BIOMECHANICAL EVALUATION OF A NOVEL ANTERIOR CERVICAL PLATE

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Introduction: Benefits of cervical plate fixation include immobilization during fusion and possibly increased fusion rates. Concerns relate to implant size and bulk, retraction required to place the implants, and added costs. A unique cervical plate, utilizing a single screw in each vertebrae, has been developed to address some of these issues **(Figure 1)**. To date, no data are available comparing the kinematics of this plate to a standard cervical plate system.

Figure 1: Cervical plate systems used in this study included (Left) UNIPLATE™ Anterior Cervical Plate System, and (Right) SLIM-LOC™ Anterior Cervical Plate System.

Methods: Two plate designs were evaluated; the UNIPLATE Anterior Cervical Plate System and the SLIM-LOC Anterior Cervical Plate system (DePuy Spine, Raynham, MA). For this study, a total of 12 fresh-frozen human cervical spines (C3-7) were obtained with IRB approval. Kinematic spine testing was performed using a custom seven-axis spine simulator (Figure 2), applying independent flexion/extension, lateral bending, and axial rotation moments with a 50N compressive axial follower-load. Torques were collected by the spine simulator and ROM data were collected by OPTOTRAK® diodes for the intact state, C4-5 plate fixation following ACDF, randomized to one of the two cervical plate systems, followed by a second ACDF at C5-6 with plate fixation of C4-6. Stiffnesses were calculated from the moment-rotation data.

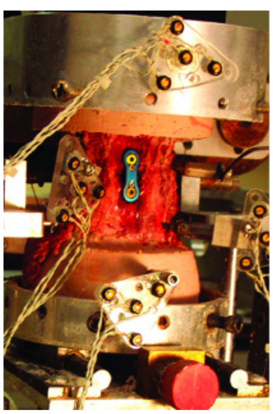

Figure 2: Spine simulator loading specimen with a C4-5 UNIPLATE Anterior Cervical Spine System and OPTOTRAK® diodes tracking the motions.

Results: The intact stiffness of the one-level construct averaged 0.6 Nm/deg in flexion/extension, 1.1 Nm/deg in lateral bending, and 0.9 Nm/deg in axial rotation. When plated with either anterior cervical plate system, the stiffness significantly increased nearly 4x in flexion/extension, 4.5x in lateral bending, and 1.6x in axial rotation **(Figure 3)**.

The intact stiffness of the two-level construct averaged 0.6 Nm/deg in flexion/extension, 1.4 Nm/deg in lateral bending, and 1.1 Nm/deg in axial rotation. When plated with either anterior cervical plate system, the stiffness significantly increased at least 6.8x in flexion/extension, 6.9x in lateral bending, and 1.6x in axial rotation **(Figure 4)**.

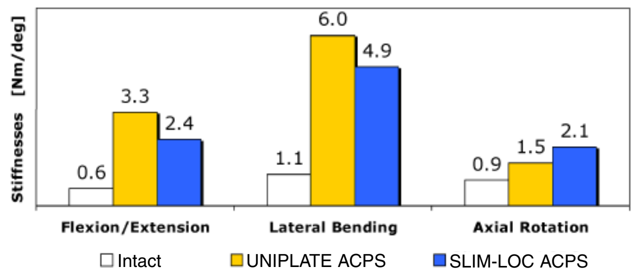

Figure 3: Stiffness of C4-5 motion segment Intact, and with each anterior cervical plate system. No significant differences were measurable between the two systems.

There were no significant differences in the stiffness of the spines with either implant. With further detailing of the limitation on ROM, the UNIPLATE Anterior Cervical Plate System limited the one-level ROM more than the SLIM-LOC Anterior Cervical Plate System. Independent of the direction of loading, the UNIPLATE Anterior Cervical Plate System reduced the ROM 67% of the intact state; the one-level SLIM-LOC Anterior Cervical Plate System construct reduced the ROM 33% of the intact state. Both systems reduced the two-level ROM 67% of the intact state.

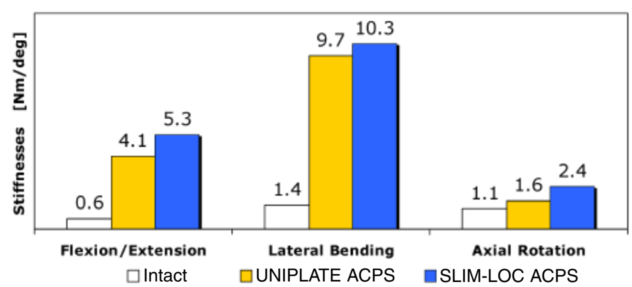

Figure 4: Stiffness of C4-6 motion segments Intact, and with each anterior cervical plate system. No significant differences were measurable between the two systems.

Conclusions: The kinematic stability of the single-screw/plate construct (UNIPLATE Anterior Cervical Spine System) was found to be statistically equivalent to the double-screw construct (SLIM-LOC Anterior Cervical Spine System) in both the one-level and two-level ACDF construct models.

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