CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)
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Project Number
36498

Project Title
An Exoskeleton of the Spinal Cord to Prevent Scoliosis

Abstract

Objectives/Goals
Spinal vertebrae come in a variety of shapes, but how do the angles of each vertebra change the shape of the corresponding plate. Can an exoskeleton following these angles be worn on the exterior of the body? The larger differences in the vertebrae, the larger differences in the shapes of each plate would be; therefore, looking into specifics on each vertebra with the use of around thirty cadavers would aid in the process of calculating the different angles of each vertebra. A designed model of the corresponding plate, was created using Creo Parametric and GeoGebra. As the angles generally increased from the C3 vertebra to the T7 vertebrae, they ranged from 118.9 degrees to 292 degrees, and near the lower region of the spinal cord, the angles spiked (319.7 degrees) due to their larger size and lesser necessity for movement. The original hypothesis was accepted, because the data shows large changes in each vertebra depending on the calculated angles; however, a trend noticed with the middle vertebrae section is that they are very similar in structure due to minimal differentiation in their angles and homogenous functions. The viability of the exoskeleton will be determined by the structures of each vertebrae and how they aid in the function of supporting the spinal cord.

Methods/Materials
The largest aspect of the this project was finding the angles of each vertebrae in order to make the corresponding plates. The software GeoGebra was used to find the specific angles of each vertebrae in the spinal cord. Then the software PTC Creo Parametric (a computer aided design software) was used to 3D model each plate to be made by a manufacturer.

Results
Depending on the angle of the vertebra, having some form of an angle upward to extend was very common. The Thoracic plates were greatly affected by these angles, because they had to accommodate angles as high as 292.48 degrees in T8. The larger the angles, the larger the cutout would be at the top of each plate.

Conclusions/Discussion
The hypothesis, if the spinal cord has minor differences in structure, then the angles will have minor differences was accepted. Some vertebrae had practically the same angles, or were only different by half a degree, and those plates appeared very similar. Most of the angles increased, but there were some points where there was an obvious decrease. Overall, the data and CAD model showed the hypothesis to be almost always accurate.

Summary Statement
A spinal cord exoskeleton was designed by using the different angles in each vertebrae in order to develope a CAD model of the exoskeleton.

Help Received
I received a book on the Biomechanics of the Spinal Cord from a local chiropractor; however, I calculated my data and designed the exoskeleton by myself.