Biomechanical Analysis of Multi-Level Cervical Corpectomy and Plating Constructs

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INTRODUCTION: Three-level corpectomy ("3C"), fusion, and plating has been associated with a high rate of hardware failure. We compared three-level corpectomy with two-level corpectomy + discectomy ("2C+D") to determine whether the effort to perform the latter technique is worthwhile biomechanically.

METHODS: Seventeen human cadaveric spines were studied. In Group 1 (n=9), corpectomies were performed at C5, C6, and C7. In Group 2 (n=8), corpectomies were performed at C5 and C6 and discectomy at C7-T1. In both groups, fibular strut grafts were shaped for the corpectomy/disectomy voids. Anterior cervical plates were applied from C4 to T1 (4 screws in Group 1, 6 screws in Group 2). Specimens were tested by applying nondestructive, nonconstraining pure moments (1.5 Nm maximum) quasistatically to C3 while recording three-dimensional angular displacement stereophotogrammetrically from infrared-emitting markers affixed to the lateral masses during flexion, extension, lateral bending, and axial rotation.

RESULTS: Three specimens in the 3C group and two specimens in the 2C+D group failed during testing, leaving N=6 in both groups for biomechanical analysis. The combined mean range of motion (ROM) was reduced across plated segments in all directions of loading and was smaller in 2C+D than 3C constructs (2C+D, 20%-30% of normal; 3C, 27%-40% of normal). Neutral zone in flexion/extension was significantly smaller in 2C+D (35% of normal) than 3C (85% of normal, p=0.042, nonpaired t-test). Adding a screw to the strut graft reduced ROM only in 3C specimens, significantly reducing ROM in flexion (p=0.014) and lateral bending (p=0.036; paired t-tests).

CONCLUSIONS: Because 2C+D constructs were more stable than 3C constructs, we recommend using the former for three-level decompression and plating. We recommend inserting an additional screw into the strut graft of the 3C construct to enhance stability.