THE STABILISING ROLE OF THE COSTOVERTEBRAL JOINTS AND SPINOUS PROCESSES ON THORACIC SPINE STABILITY

*Suni N, Askin GN, Labrom RD, Izatt MT, Pearcy MJ, Adam CJ

QUT/Mater Paediatric Spine Research Group, Queensland University of Technology, Mater Health Services, Brisbane, Qld, Australia

Introduction
The importance of in vitro biomechanical testing in today’s understanding of spinal pathology and treatment modalities cannot be stressed enough. Different studies have used differing levels of dissection of their spinal segments for their testing protocols[1, 2]. The aim of this study was to assess the impact of removing the costovertebral joints and partial resection of the spinous process sequentially, on the stiffness of the immature thoracic bovine spinal segment.

Materials and Methods
Thoracic spines from 6-8 week old calves were used. Each spine was dissected and divided into motion segments with 5cm of attached rib on each side and full spinous processes including levels T4-T11 (n=28). They were potted in polymethylemethacrylate. An Intron Biaxial materials testing machine with a custom made jig was used for testing. The segments were tested in flexion/extension, lateral bending and axial rotation at 37°C and 100% humidity, using moment control to a maximum 1.75 Nm with a loading rate of 0.3 Nm per second. They were first tested intact for ten load cycles with data collected from the tenth cycle. Progressive dissection was performed by removing first the attached ribs, followed by the spinous process at its base. Biomechanical testing was carried out after each level of dissection using the same protocol. Statistical analysis of the data was performed using repeated measures ANOVA.

Results
In combined flexion/extension there was a significant reduction in stiffness of 16% (p=0.002). This was mainly after resection of the ribs (14%, p=0.024) and mainly occurred in flexion where stiffness reduced by 22% (p=0.021). In extension, stiffness dropped by 13% (p=0.133). However there was no further significant change in stiffness on resection of the spinous process (<1%) (p=1.00). In lateral bending there was a significant decrease in stiffness of 13% (p<0.001). This comprised a drop of 11% on resection of the ribs (p=0.009) and a further 8% on resection of the spinous process (p=0.014). There was no difference between left and right bending. In axial rotation there was no significant change in stiffness after each stage of dissection (p=0.253). There was no difference between left and right rotation.

Conclusion
The costovertebral joints play a significant role in providing stability to the bovine thoracic spine in both flexion/extension and lateral bending, whereas the spinous processes play a minor role. Both elements have little effect on axial rotation stability.

References