Cervicothoracic Changes After Dual Growing Rod Surgery for EOS

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DISCLOSURES

1. NuVasive: a, b, e
2. K2M: b, e
3. ISSGF: a

a. Grants/Research Support
   b. Consultant
   c. Stock/Shareholder
   d. Speakers’ Bureau
   e. Other Financial Support
• Posterior distraction-based growing rods are a commonly used technique for the surgical management of EOS

• However, there are no published studies on how serial growing rod lengthenings effect:
  – Sagittal balance
  – Cervicothoracic alignment
Shah et al. reported:

- 42 growing rod patients with 2-year follow up
- TK, SVA, Pelvic Parameters (PI, PT, SS), LL
- TK and LL decreased after index procedure; then increased until final FU
- Pelvic parameters remained unchanged
- SVA returned to more neutral alignment
Concept CT “Incidence” - T1 slope
T1 Slope Concept

C0-2 : C2-7 angle = 77 : 23%

C0-2 angle

C2-7 angle

T1 slope

Thoracic inlet angle

Pelvic Incidence

r=0.52

r=0.34

r=0.51

CHAPTER 27

Posterior Cervicothoracic Osteotomy

Justin K Scheer, Vedat Deviren, Sang-Hun Lee, Christopher P Ames
Clinical Questions

• What effect does distraction based lengthening in growing rod surgery have on:
  – Cervical sagittal alignment
  – Cervicothoracic junction

• Are we altering the cervicothoracic sagittal profile?
  • Fostering development cervical kyphosis
  • May lead to poor clinical outcomes
Hypothesis

- Serial Dual Growing Rod Lengthenings **do not** lead to Cervicothoracic Kyphosis or sagittal plane decompensation
Methodology

- Retrospective review of a multicenter EOS database
- Determine if dual growing rod surgery alters sagittal plane alignment after serial distraction
Methodology

• **Inclusion Criteria:**
  – Diagnosis of EOS
  – Any etiology
  – Ambulatory prior to index growing rod surgery
  – Dual rowing rod treatment
  – Minimum of 2-year FU
Methodology

- **Standing scoliosis x-rays**
- **Study time points:**
  - Pre-op, immediate post-op, FU prior to definitive fusion
- **Radiographic analysis included:**
  - Cervical Lordosis (C2-C7)
  - T1 Slope
  - T1 Thoracic Incidence (surrogate measure CT junction)
  - Thoracic Kyphosis (T2-T12/T5-T12)
  - C2 (SVA)
  - C7 (SVA)
  - Pelvic incidence; Pelvic Tilt, Sacral Slope
Thoracic inlet angle = T1 slope + Neck tilt
Results

• Demographics
  – N = (33)
    • Female = (18)
    • Male= (15)
  – Mean age at index procedure = (5.2 yrs.)

• Diagnoses
  • Idiopathic = (13)
  • Syndromic = (13)
  • Congenital = (5)
  • Neuromuscular = (2)
### Results

<table>
<thead>
<tr>
<th></th>
<th>PRE-INDEX (mean, range)</th>
<th>INITIAL POST-OP (mean, range)</th>
<th>2-YEAR POST-OP (mean, range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical Lordosis C2-C7 (°)</td>
<td>45 (16-80)</td>
<td>42 (10-78)</td>
<td>47 (22-74)</td>
</tr>
<tr>
<td>T1 Slope (°)</td>
<td>30 (2-70)</td>
<td>28 (12-54)</td>
<td>28 (10-64)</td>
</tr>
<tr>
<td>T1 Thoracic Inlet (°)</td>
<td>77 (52-88)</td>
<td>80 (61-89)</td>
<td>78 (45-89)</td>
</tr>
<tr>
<td>Pelvic incidence (°)</td>
<td>42 (30-74)</td>
<td>42 (30-71)</td>
<td>42 (30-74)</td>
</tr>
<tr>
<td>Pelvic tilt (°)</td>
<td>7 (-10-32)</td>
<td>8 (-18-43)</td>
<td>6 (-15-22)</td>
</tr>
<tr>
<td>Sacral slope (°)</td>
<td>36 (18-50)</td>
<td>34 (18-50)</td>
<td>35 (14-62)</td>
</tr>
<tr>
<td>T2-T12 (°)</td>
<td>*40 (2-76)</td>
<td>*32 (14-68)</td>
<td>*39 (14-84)</td>
</tr>
<tr>
<td>T5-T12 (°)</td>
<td>*36 (9-73)</td>
<td>*24 (5-64)</td>
<td>*30 (10-68)</td>
</tr>
<tr>
<td>C2 SVA (mm)</td>
<td>37 (-53-126)</td>
<td>*39 (-54-127)</td>
<td>*22 (-24-88)</td>
</tr>
<tr>
<td>C7 SVA (mm)</td>
<td>24 (-44-101)</td>
<td>*27 (-62-119)</td>
<td>*10 (-43-87)</td>
</tr>
</tbody>
</table>

* Significantly different from the previous time point (p<0.05)
Conclusion

• Our findings suggest patients did not experience unwanted reciprocal changes of the Cervicothoracic Junction
  – T1 Thoracic Inlet remained constant over time

• TK decreased after index surgery, then slightly increased at final FU

• SVA returned to more neutral alignment with serial lengthening's
The Growing Spine Foundation acknowledges and thanks all donors who support its cause.