3D Printable Transtibial Prosthetic

Kroll, Everett

Amputations affect over 1 million people worldwide each year. War and disease take a toll from too many who can hardly afford to pay. The goal of this project is to design and build a cost effective 3D printable transtibial prosthesis that functions as capably as mainstream prostheses standardly available in developed countries. 3D printing allows for prostheses to be easily scaled, redesigned and reprinted as needed, by replacing expensive materials such as metals and circuits with 3D printable polymers instead. Polymer research identified key chemical and mechanical properties necessary for a durable prosthetic. Polycarbonate, Polystyrene and Polypropylene were identified as having the optimal balance of elasticity, structural integrity and strength required for the prosthesis. Researching ankle and foot movement; combined with the study of gait analysis; allowed for an understanding of how various bones, ligaments, tendons and muscles work together, to enable walking; so they could be mirrored in the 3D printable design. Key physics concepts, including center of mass, moment of inertia, and Young's modulus were also incorporated into the prosthesis development. Other details, such as improved grip and a split toe shank base plate, ensure all manner of standard walking can be accommodated. The estimated cost will be less than $100, substantially more affordable than the $18,000 average cost of a transtibial prosthetic. The result is an affordable, highly versatile and aesthetically appealing transtibial prosthetic, capable of restoring the fundamental human function of comfortably walking for millions of transtibial amputees in developing countries.

Awards Won:
U.S. Agency for International Development: USAID Global Development Innovation Second Place Award of $2000