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Mechanical Effect Characterization in Posterior Monosegmental Instrumentation in Burst Fractures: Biomechanical Analysis

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Introduction

Different treatment options and approaches have been applied to treat thoracolumbar burst fractures. From an anterior to a combine 360-degree approach, none has proven to be a gold standard for this type of fracture. Considering the four principles for proper spinal patient management (stability, function, alignment, and biology), different treatment options arouse to treat thoracolumbar bust fractures. Short posterior instrumentations with an intermediate pedicle screw, which acts as an anchorage point, counterbalancing anterior forces and favoring the lumbar lordosis strength. And monosegmental instrumentation are been applied to preserve as much spine segments as possible, allowing mobility and maintaining spine stability. The objective of this study is to determine the biomechanical effects of posterior monosegmental constructs in burst fractures by a characterization analysis.

Material and Methods

Otherwise healthy swine thoracolumbar vertebrae were used to apply an axial load to simulate a burst fracture. Initial force, end force, and total displacement were analyzed. Posterior monosegmental instrumentation was performed in the thoracolumbar segment. Healthy swine vertebrae were used as control group. A CT scan was done in the instrumented segment. The images then were converted for biomechanical analysis using meshing and reconstruction software.

Results

Initial compression force: 34.92 N. End force: 1.44 kN. Total displacement: 11.27 mm. Healthy and instrumented specimens initial compression force: 2.311 and 2.657 kN, respectively. Young module in healthy and instrumented specimens was 123,276 versus 159.749 MPa. Maximum load applied 2.126 kN/m. Mean displacement was 5.30272 mm.

Discussion

There is much more resistance against deformation, even when the specimen is fractured. SolidWorks software is a useful tool for biomechanical testing. When comparing simulated results with live compression tests there is a 17.3% chance of error during the maximum load test

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