGR) of 4.1%, surpassing $2.61B USD by 2028, [5] there is a need for a new storage device for GWs. The GWDisc and FrissStand are a safe and efficient storage and dispensing solution for the fast-paced environment of endovascular procedures. Commercialization of the device will advance the way healthcare professionals operate in endovascular procedures.

Figure 13: Endovascular Device Market Growth [5].

References

[1] "Guidewires," *Spiros*. https://spirosind.com/guidewires/
[2] "Figure 2: Interventional Radiology fellow shows various types of..." *ResearchGate*.
[3] "Lint Fiber–Associated Medical Complications Following Invasive Procedures," News. https://array.aami.org/do/10.2345/article.073cc92d-0ff5-49c9-8d71-7462c5939054/
[4] A. C. Antonacci, S. Lam, V. Lavarias, P. Homel, and R. D. Eavey, "Benchmarking Surgical Incident Reports Using a Database and a Triage System to Reduce Adverse Outcomes," Archives of Surgery, vol. 143, no. 12, pp. 1192–1197, Dec. 2008, doi: 10.1001/archsurg.143.12.1192.
[5] [1] "Endovascular Treatment Devices Market Size 2023: Global Analysis and Forecasting 2030," MarketWatch. https://www.marketwatch.com/press-release/endovascular-treatment-devices-market-size-2023-global-analysis-and-forecasting-2030-2023-04-19 (accessed Apr. 25, 2023).