



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

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| Name(s) Sophia A. Brodish | Project Number S0301 |
| Project Title Spinal Curvature Treatment: The Utilization of Resorbable Anterior Spinal Fusion Systems to Combat Spinal Deformities | |
| <p style="text-align: center;">Abstract</p> <p>Objectives/Goals Considering the variety of spinal deformity treatments, many patients agree that after surgery their mobility is significantly reduced. The utilization of resorbable materials for anterior spinal fusion systems, patients will experience the success of spinal deformity treatment and retain their prior mobility. If the systems are used on vertebrae with larger anterior width, then the spinal plate curvatures and screw trajectories will be at larger angles. Plate curvature and screw trajectory (in degrees) observations can be seen because the spinal plates varied based on the sine curvature shape of the spinal cord and increased downward from the Cervical Cord to the Coccyx. This is shown because the largest vertebra (L5) with a 2.18-inch width had the largest angles and second largest screw trajectory. The smallest vertebrae were the C4 and T4 vertebrae that had the same width of 1.08-inches; however, the C4 had the smallest plate angles and screw trajectories ranging from 76.95-95.13 degrees. The research and data provided insight to see how anterior spinal fusion systems would be required to be shaped in ways that correlate with the spinal cord in order for improved mobility.</p> <p>Methods/Materials Sahand University provided a CAD cadaver of a spinal cord specimen and was imported into Creo to retain measurements for the design of the spinal cages. Creo was used to create the spinal cages along with Desmos to view spinal curvature and Geogebra to look at different angles within the systems. The models were imported into a MakerBot (3D Printer Software) and printed with plastic filament.</p> <p>Results An increase in angles of spinal curvature can be seen from the C1 to the L5. The screw trajectory data did not show a specific trend for the plates; however, the maximum angle was 115.34 degrees and the minimum was 67.36 degrees. The data favored that the higher the width of the spinal vertebrae, the larger the screw trajectory and plate angle.</p> <p>Conclusions/Discussion The hypothesis, if the spinal implant systems are used on vertebrae with larger anterior width, then the spinal plate curvatures and screw trajectories will be at larger angles, was accepted. Many of the vertebrae with larger widths were in the Lumbar cord, which had the largest plate angles; however, they did have a few lower screw trajectories. The vertebrae with the smallest widths were mainly in the Cervical Cord which had the lowest plate angles.</p> | |
| Summary Statement By viewing different anterior spinal fusion systems in correlation with the spinal cord, spinal cages were designed via the use of 3D modelling and printed using a 3D printer in order to show variation within each systems' curvature. | |
| Help Received Sahand University of Technology- Provided CAD Cadaver & Dr. Bret Sullivan- Local Chiropractor | |