GUIDEWIRE ORGANIZER FOR ENDOVASCULAR PROCEDURES

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ABSTRACT Endovascular procedures require multiple guidewires to be used then stored. Guidewires must be stored neatly, which is a difficult task due to their spring-like nature. The team tested three prototypes (DYWheel, CutChimney, and CurveSpout) to solve this issue of organizing guidewires. The DYWheel was determined most efficient after testing, but the CutChimney has alternative design advantages. A stand will be designed to be compatible with the final wheel, and an autoclavable material will be chosen for the market device.

Problem Statement

During an endovascular procedure, numerous guidewire types are used to navigate the vascular system and position catheters. After guidewires are removed, however, they can easily become tangled and disorganized, risking contamination and increasing time in the operating room. To address this problem, the team created a system to store and dispense guidewires during endovascular procedures.

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

Background and Motivation

In many endovascular surgeries, the main concern is a dangerous and unorganized environment due to guidewires being difficult to store and manage. Each lost minute in a hospital operating room costs an average of $60 [3]. Thus, this device will decrease time spent on guidewire management, and decrease the number of duplicate wires used due to contamination, overall decreasing the amount of wasted time and money in the operating room (OR). Additionally, this device will allow for better organization and a less hazardous setting in the OR.

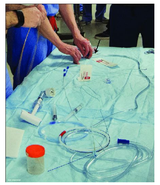


Figure 2. Unorganized Guidewires [2]

Design Criteria

- Enables efficient guidewire loading and unloading
- Little to no learning curve for guidewire loading
- Guidewires stay organized and untangled while stored in the wheel
- Guidewires are removable if the wheel is on or off stand
- Device able to hold guidewire with diameters of 0.014, 0.018, and 0.035 inch with varying stiffnesses
- Ability to remove wheel from stand once the guidewire is removed
- Final market device should be biocompatible and able to be sterilized

Final Design

Description:

- The device includes 3 guidewire wheels and a stand.
- The wheel has a inner cavity that holds the guidewire in place

Progress:

- The team has made 3 prototypes:
  - The first prototype (DYWheel) was the standard and provided by client
  - The latter prototypes were modifications based off of the standard prototype
- The team has tested all prototypes:
  - Loading and Unloading Time Test.
  - Load/Unload Rating Scale (0-3)

Figure 3. *DYWheel* (prototype provided by client) Outer Diameter: 19cm, Chimney Diameter: 4.5cm

Figure 4. *CutChimney* Outer Diameter: 19cm, Chimney Diameter: 4.5cm

Testing and Results

- DYWheel had the most occurrences of 3 rated loading
- DYWheel showed most efficient loading times (ave. 19.61s)
  - Cut chimney did not show significant difference in loading time (p = 0.96)
- DYWheel had shortest unload times
- ***Figure 8*** shows reduction of loading time as number trials increase indicating a small learning curve

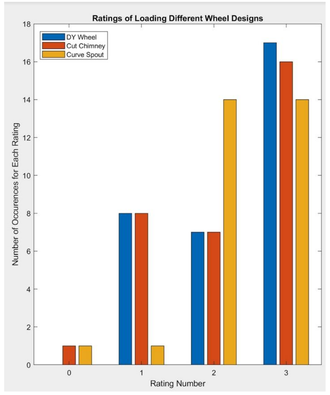


Figure 5 *(left)*. Data distribution of Load Ratings comparing 3 designs

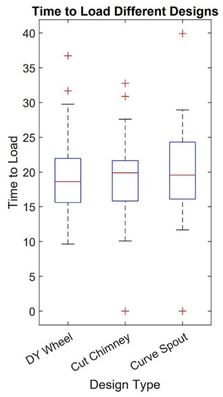
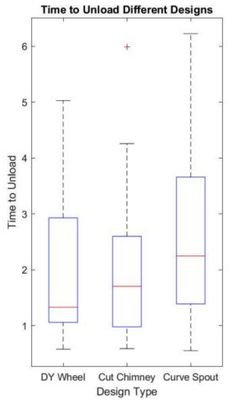


Figure 6 *(right)*. Data distribution of Loading and Unloading times comparing 3 designs



Future Work

- Reprint the wheel design with autoclavable material for sterilization purposes
- Test wheel design with doctors to determine its efficiency in the industry
- Design stand to be compatible with DYWheel or CutChimney

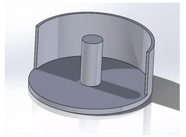


Figure 7. *UHold stand* Dimensions: Outer Diameter: 21 cm. Inner Diameter: 3.5 cm

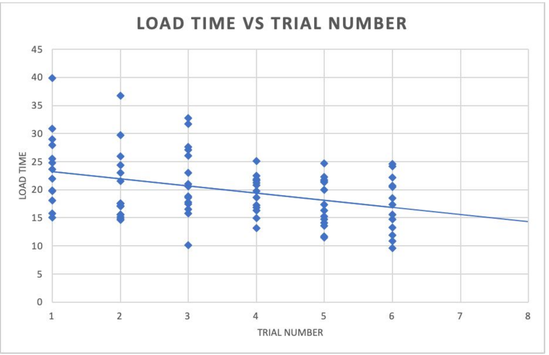


Figure 8: Trend line with projection shows that loading time decreases as trial number increases

Conclusion

The DYWheel loaded most efficiently, but the CutChimney is a close alternative that allows for any wheel to be removed at any location on the stand. Both designs will be considered for future work.

References

[1] "Guidewires," *Spiros*. [Online]. Available: https://spirosind.com/guidewires/. [Accessed: 26-Apr-2022]
[2] "Figure 2: Interventional Radiology fellow shows various types of...," *ResearchGate*.
[3] H. Gül, "Occupational health and safety in operating rooms," *IntechOpen*, 26-May-2021. [Online]. Available: https://www.intechopen.com/online-first/76118. [Accessed: 23-Sep-2021].
https://www.researchgate.net/figure/Interventional-Radiology-fellow-shows-various-types-of-angiography-catheters-and_fig2_320048703 (accessed Apr. 26, 2022).