Utilization of Biomimetic and Mechanical Designs To Engineer a More Efficient Surgical Laparoscopic Grasper

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A reputable study (Heijnsdijk et al., 2002) found that only 62% of grasping actions using laparoscopic graspers were a success. One reason for this low success rate could be the way the grip pattern is designed. The other is that surgeons are not able to feel the graspers are slipping, which is a lack of haptic feedback. Possible ways to solve this are by providing force feedback and haptic feedback to the surgeon. Although the latter are possible solutions, they were not the focus of this project. Biomimicry was utilized in this project by mimicking Tree Frog's toe pads due to their ability to grasp objects in a rainforest environment. There was also a mechanical design that was used from a high-performance Summer and wet season tire. These designs were mimicked in Fusion 360 via caps roughly the size of Laparoscopic Graspers, using standard filament and resin to 3D print them. Through testing using the 3D printed caps and a force sensor, the results found that in dry conditions the Mechanical design worked best. In wet conditions, the Mechanical and Biomimicry design were found to be statistically better than the current design, also with a potential trend towards the Frog Pad design being the best with more testing. In both wet and dry conditions, our current solution and the slick design were found not to be statistically different. This study demonstrates that the current design used for surgical graspers is not as effective as the mechanical or biomimetic counter-designs.

Awards Won:

Fourth Award of $500

Missouri University of Science and Technology: $575 Missouri S&amp
T summer camp scholarship