Vertebral Body Growth During Growing Rod Instrumentation: Growth preservation or stimulation?

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Background

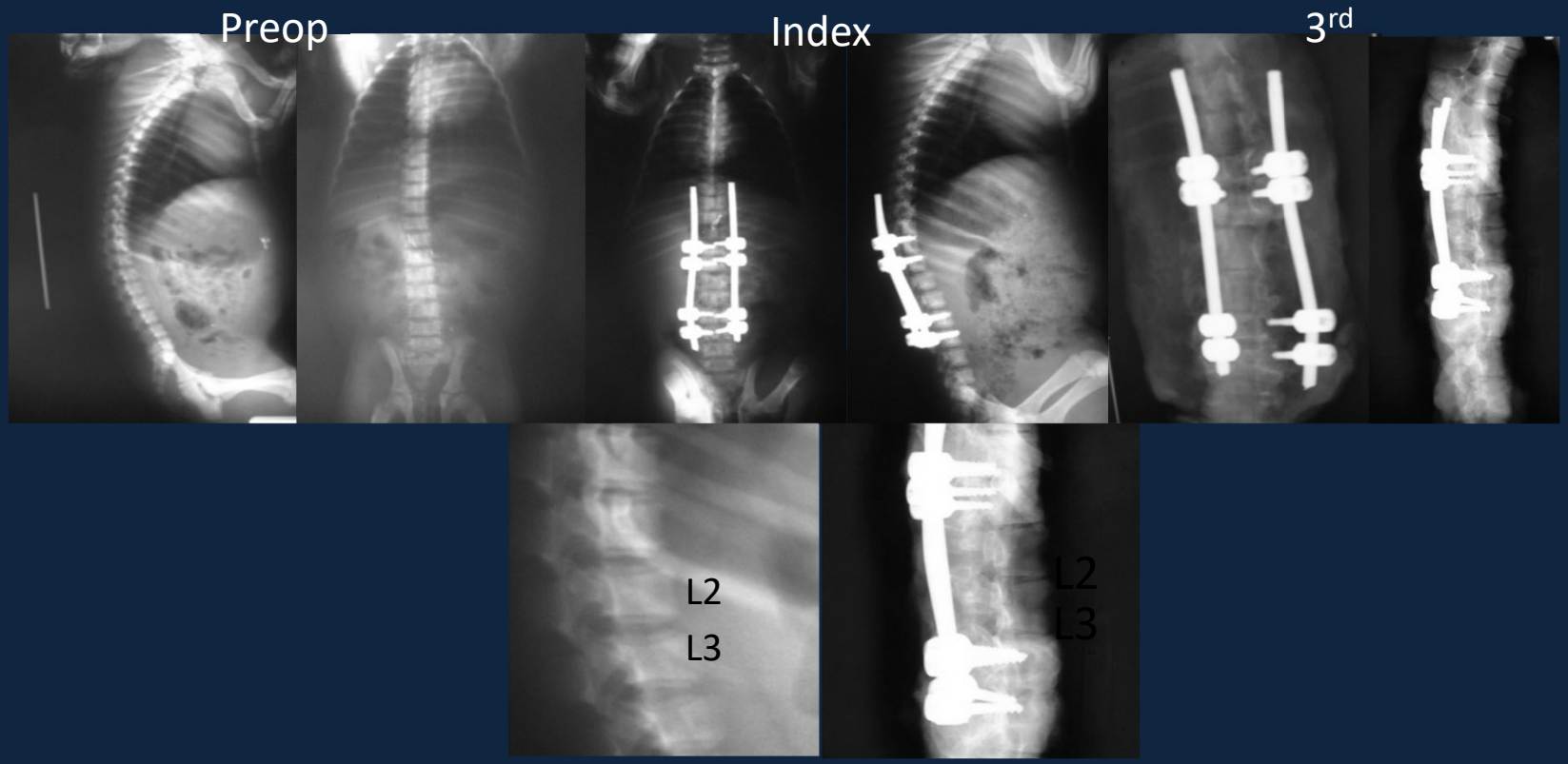
- Hueter-Volkmann principle
  - Appendicular skeleton
    - Growth stimulation with distraction
    - Growth inhibition with compression
  - Spine

Background

Growing rod instrumentation and vertebral body growth. A radiological investigation in immature pigs

Guney Yilmaz, Gokhan Demirkiran, Cenk Ozkan, Kenan Daglioglu, Gazi Huri, Muharrem Yazici

Spine, *In press*



Background

- Growing rod series
  - Akbarnia et al., 2005
    - Annual T1-S1 growth
      - 1.21cm/yr
  - Normal vertebral growth
    - Dimeglio
      - 1.21cm/yr

During growing rod treatment, growth potential of vertebrae is preserved.

Background

- Growing rod series
  - Akbarnia et al., 2008
    - Annual T1-S1 growth
      - Lengthening every 6 mo or less
        - » 1.8cm/yr
      - Lengthening later than every 6 mo
        - » 1.0cm/yr

Growth stimulation instead of just preservation?

Questions

- Does routine lengthening every six months using the growing rod technique stimulate vertebral growth?
- Is growth different between vertebral segments outside the instrumentation and vertebral segments that are spanned by the instrumentation rods but not instrumented themselves?

Material and Methods

- Near normal vertebral anatomy
- Instrumentation to L3-L4
- A minimum of 5 lengthening procedures undergone
- All lengthenings every six months regularly
- Only x-ray data which has appropriate scale information and clear digital images of these
- Radiologic measurements
  - Heights of selected vertebrae within instrumentation (WIL) and vertebral segments outside instrumentation (OIL)
  - Post-index and final follow-up
  - Difference in height

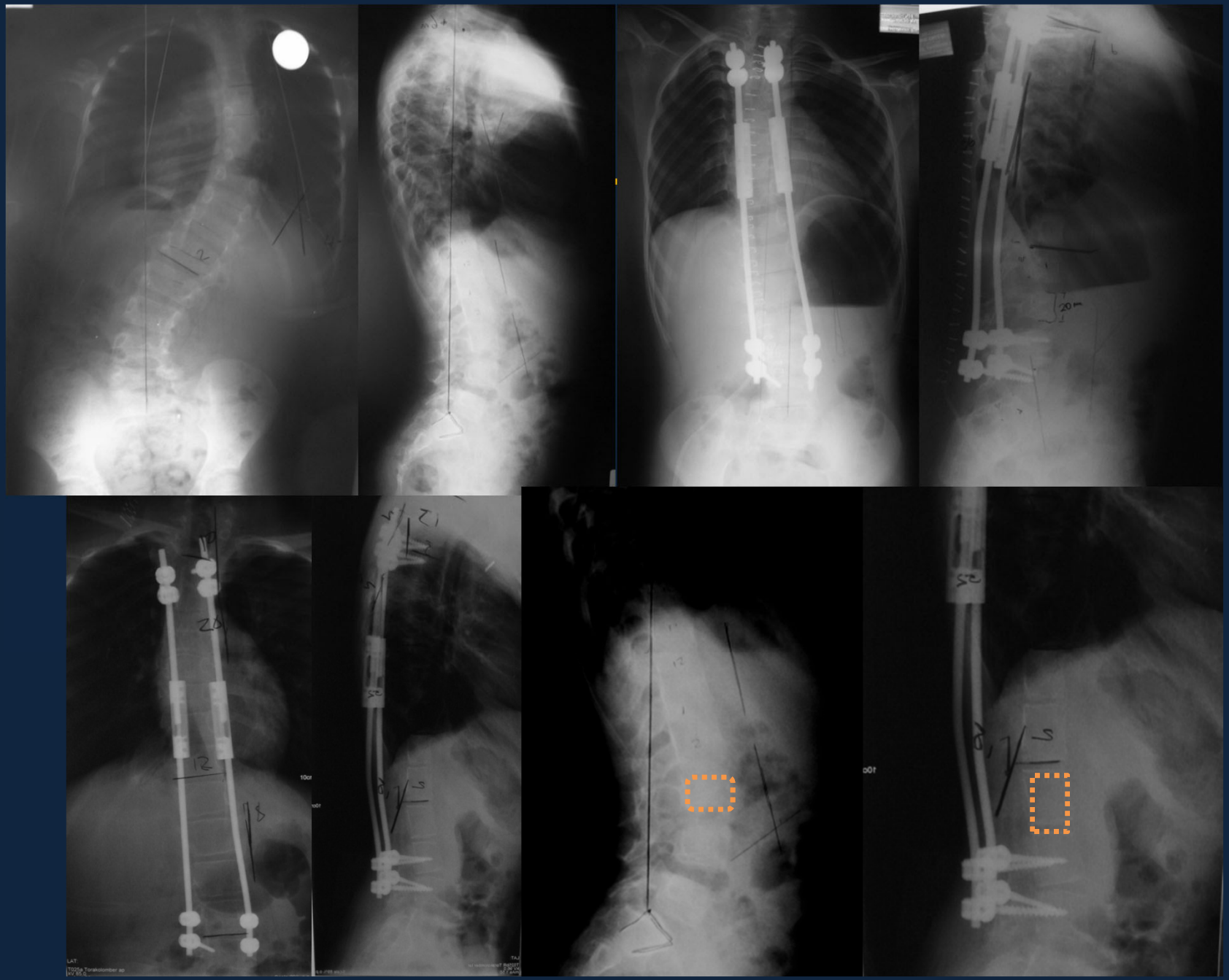
Results

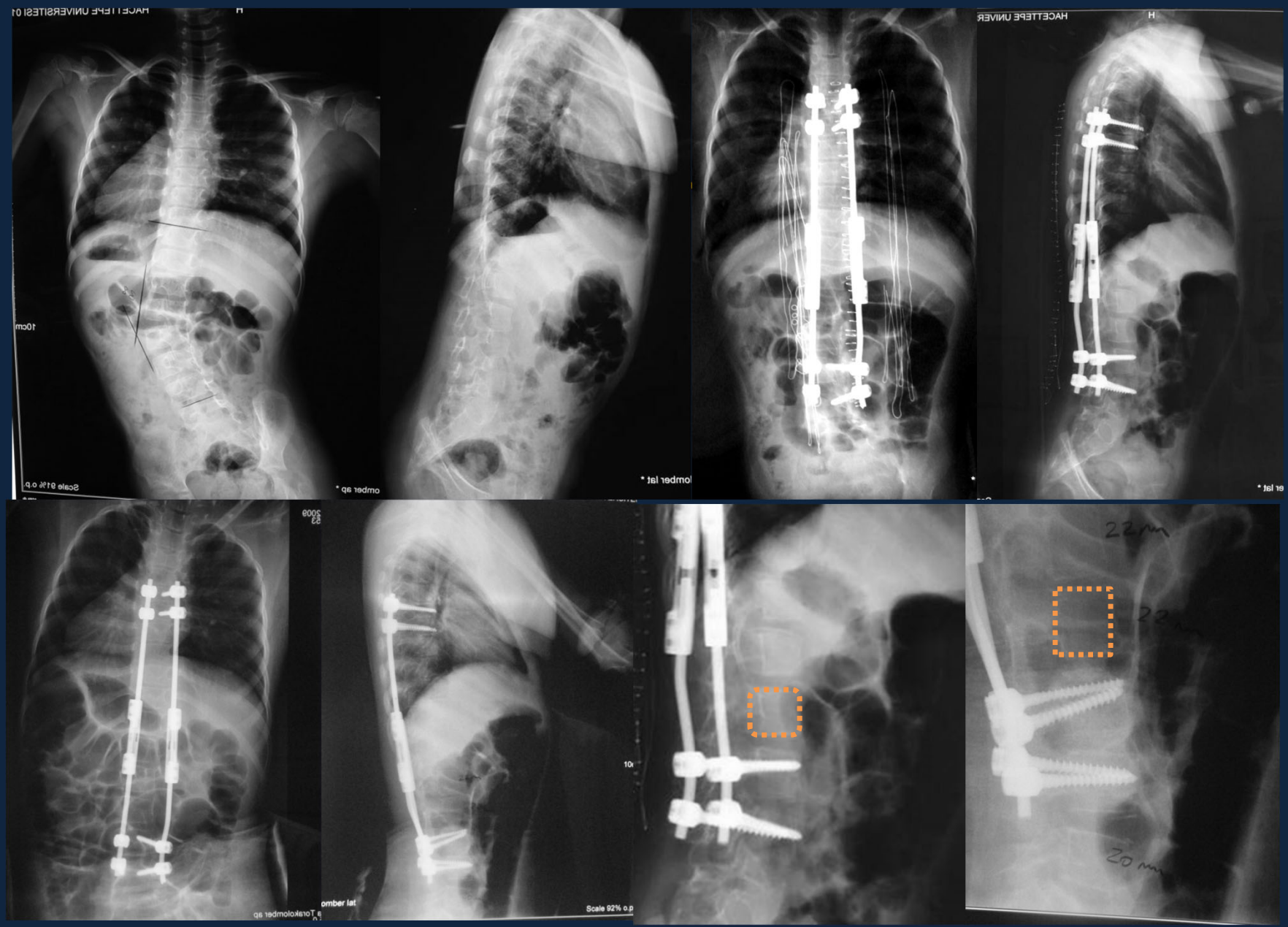
- 17 patients
  - Age @ index operation
    - 72.6 months (38-105)
  - # of lengthenings
    - 6.6 (5-9)
  - Measured levels:
    - WIL: L1 (6), T12(4), T11 (3), T7, T9, T11
    - OIL: L4 (9), L2 and L3 (3 each), L5 (2)

Results

	Post-index	Final FU	Δ
WIL	15.6(10.0-21.1)	20.8(15-26.6)	5.2±2.3
OIL	17.8(13.5-22)	22.5(14.0-28.8)	4.7±2.0

- Statistics
  - Post vs. FU, $p<0.01$
  - Δ, $p=0.480$





Conclusion

- Normal growth
  - Dimeglio A,

    in Growing Spine , eds Akbarnia, Yazici, Thompson

    - Lumbar vertebrae grow faster than thoracic
      - 2 mm/year Lumbar vertebra and disc
      - 1 mm/year Thoracic vertebra and disc
- Study group
  - Thoracic (distracted) vertebrae appear to have grown faster than lumbar (control) vertebrae!

Conclusion

- Growth preservation
  - Definitely YES
- Growth stimulation
  - Probably YES
  - Could not be proven with basic statistics
  - BUT needs appropriate coefficient
- Need longer follow-up and a larger cohort