

**Thesis Project Portfolio**

**Dual Injection Syringe for Ultrasound-Guided Musculoskeletal Injections**

(Technical Report)

**An Analysis of Morality and Ethics in the Evolution of Sports Medicine**

(STS Research Paper)

An Undergraduate Thesis

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

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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## **Sociotechnical Synthesis**

Over the course of the last few decades the field of medicine has expanded in how they diagnose and treat patients. In turn, the field of sports medicine has also been able to grow as a result of the advancement of technology and knowledge in health. As a society that desires for longevity in life expectancy and health, these advancements have been able to enhance healthcare to levels previously only dreamt of.

My technical thesis overviews the design and development of a double barrel syringe for ultrasound-guided injections within the musculoskeletal system. These are common procedures in both family and sports medicine practices. Due to the need for precision, the physician must use an ultrasound with one hand, forcing them to administer two injectates with other. The goal of this project was to improve the procedural efficiency for physicians as well improve the comfort of the patients. My team underwent the iterative design process in order to develop a syringe prototype capable of being operated with one hand. Using a rapid prototyping approach, we were able to 3D print different models that would improve this procedure.

My STS thesis analyzes the advancements of sports medicine and the moral and ethical issues within the field. I demonstrate how the field has grown in the number of participants as well as how the technology and knowledge used has evolved. Analysis on the relevant actors within the field, along with the moral and ethical dilemmas they face demonstrates a grey area in decision making as the field of medicine is considered. With the advancements in the technology used in sports medicine, moral and ethical decisions regarding an athlete's health and safety are examined.

The technical project achieved the goal of developing a prototype that satisfied most of our specific requirements. However, we were unable to gather significant data to analyze and

justify our device as improving the procedure. Precision errors in 3D printing as well as lack of access to necessary printers as a result of the COVID-19 pandemic hindered my team's ability to achieve all of our goals. My STS research introduces an issue within the field of sports medicine that I believe needs to be discussed on a higher level. How injuries are monitored and treated as technology and knowledge expand, the ethics in the decisions regarding player health and safety needs to be addressed by the sports medicine society.

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