A BIOMECHANICAL ANALYSIS OF GROWING RODS USED IN THE MANAGEMENT OF EARLY ONSET SCOLIOSIS USING A ROBOTIC TESTING FACILITY.

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Introduction
This investigation tested semi-constrained growing rods and rigid fusion rods used in the management of scoliosis and examined how instrumentation with these devices affected the biomechanical properties of the spine.

Methods
A six-degree of freedom robotic arm was used to test fresh frozen, seven level (T9-L2) porcine spine sections fitted with optical tracking equipment. The specimen was attached to the robotic arm superiorly and an x-y plate inferiorly to allow for unconstrained motion in these axes. Each specimen was tested uninstrumented and instrumented with both semi-constrained growing rods and rigid fusion rods. Displacement-controlled testing of each specimen was conducted to 4Nm (1deg/sec) in flexion and extension, lateral bending and axial rotations and the motion of individual vertebral bodies was recorded. The effects of the two instrumented constructs were compared to the unistrumented spine at each level in the specimen.

Results
A change in the rotation distribution was seen with the addition of the two constructs. For example, at the T12-13 level (centre of the construct), under extension the proportion of the total rotation in this joint was 15% in the unistrumented state (UN), 7% instrumented with growing rods (GR) and 3% when instrumented with rigid rods (RR). In flexion this changed to 27% UN, 12% GR and 10% RR. Lateral bending 20% UN, 13% GR and 10% RR. The smallest differences were seen in axial rotation 14% UN, 12% GR, 6% RR.

Conclusion
This study shows that semi-constrained growing rods allow a greater range of motion than rigid rods in our porcine model through instrumented levels. These findings support the use of semi-constrained growing rods, as this construct allows a range of motion that is closer to that found in an uninstrumented spine while correcting deformity and allowing for continued growth.

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