

Ergonomic Reevaluation of a Surgical Stapling Device

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Surgical staples are commonly used for tissue closure during laparoscopic surgeries. However, many of the stapler devices on the market are heavy and require both a large grip size and force; therefore, a majority of female or aging surgeons are not accommodated. This is especially a problem because the female surgeon population is growing at a larger rate every year. Under the request and supervision of our client Dr. Liepert, a surgeon at the University of Wisconsin Hospital, we have focused our efforts this semester on designing a laparoscopic surgical stapler grip that will accommodate a larger portion of the surgeon population. In addition, Dr. Liepert requested that the speed of the stapler clamping mechanism can be controlled for safety reasons.

There are numerous comparable surgical staplers available on the market, and the average automatic, disposable stapler can cost up to \$800 per unit. The competing design that best fulfills the project problem statement and design criteria is the iDrive Ultra Powered Stapling System by Medtronic. The stapler is powered by a battery pack and is controlled via three buttons near the surgeon's right hand. However, the configuration and the weight of the device still inflicts excessive, unnecessary strain on the operator's wrist and elbow. The iDrive Ultra also lacks the clamping control desired by Dr. Liepert, introducing a possible safety concern for patients under her care.

After several iterations, the team finalized an in-line grip configuration that meets Dr. Liepert's specifications. Using anthropometric standards, the team designed the model to be comfortable for most grip sizes, with considerations for all the stages of the procedure. All of the necessary levers and triggers are included from the existing model, simply rearranged to better accommodate a larger percentage of the population. Therefore, the surgeon's experience with the existing stapler mechanisms should be transferable to our design, which minimizes the amount of retraining required. The potential for intellectual property lies in the rearrangement of the components from the old device in order to support the wide range of surgeons within the niche of laparoscopic surgeries.

This product will be marketed as "procedure-specific" for smaller procedures such as an appendectomy. The in-line grip has been designed to fit a majority of grip sizes and aims to be comfortable for the greater surgeon population. Because of the affiliation of UW Health with Johnson & Johnson's Ethicon company, partnering with Ethicon in order to produce the device would be both beneficial and preferable.

The team will begin the testing and validation stage by presenting our prototype to Dr. Liepert and her colleges to gain valuable opinions on the comfort of the grip. We plan to observe how the device is gripped throughout different procedures in which the stapler would be used, and we will make assessments on the surgeon's hand and arm placement. Based off of anthropometric standards, we strongly believe our design will fit the requirements described by the client.

With success of this design, the team aims to not only better accommodate the female surgeon population, but also reimagine how the surgical stapler is used. With the in-line grip and improved configuration, this prototype expands the usage possibilities of the stapler and allows for more procedure-specific care for patients. This means that our product will not only benefit the surgeon, but also the patient, who will always be the first priority in medical device design.