

## Sociotechnical Synthesis (Executive Summary)

The technical and STS projects were focused on improving the condition and development of rehabilitation aids with lower limb difficulties. The technical portion analyzed forces on three versions of a knee brace whereas the STS research was geared towards increasing prosthetic acceptance. These two fields are quite similar as they both were aimed to increase the efficacy of lower-limb rehabilitation aids and thus the information gained is transferable. My personal interest is in the field of prosthetics which is why the STS research looked into a potential method to increase prosthetic embodiment in patients. Knowledge gained from the research guides engineers how to create a more inclusive, empathetic, and patient-centered design process in order to produce the best results in patient approval and functionality. Since the technical portion of the research involves the engineering design process, factors identified in the STS research should be applied to future engineering design.

The technical portion of research involved a finite element analysis of forces on 3 forms of the Icarus Ascender knee brace with and without extension stops. These extension stops help prevent osteoarthritis patients from overextending the knee. Lateral, medial, tensile, and compressive forces were placed on the braces using Autodesk Inventor to simulate daily and activewear. Results indicate the safety of these braces with the new extension stop technology included in the Ascender brace. This technological research ensures the success of the brace under the different loading conditions and expedites the development process as many simulations can be run for many designs.

The STS research included an analysis of prosthetic embodiment utilizing a lens of phenomenology. Prosthetic embodiment touches on the success of the prosthetic in the eyes of the engineer and also the eyes of the patient and their interactions in society. In this case, utilizing phenomenology to include the prosthetic and the user's perceived experience provided a way to better understand the factors impacting prosthetic embodiment. This expanded view of prosthetic embodiment provides the framework for future prosthetic development processes, implementation, and education.

Overall, the combination of technical and STS research highlights the importance of ethical responsibility in engineering. The technical finite element analysis of the knee brace does not include the perspective of the patient. The STS research indicates the importance of including amputee patients in the design process as it increases acceptance and guides engineers on potential solutions otherwise not noted. Here, the STS research provides an empathetic perspective for engineers to increase the success of lower limb rehabilitation and mobility aids. Without considering phenomenology or the patient experience in research for lower limb rehabilitation aids, engineers will be limited in the success of their technical designs as expressed by the combination of the technical and STS research conducted.