FUNCTIONAL OPTIMIZATION OF LAYCO'S VELA™ VACUUM EXTRACTOR

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Layco is a medical device start up developing affordable and high-quality medical devices without disposables [1]. They are currently working on the Vela which is a reusable vacuum extractor. Vacuum extraction uses vacuum and traction to help assist a delivery. The Vela consists of 3 main parts, the handle with the pump, suction tubing, and cup. This thesis looks at the functional optimizations of the suction tubing and cup connection. These optimizations should all keep in mind the company's main objectives described above. Assumptions and research findings will be used to critically evaluate what is desirable for this product.

This project will tackle the following question:

What is possible to optimize in the functionality of the construction of Layco's Vela extractor vacuum regarding the suction tubing?

This main question will be answered with the help of already existing solutions, research, manufacturing company's inputs and Layco's assumptions. These solutions will be translated into a logical overview and then attacked to see which solution is most optimal. With the decisions made for optimizing the product, a final prototype has been designed. This design works with the balance of strength and flexibility to fulfill the requirements. Looking forwards, Layco can further develop this design's material and manufacturing selection and then test if all requirements are fulfilled.

This thesis includes the preliminary phase, design phase, embodiment, and detailing phase and lastly, the implementation phase.

The preliminary phase covers the research and analysis of existing solutions, concluding with a requirement list. It looked at the single use solution and took out information that can be incorporated into the Vela. Furthermore, it looked at the single use solutions and found the differences which were then researched to create new requirements. Requirements regarding the amount to uses the product will have to survive without impacting the functionality, ergonomics or cleanability of the device were found with these differences.

The design phase covered the conversion of the findings from the first phase into ideation and conceptualization. It looked at how to balance between strength and flexibility using geometry, material and production definition. An FMEA was made finding solutions, which were organized using a morphological chart. With this logical overview concepts were created. In concluded on deciding the cup and tube will be an encapsulated part.

In the embodiment and detailing phase these solutions were critically assessed and with the help of professor, manufacturer and Layco's input decided on specific optimizations, resulting with the final prototype. Looking into the feasibility of the product from a manufacturing point of view helped decide the final design.

Lastly, the implementation phase wraps up the design process by evaluating the final prototype and decisions made in the phase before. This concludes with a recommendation for the company's next steps and what to look out for when optimizing. It challenges them to shake their own assumptions and requirements. It also questioned them when there are enough optimizations. When is this the minimal viable product?

Figure 1: Existing Vacuum Extractor Tubes

Bibliography

[1] Layco Medical Devices, “About us,” *Laycomedical*, 2023. https://laycomedical.com/about-us/ (accessed Jun. 29, 2023