**Thesis Project Portfolio**

# Quantitative ACL Tibial Guide: Improving Clinical Outcomes of ACL Reconstruction Surgery

(Technical Report)

# Factors that Influence the Disconnect Between Physicians and Engineers

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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Bachelor of Science, School of Engineering

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## Sociotechnical Synthesis

Engineers must consider the users of their technology to properly develop a tool for them to use. This is especially important for biomedical engineers as they want to produce life-saving technology for doctors to use. They do not want to create something that will hinder the doctor's actions in any way. Therefore, the two professions need to understand one another and the way each other thinks. This will allow better communication and a better product. Both my technical and STS projects investigate this relationship between engineers and doctors. The technical project puts me in a position, as an engineer, to work with a physician to create a new medical device. The technical project team designed a new tibial guide to be used in anterior cruciate ligament (ACL) reconstruction surgery to improve the procedure and clinical outcomes. The STS project looked into what factors motivate the decision-making of engineers and doctors in order to identify the disconnect between the two professions.

ACL injuries are among the most prevalent knee injuries, with 100,000 to 200,000 people in the United States getting ACL tears annually. The goal of our capstone design project is to reduce variability in the location of the graft placement and improve postoperative knee stability. The current tibial guides on the market utilize anatomical landmarks identified through arthroscopy to locate the tunnel placement, which yields inconsistent graft placement. We created 3 prototypes that incorporated measurement features to provide increased accuracy and consistency for the bone tunnels. The design utilizes the fact that the measurement of anterior to posterior tibial plateau length can be utilized as a quantitative determinant of optimal graft placement, without reliance on cameras. Adjustments were made between each prototype to create a tibial guide with the most holistic functions in the most simplistic form which provides orthopedic surgeons with maximum efficiency during an ACL reconstruction surgery.

The STS research investigated the disconnect that occurs between physicians and engineers as it is often difficult to get physicians to adopt new medical technology. This project looks into the difference in the way the two professions think as a potential reason. Professionals are strongly influenced by the way they are trained which may cause differing points of view. I performed content analysis on studies looking into the factors that influence physician decision-making to identify which common factors among all the studies. Moreover, I performed discourse analysis on user manuals for various surgical tools. I examined these texts through the lens of configuring the user, by Steve Woolgar, to see if engineers are improperly limiting their users, the physicians, with the medical tools they are developing. This is used along with the factors that influence physician decision-making to understand differences in how the two professions view the creation of a new medical device. The results identified some considerations engineers should look at when developing medical technology to be used by physicians and how they should portray that information.

In working on both projects simultaneously, I was able to utilize different perspectives that I wouldn't have if I did each project individually. Since the topics complemented each other, I could take experiences from one project to influence the next steps in the other project. As I conducted my research into the disconnect between physicians and engineers, I was able to take what I found and influence how I interacted with my physician advisors on the technical project. Additionally, my experiences as an engineer, designing a medical device, gave me a better perspective on what engineers are thinking about through the design process. Therefore, each study bettered the results of the other. The STS research helped me better communicate with my physician advisor throughout the lifespan of the capstone. On the other hand, the technical project put me in a situation that reflected the topic of the STS research.