

# Preoperative Cervical Flexion-Extension Evaluation in Adult Spinal Deformity Patients with Symptomatic Neck Pain Undergoing Thoracolumbar Fusion as a Predictive Tool for Postoperative Cervical and Global Deformity

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## Introduction

Preoperative neck mobility and cervical deformity may influence alignment goals and success. The authors hypothesize that flexion-extension parameters are predictive of the maintenance of normal cervical alignment and the achievement of sagittal balance.

## Methods

Perioperative radiographs for 85 patients undergoing long-segment fusion for ASD were retrospectively reviewed. Preoperative cervical flexion-extension views were obtained in symptomatic patients. Cervical flexion and extension sagittal parameters included C1-C2 angle, C0-C2 angle, C2-C7 plumb line (CPL), and C2-C7 cervical lordosis (CL). In scoliosis studies, T1 slope (T1S) minus CL (T1S-CL), T2-T12 thoracic kyphosis (TK), L1-S1 lumbar lordosis (LL), as well as spinopelvic and global sagittal parameters. CD was defined as  $CPL > 4\text{cm}$ ,  $CL < 0^\circ$ , or  $T1S-CL < 0^\circ$  or  $\geq 15^\circ$ .

## Learning Objectives

1. Understand the relationship of cervical deformity with thoracolumbar deformity.
2. Understand the utility of preoperative flexion-extension views for planning thoracolumbar fusion in adult spinal deformity patients.

## Results

85 patients (mean age  $64 \pm 11.1$ ) were identified (21.5 months follow-up). LL changed from  $30^\circ$  to  $53^\circ$  ( $p < 0.0001$ ), SVA 7.5 to 3.9 cm ( $p < 0.0001$ ), TPA  $27^\circ$  to  $18^\circ$  ( $p < 0.0001$ ), T1S-CL  $10^\circ$  to  $14^\circ$  ( $p = 0.021$ ), CL from  $17^\circ$  to  $12^\circ$  ( $p = 0.013$ ), and CPL 2.8 to 3.0 cm ( $p = 0.172$ ). CD increased from 41 (48%) to 47 (55%) patients and All symptomatic patients (24%,  $n = 20$ ) had CD (100%). Increased C0-C2 preoperative range of

motion correlated with suboptimal TPA ( $r = -.492, p = 0.022$ ). C0-C2 was an independent predictor of suboptimal TPA correction ( $\beta = -0.599, 95\% \text{ CI: } -1.182 \text{ to } -0.016, p = 0.028$ ). In patients with limited preoperative CL ( $CL < 30^\circ, n = 11$ ), preoperative C1-C2 range of correlated highly with suboptimal TPA correction ( $r = -.588, p = 0.014$ ), as well as C0-C2 ( $r = -.657, p = 0.014$ ). C0-C2 mobility was a predictor of TPA correction on linear regression analysis of patients with suboptimal preoperative CL ( $\beta = -0.657, p = 0.028$ ). Preoperative range of motion correlated

strongly with postoperative thoracic compensation, when normalized by the number of remaining

unfused thoracic vertebral segments (C1-C2  $r = -.762, p < 0.0001, CL$

## Conclusions

Preoperative cervical flexion-extension radiographs aid in identifying patients at risk for suboptimal deformity correction. An increased preoperative upper cervical range of motion (C0-C2, C1-C2) is

predictive of a suboptimal global deformity correction.

## References

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