Overview

Over the past decade, the ACL tear is becoming more common in younger athletes due to increase in physical activities. The ACL reconstruction surgery is a complex procedure in younger patient due to the presence of the growth plates. Therefore, there is a need for a paediatric patient specific 3D printed model, so, the surgeons can practice the surgery before repairing a damaged ACL to have a minimum effect on the growth plate.

Objectives

The objective of this project was to utilize the MRI scans of adolescent knees provided by the sponsor. The data were compiled using software such as Simpleware and Solidworks to create 3D models of an adolescent knee that includes growth plate for tibia and femur. Lastly, the models were assembled using pegs and holes and printed on a ABS material.

Approach

- Customer needs were requirements given by both Stephan J. Piazza, Professor of Kinesiology and Dov A. Bader, MD.
- Five concepts were generated after taking into account all of the customer needs.
- Existing product were researched and we had a meeting with our sponsor almost every week.
- We used a Pugh scoring matrix to rank the importance of our five concepts.
- We created 3D models from the MRI scans using Simpleware, and then we exported these models models as STL. Using a software called Rhinoceros, we were able to modify our models.
- We modified the models we created using Solidworks and 3D printed them.
- We tested the models and the the test was comprised of a drilled hole through a fully assembled tibia.
- Validating the model was basically checking the model if it melts or fractures after drilling the hole.
- Generated results were that the models we created can handle what surgeons do to a real knee.

Outcomes

- The sponsor will have a foundation (our models) that can be used to build more advanced prototypes.
- This project showed a proof of concept 3D printed models provide useful information for planning adolescent ACL reconstructive surgery.