O-36

The C2-Tilt as a Predictor for Successful Correction of Congenital Cervical/Cervicothoracic Scoliosis

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Introduction: Children with congenital cervical/cervicothoracic scoliosis typically exhibit compensatory shifting of the trunk towards the convex side (trunk shift, TS) and head tilt (HT), both of which can be corrected surgically. The aim of our study was to investigate how HT and TS change postoperatively and to identify any predictors for successful correction of TS and HT.

Methods: Retrospective analysis of CAT and X-ray images from patients with cervical/cervicothoracic scoliosis treated between 2006 and 2022. The sample consisted of 16 patients (mean age 7.25 years, 8 f and 8 m). Pre- and postoperative measurements of TS, HT, Cobb angle of the main curvature (CW-MC), and T1-, C2- and UEV- (Upper End Vertebra) tilt were taken from whole-spine images, and CAAD was measured from coronal CAT reconstructions. Statistical analysis was performed using SPSS, $p<0.05$. Changes in TS and HT were examined (expressed as ΔTS and ΔHT, respectively), and the correlations between CW-MC, T1-, C2-, UEV-tilt and CAAD and ΔTS and ΔHT were analysed.

Results: Preoperatively, TS measured 3.7° ± 4.3°, and HT 9.2° ± 9.6°. Postoperatively at the last follow-up, TS was 1.9° ± 2.3° ($p = 0.863$), and HT was 3.3° ± 1.8° ($p = 0.16$) (Fig. 1). There was a highly significant correlation between C2-tilt and ΔTS, $r = 0.604$, $p = 0.013$ (Fig. 2). No correlation was found between ΔTS/ΔHT and CW-MC, UEV-tilt, or CAAD.

Discussion: Surgical interventions for children with cervical/cervicothoracic scoliosis resulted in improvements in TS and HT. C2-tilt is a reliable predictor for successful correction of TS, as demonstrated by the significant positive linear correlation between these two parameters: a high preoperative C2-tilt indicates good postoperative rebalancing of TS. Conversely, CW-MC, UEV-tilt, and CAAD are not reliable predictors for good correction.

Fig. 1: Boxplots showing the changes in the Trunk Shift and Head Tilt

Fig. 2: Graph illustrating the correlation between C2-tilt and delta TS

Fig. 1

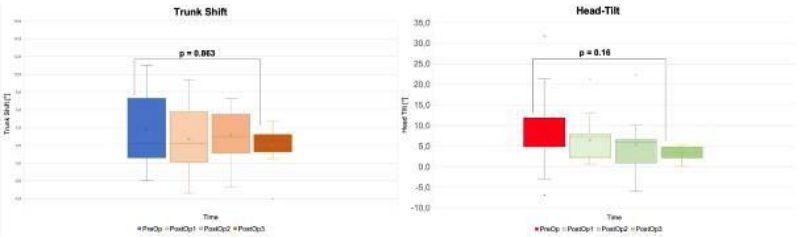
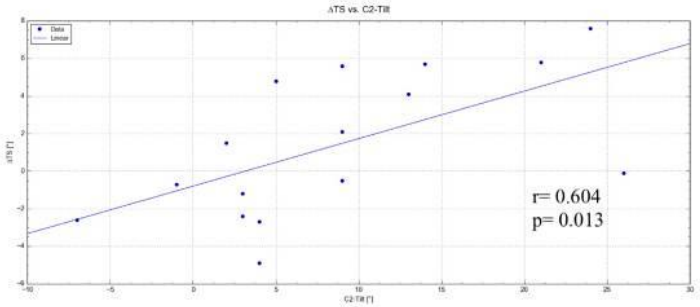

Trunk Shift
p = 0.863
Trunk Shift [°]
Time
PreOp PostOp1 PostOp2 PostOp3
Head-Tilt
p = 0.16
Head Tilt [°]
35,0
30,0
25,0
20,0
15,0
10,0
5,0
0,0
-5,0
-10,0
Time
PreOp PostOp1 PostOp2 PostOp3

Fig. 2


ΔTS vs. C2-Tilt
Data
Linear
ΔTS [°]
C2-Tilt [°]
r= 0.604
p= 0.013