

**Title:** Can Baseline Disability Limit Clinical Improvement After Surgical Correction of Cervical Deformity?

**Background:** Surgical intervention has proven an effective treatment modality for adult cervical deformity (CD), yet patient reported outcomes vary even when optimally realigned.

**Research Question:** Although patients with higher baseline disability have more room for improvement, is there a threshold beyond which greater disability limits HRQL improvement due to elevated risks and a point of no return?

**Design:** Retrospective study of a single center CD database.

**Methods:** CD patients with baseline (BL) and 2-year (2Y) data included. Cohort was ranked into disability quartiles by BL NDI, from lowest/best score (Q1) to highest/worst score (Q4). Means comparison tests analyzed differences between quartiles. Multivariable Analyses (MVA) assessed differences in outcomes controlling for covariates such as BL deformity, demographics, HRQLs, surgical details, surgical realignment and complications.

**Results:** 89 patients were included. Mean BL NDI of the quartiles were: Q1:  $24 \pm 8$ , Q2:  $40 \pm 3$ , Q3:  $53 \pm 5$ , and Q4:  $68 \pm 8$ . MVA found patients in Q2 demonstrated the greatest improvement in NRS Neck at 2Y ( $-3.5$ ,  $p=.039$ ) and achieved  $\geq 1$  MCID in NRS Neck at higher rates than Q4,  $p=.014$ . Furthermore, MVA found that patients in Q2 also demonstrated greatest improvement in NRS Back at 2Y ( $-1.71$ ), and improvement was superior to those in Q4 ( $+0.84$ ) who deteriorated on average,  $p=.010$ . With respect to EQ5D, MVA found Q2 demonstrated the greatest improvement ( $+0.74$ ,  $p=.042$ ). Compared to Q1, patients in Q2 were 12.0x more likely to reach MCID in EQ5D, ( $p=.015$ ) whereas odds were not significantly different for Q3 or Q4.

**Discussion:** Moderately disabled CD patients reliably demonstrated the greatest improvement in HRQLs whereas those with severe or complete disability, saw the least improvement. We propose that a baseline NDI of 40 may represent a disability “Sweet Spot,” within which surgical intervention maximizes patient reported outcomes. Furthermore, delaying intervention until patients are severely disabled, may limit benefits of surgical correction in CD patients.