Progressive Spinal Deformity Correction via an Anterior Based Tether in a Porcine Scoliosis Model: A Detailed Radiographic Analysis

B.N. Ungar¹, F.J. Schwab¹, A. Patel¹, E. Chay¹, J. Demakakos¹, J.-P. Farcy², V.C. Lafage¹
¹NYU Hospital for Joint Diseases, Orthopaedics, New York, NY, United States, ²Maimonides Medical Center, Brooklyn, NY, United States

Introduction: Non-fusion techniques for surgical correction of scoliosis in an immature spine have recently received substantial interest. Using an established Porcine Scoliosis Model (PSM), this study aims to investigate the impact of an anterior convex spinal tether on radiographic alignment changes with growth (non-fusion).

Methods: This IACUC approved Study included 10 immature Yorkshire Pigs divided equally into 2 groups; tether release group (TR) and anterior corrective tether group (AC). All animals underwent scoliosis induction surgery (max. coronal Cobb: 17°-25°) at 12 weeks of age and progressed a mean 4.0°/week. Once >50° was noted, a second surgical intervention was pursued: TR had release of the inducing tether; AC had tether release and placement of a corrective device over the 5 apical vertebrae. Both groups were observed for an additional 16 weeks with bi-weekly radiographs. Student t-test was used to investigate radiographic differences between groups.

Results: No significant differences existed between TR and AC regarding: induced Cobb angle, days with deforming tether, or coronal and sagittal alignment before the 2nd intervention (all, p>0.05).

Coronal Plane:
Significant differences in Cobb angle between TR and AC animals were noted following the 2nd intervention (TR: 44.4°±2.2° and AC: 35.0°±2.4°; p=0.001) and bi-weekly beyond 4 weeks (p< 0.01). Final Cobb measurements were 45.0°±2.9° for TR and 24.4°±9.0° for AC (p=0.001).

Sagittal Plane:
No significant differences existed in sagittal alignment between TR and AC animals immediately following the 2nd intervention (TR: 14.4°±26.2° and AC: 16.2°±10.2°; p=0.88) and at final follow up, TR: 16.2°±20.9° and AC: 21.2°±12.3° (p=0.65).

Conclusions: Using the PSM, this study investigated radiographic differences between control and treatment groups. Application of a non-fusion anterior based convex staple-screw-tether resulted in significant progressive correction of the coronal spinal deformity (~50%) without significant sagittal plane re-alignment. Data from this study support the possibility of clinical techniques for non-fusion scoliosis correction in the immature spine through growth modulation.
Coronal Cobb Angle Progression: Tether Release vs. Anterior Correction Branch

[Cornoral Cobb Angle Progression: TR vs. AC]