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Tissue Loading of the Total Facet Arthroplasty System™ (TFAS™)

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The Total Facet Arthroplasty System (TFAS™, Archus Orthopedics, WA) is designed as an alternative to instrumented fusion to replace the resected facet joints of a lumbar intervertebral joint in order to provide stabilization and to restore physiologic-like kinematics and load-sharing. The purpose of this study is to compare lumbar spine tissue loading in the TFAS™-implanted spine with that in the intact spine.

Flexibility tests were performed on twelve cadaveric lumbar spine specimens (L3-S1) in the intact and injured states, and following facet arthroplasty at L4-L5 level with the TFAS™. A subset of five specimens was also tested with a rigid posterior fixation (UCR, Seaspine, CA) system between injury and arthroplasty. The injury condition involved wide decompressive laminectomy and facetectomy, consisting of removal of all posterior ligaments (L4-L5), the facet joints (L4-L5), and the lamina and spinous process (L4 only). A pure moment of ±10 Nm with a compressive follower preload of 600 N was applied to the specimen in flexion-extension, axial rotation, and lateral bending for three cycles in each test condition. Intervertebral disc (IVD) pressure was measured with needle pressure transducers inserted into the L4-L5 disc. Loads were measured using strain gauges on TFAS™ articulation components and at the anatomic facet joints for a seven specimen subset.

Compared to the IVD pressure of the intact condition at maximum extension, the rigid fixation significantly decreased pressure ($p = 0.033$), whereas the TFAS™ showed no significant differences. Compared to the intact condition, there were no significant disc pressure differences at the maximum motion for flexion, axial rotation, or lateral bending due to injury, the rigid fixation or TFAS™ conditions.

The contact loads of the TFAS were 159% of the intact facet joint in extension, and 55% of the maximum loads measured in axial rotation. These differences were not significant, possibly due to relatively high interspecimen variability.

The TFAS contact loads were of a similar magnitude to those of the intact facet. By allowing motion, the TFAS™ device exhibited more intact-like disc load-sharing behavior than did the rigid fixation.