Executive Summary

Surgical Simulator for Endoscopic Carpal Tunnel Surgery

All surgical procedures require practice and repetition in order to achieve optimal outcomes. Currently, carpal tunnel syndrome release surgery is only performed on cadavers or live patients. Therefore, the cost of practicing this procedure is quite high. To reduce this cost and improve surgical performance, an ideal solution is an anatomically accurate simulator with realistic haptics. Our simulation device will not only reduce costs, but also improve patient safety and maximize hospital resources.

Although many surgical simulators are in use, no current devices incorporate haptics and realistic visuals simultaneously for a low cost. Hybrid surgical simulators allow for interaction between virtual and physical models where the surgeon views virtual images on a monitor but uses real instruments, but currently only exist for laparoscopic surgery. Until now, no device has existed for simulating endoscopic carpal tunnel surgery that employs the hybrid approach while providing an accurate anatomical model.

Our design is marketable to hospitals around the country as it reduces the need for cadaver utilization and increases the frequency at which surgeons are able to practice the procedure. Costs of simulation systems can range anywhere from $75,000 for basic models, to over $100,000 for advanced, high end models. Currently, the unit cost of our device is approximately $900 with a possible selling price of $10,000. Not only is this a considerable reduction in cost, but our design could also serve as a model for the development of subsequent simulators, opening tremendous commercial opportunity across surgical fields.

Our device consists of a silicone-based hand model, an endoscope fitted with a circuit board housing three LEDs, and a receiver which reads three-axis position data from the LEDs. This combines both a mechanical model and software images to create a realistic training tool. Our design has been tested for both accuracy and range of distance readings. Feedback from experienced surgeons was implemented to help optimize the prototype and produce realistic haptics throughout the simulation.