Prediction of Inter-Segment Stability and Osteophytes Formation on the Multi-Segment C2-C7 after Unilateral and Bilateral Facetectomy

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Abstract

The objective of this study was to determine the inter-segment stability, disc degeneration and osteophytes formation on the multi-segment cervical spine (C2-C7) after unilateral and bilateral facetectomy. A geometrically accurate nonlinear three-dimensional model of the intact human cervical spine was created from the digitized coordinates of the dry vertebrae. The intact model was validated against the published results under physiologically loading conditions. Eight surgically altered models were created from the intact model. The intact and surgical altered models were subjected to physiological loading. The inclusion of five levels in the present model allowed accurate determination of the inter-segment responses and internal cortical bone and disc annulus stress in the adjacent spinal components.

Results indicated that facetectomy performed on C5-C6 significantly affects the corresponding stress and inter-segment motions at the corresponding C5-C6 levels. The maximum increases were 18% for bilateral facetectomy and 7% for unilateral facetectomy under lateral bending. Combined flexion-extension and axial rotation caused approximately similar amount of increases after total facetectomy. In addition, adjacent segments (C4-C5 and C6-7) also experience a slight increase in the inter-segment responses and internal stress after facetectomy. It has been shown that facetectomy of greater than 50% resulted in segment hyper-mobility and substantial increase in the disc annulus and cortical bone stress. Increase in the stress may lead to osteophytes formation.

This study revealed important information that will help the clinicians identify the critical inter-segment stability and to decide on the amount of facets resection.

Keywords: Stress Analysis, Biomechanics, Material, Finite Element, Cadaver, Cervical, Spine