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Kinematic study of total facet arthroplasty after complete laminectomy-facetectomy.

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Background: Arthroplasty of the facet joints has been proposed for the treatment of facet joint pathologies. In the United States, facet arthroplasty is initially being clinically studied as a reconstructive procedure after laminectomy-facetectomy for the treatment of spinal stenosis. We hypothesize that after a destabilizing laminectomy-facetectomy, the Total Facet Arthroplasty System™ (TFAS™) will restore stability while allowing for motion at the operated segment. Restoring motion at the operated level rather than fusing it may provide a better outcome to the patient in terms of functionality and reduced incidence of complications, including adjacent level degeneration.

Methods: Four human cadaveric lumbar spines (L1-sacrum) were tested in flexion-extension (+8 to -6 Nm), lateral bending (±6 Nm), and axial rotation (±5 Nm). The specimens were tested without preload and under 400 N of follower-load. Tests were performed in the following sequence: (1) intact, (2) total laminectomy-facetectomy at L3-4, (3) TFAS (Archus) implanted at the same level. Three-dimensional segmental motion was recorded and analyzed using ANOVA and multiple comparisons with Bonferroni correction.

Results: **:** The range of motion of the intact L3-L4 segment was 8.7 (±2.1) degrees in flexion-extension, 8.4 (±2.5) degrees in lateral bending, and 3.5 (±1.8) degrees in axial rotation. Laminectomy-facetectomy significantly increased L3-4 motion in flexion extension ($p=0.05$) and axial rotation ($p=0.09$), but not in lateral bending. TFAS reduced the increased motion induced by laminectomy-facetectomy; restoring flexion-extension to 7.6 (±1.1) degrees ($p=0.69$) and lateral bending to 9.7 (±4.1) degrees ($p=0.84$). In axial rotation, TFAS significantly reduced the increased motion after laminectomy-

facetectomy, but the motion remained larger than the intact, although statistical significance could not be reached. The pattern of load-displacement curve (quality of motion) after TFAS insertion was similar to that of the intact spine. Adjacent level kinematics was preserved after implantation of the TFAS.

Discussion: This study is one of the first to report the kinematics of a facet arthroplasty device. These data suggest that after wide decompression of the neural elements, TFAS may avoid the need for fusion by virtue of its ability to restore stability while allowing motion at the operated and adjacent levels, similar to the intact spine.