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
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Summary of Background Data

- 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

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Summary of Background Data

- **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

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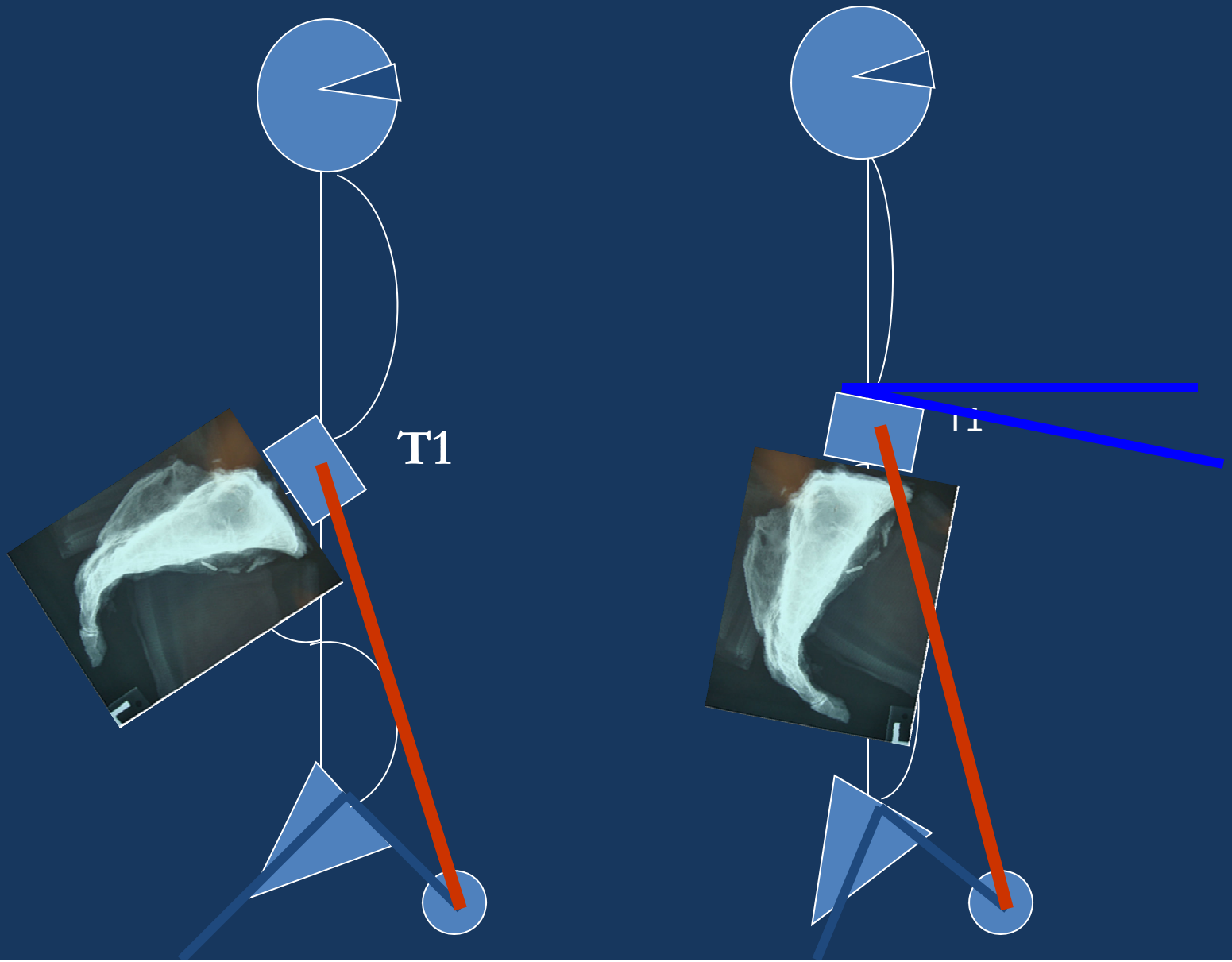
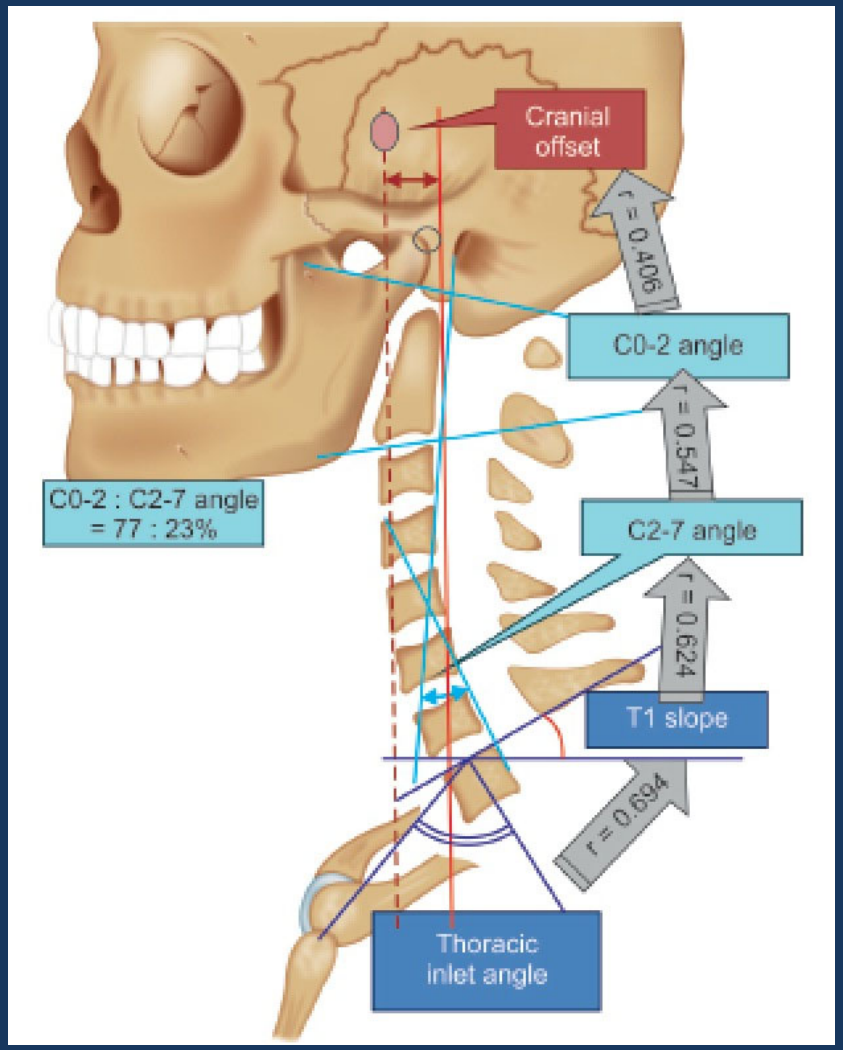
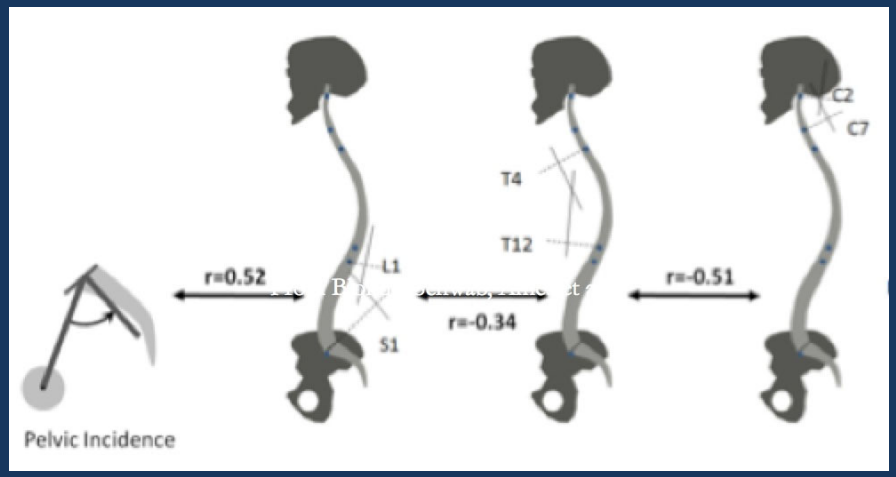
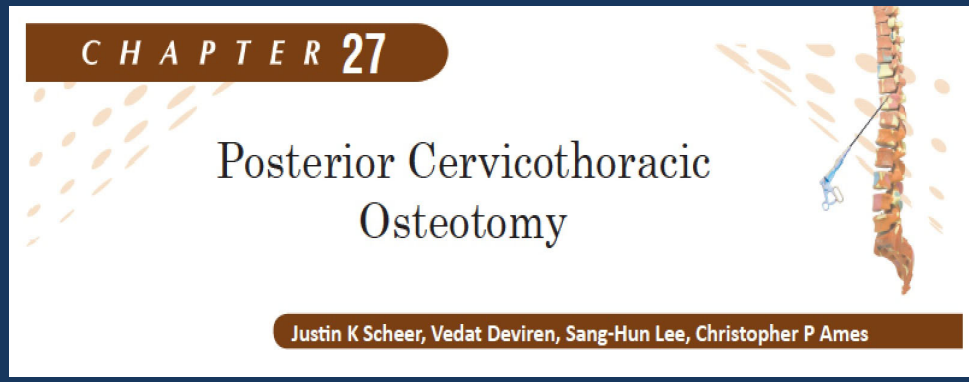
Concept CT "Incidence"-T1 slope



T1 Slope Concept







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

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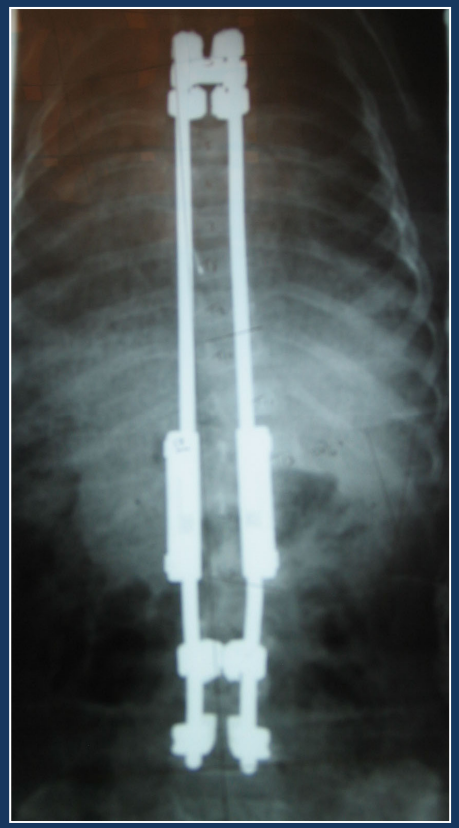
Hypothesis

- Serial Dual Growing Rod Lengthenings does not lead to Cervicothoracic Kyphosis or sagittal plane decompensation



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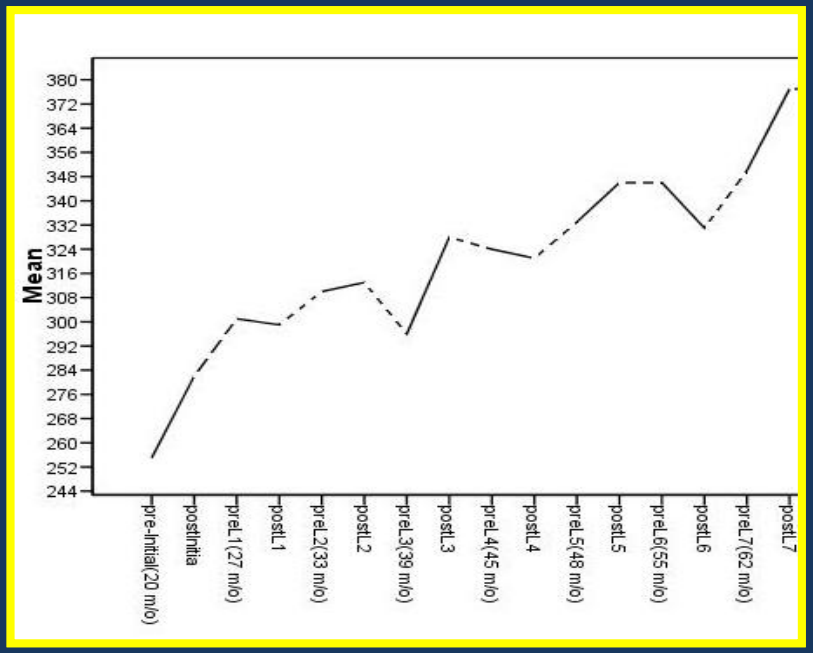
Methodology

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



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Methodology

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

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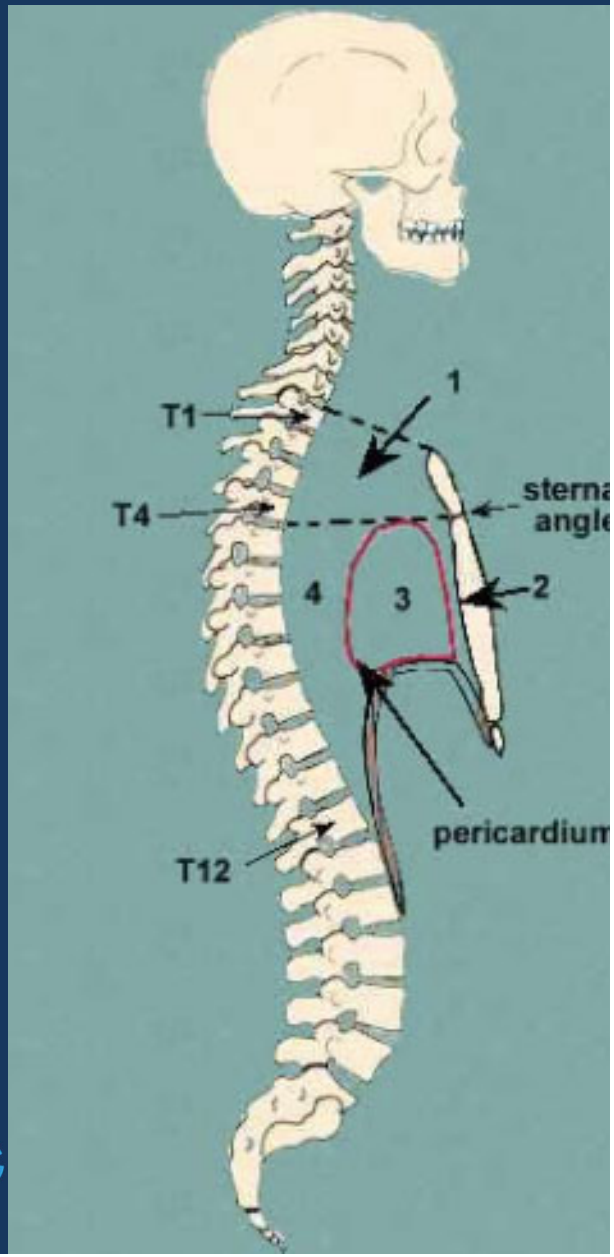
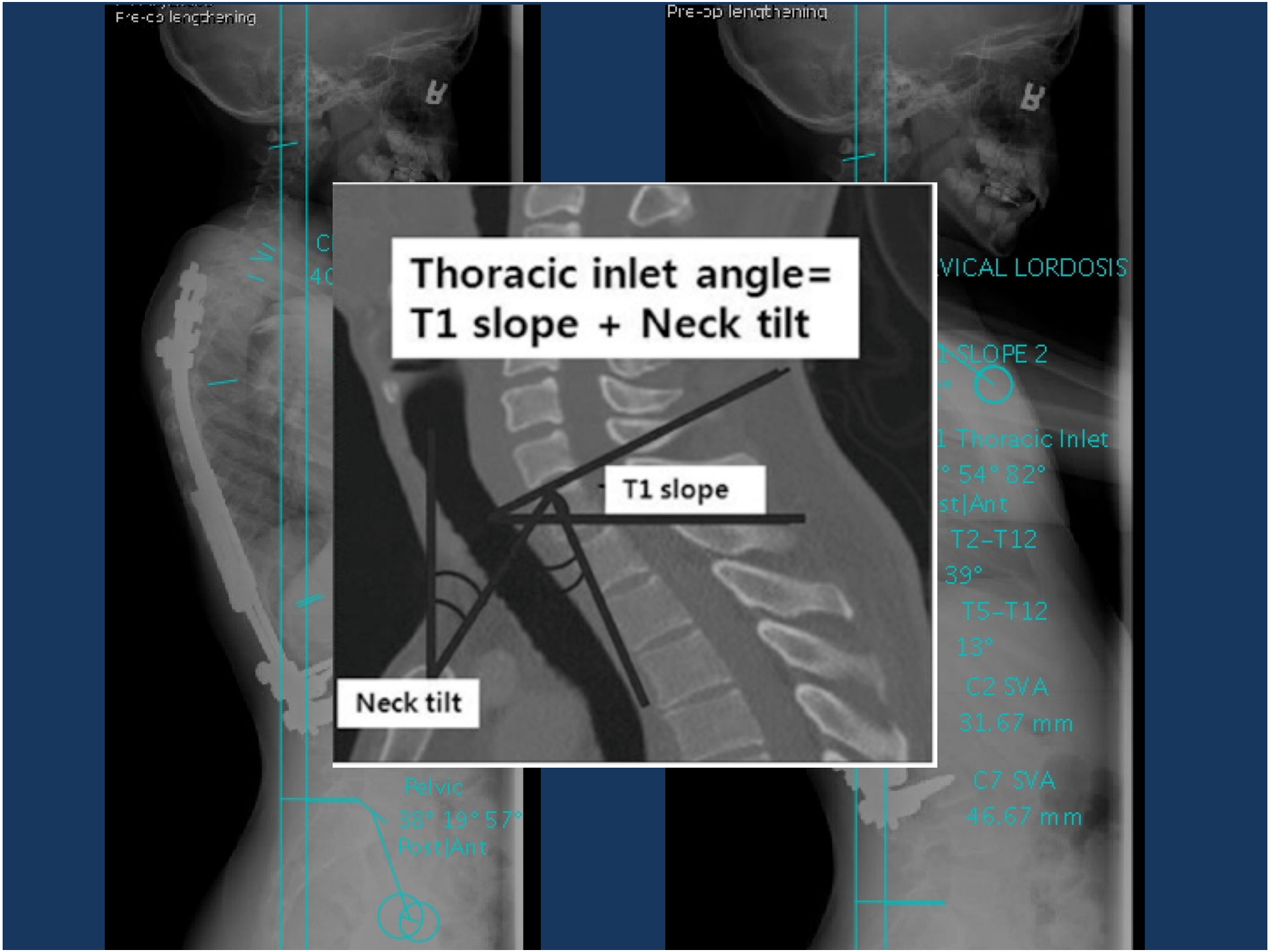
Methodology

- **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

SurgimapSpine
The Physician Driven Imaging Solution




Pre-op lengthening
Pre-op lengthening
Thoracic inlet angle=
T1 slope + Neck tilt
T1 slope
Neck tilt
VICAL LORDOSIS
SLOPE 2
1 Thoracic Inlet
° 54° 82°
st|Ant
T2–T12
39°
T5–T12
13°
C2 SVA
31.67 mm
C7 SVA
46.67 mm
Pelvic
38° 19° 57°
Post|Ant

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)

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Results

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

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

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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

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THANK YOU

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