

Thesis Project Portfolio

Redesigning and Prototyping a Micro Scissor for Micro-Anastomosis Post-Mastectomy
(Technical Report)

Reconstructing Equity: A deep dive into the factors that influence African American women's decision to pursue breast reconstruction
(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

Breast Reconstruction has been promoted to women who have undergone a mastectomy as a way to reconstruct the look of the breast with harvested tissue. My technical project works directly with the physical side of breast reconstruction, focusing on redesigning and prototyping a sinusoidal micro scissor that can make a clean cut and maximize the usable tissue of the veins for surgery to avoid tissue death and a failed surgery. My STS project focuses on the social side, looking into racial disparity in the medical industry and analyzing the factors that influence African American women to pursue breast reconstruction. This approaches breast reconstruction from a multifaceted view of both technical and social by understanding the technology involved in the surgery and the reasons for pursuing a specialized surgery. The analysis of both the technical and social aspects of breast reconstruction has allowed for me to have a better understanding of this surgery as a whole, as well as bring awareness to inequity in the medical field and where it stems from.

According to Dr. Campbell, a vein 2.5 mm or less in diameter used in surgery leads to a higher chance of blood clotting and tissue death. Couplers are a circular device used to connect the veins that contain 6 pins on each side to hook the vein on and keep taught when stitching. We believe that redesigning the blade to have a sinusoidal curve can maximize the tissue around each pin, making it easier to stitch and less likely for the surgery to fail. The aim of my technical research project was to create a Computer-Aided Design (CAD) and 3D print a prototype of a new sinusoidal design of a micro scissor blade based on the original design of a straight micro scissor blade from my advisor, Dr. Christopher Campbell's lab. The final iteration using a titanium stereolithography (SLA) printer was analyzed and metrics were obtained using ImageJ software and compared to metrics obtained from the straight blade. While further cadaverous vein testing is needed, initial rounds suggest the sinusoidal blade creates more maximum usable tissue compared to the straight blade.

My STS project focused on using STS theories such as Actor-Network Theory (ANT) and Critical Race Theory (CRT) to analyze factors such as body image, medical mistrust, and socioeconomic standing that may have influence on African American women pursuing breast reconstruction. Studies have found lower rates of breast reconstruction amongst African American women compared to Caucasian women. I argued that a clear racial disparity existed in African American women's access to and the decision making process regarding breast reconstruction based on these factors and aimed to discover which factor had the greatest impact. I used ANT to explore the interactions between social media, cultural norms, and body image, and analyzed this network and its relationship to breast reconstruction. I used CRT to understand medical mistrust amongst African Americans and the genesis of this, along with the impact of systemic racism on socioeconomic factors and access to care.

Through thorough research and experimentation, I was able to immerse myself in the world of breast reconstruction and obtain a well-rounded understanding of both the technical and social aspects of this specialized procedure. Prior to this research, I had not known the impact this procedure can have on women, both physically and socially. My technical project allowed me to combine my passion for engineering and medicine to create a product that can help not

only those pursuing breast reconstruction, but other reconstructive surgeries involving other tissue. My STS project allowed me to explore a deeper understanding past the technology and analyze the underlying issues behind access to this surgery. Future research should look into implementing new policies to bring active change to these racial disparities.

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