Growing Spine Implant and Test Method

Paul, Harry

Congenital scoliosis is a lateral curvature of the spinal column caused by in utero segmentation failures. As initial deformities are exaggerated during anatomical development, the formation of the vital organs in the thoracic cavity is greatly impeded. This research provides a novel implant for the treatment of congenital scoliosis that has the promise of lowering the number of risky revision procedures from over a dozen to less than five over the course of pediatric surgical treatment. In the iterative biomechanical design of the implant system, six generations of successive changes improved the functionality of the implant. The design criteria for the minimally invasive, mechanically stable growth-dependent treatment system of congenital scoliosis were satisfied. The material Ti-6Al-4V-ELI was chosen for its biocompatibility, strength, and low coefficient of thermal expansion. Finite element analysis was used to optimize the structural and functional features of the implant. Bi-directional bending, torsion, and most importantly, tension tests were performed, with an 89.3% decrease in Von Misses tension stress from the first design to the last. The mechanically growing model of the spinal column that was designed for functional testing fills a gap in the industry by promoting interdisciplinary collaboration. These inventions provide a firm basis for future advances in pediatric spinal implant design and testing to greatly improve the quality of life for childhood victims of scoliosis.

Awards Won:

First Award of $5,000

Intel ISEF Best of Category Award of $5,000