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Biomechanical considerations and clinical implications of non-contiguous two-level anterior cervical discectomy and fusion: a retrospective analysis of 32 consecutive cases

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Background: Patients presenting myeloradicular radiological signs on two non-contiguous cervical levels can pose a surgical challenge. Non-contiguous two-level anterior cervical discectomy and fusion may offer a viable option, reducing surgical risks and preserving cervical mobility. However, the risk of hastening degeneration and triggering Adjacent Segment Disease (ASD) at the intermediate level can be a significant limitation. Finite elements studies have calculated stress levels on adjacent and intermediate levels by analyzing the segmental range of motion (ROM). However, in vivo studies in the literature are scarce.

Research Question: To investigate biomechanical modifications at non-fused segments and assess their clinical implications.

Design: A monocentric retrospective study. Period 2015-2022.

Methods: We analyzed clinical outcomes and investigated the presence of ASD at adjacent levels. Static and dynamic radiographs were taken before surgery and at the final follow-up. Radiographic parameters, including disc height and ROM of both intermediate and adjacent levels, were calculated.

Results: We included 32 patients with a mean follow-up of 33.3 months. The majority experienced good clinical improvement across all studied outcomes. Radiographically we observed increased cervical lordosis (from $9.65^\circ \pm 9.47$ to $15.12^\circ \pm 6.09$), a minor decrease in intermediate disc height ($5.68 \text{ mm} \pm 0.57$ to $5.27 \text{ mm} \pm 0.98$), and a uniformly distributed increase in intermediate (from 12.45 ± 2.33 to 14.77 ± 1.98), cranial (from 14.63 ± 1.59 to 15.71 ± 1.02), and caudal (from 11.58 ± 2.32 to 13.33 ± 2.67) ROMs. We observed only one instance of intermediate-level ASD and no cases of cranial or caudal level ASD.

Conclusions: Non-contiguous two-level ACDF offers a safe and effective treatment, showing excellent clinical outcomes and a better mechanical stress distribution, potentially lowering the risk of adjacent and intermediate syndrome disease.