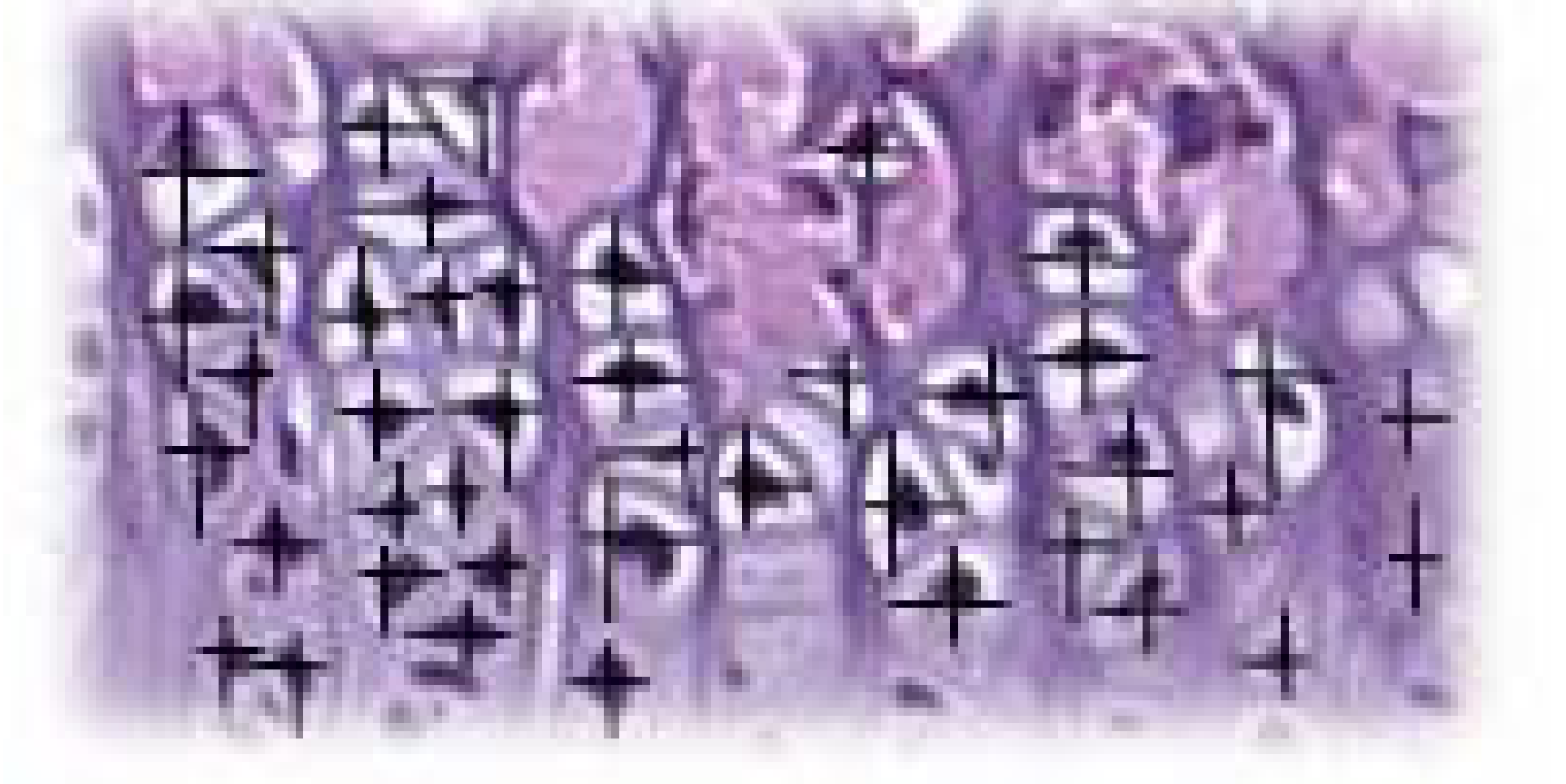
Cincinnati Children's Hospital Medical Center

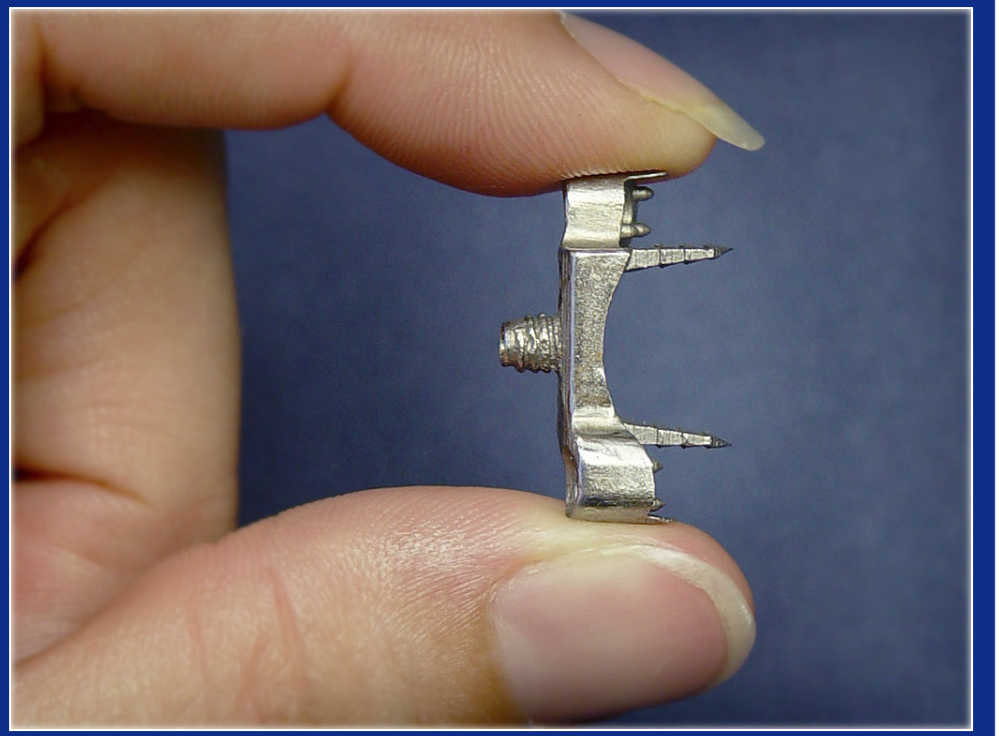
Spinal Hemiepiphysiodesis Correlates with Structural Changes

Wall E, Bylski-Austrow D, Glos DL, Ballard E, Montgomery A, Crawford, A



Long term Goal of Lab

- Develop a novel spine staple capable of correcting scoliosis.
  - ✓ Hemiepiphysiodesis
  - ✓ Redirect Spine Growth



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Staple Redirects Spine Growth (Growth Modulation)

Wall et al, Spine 2005

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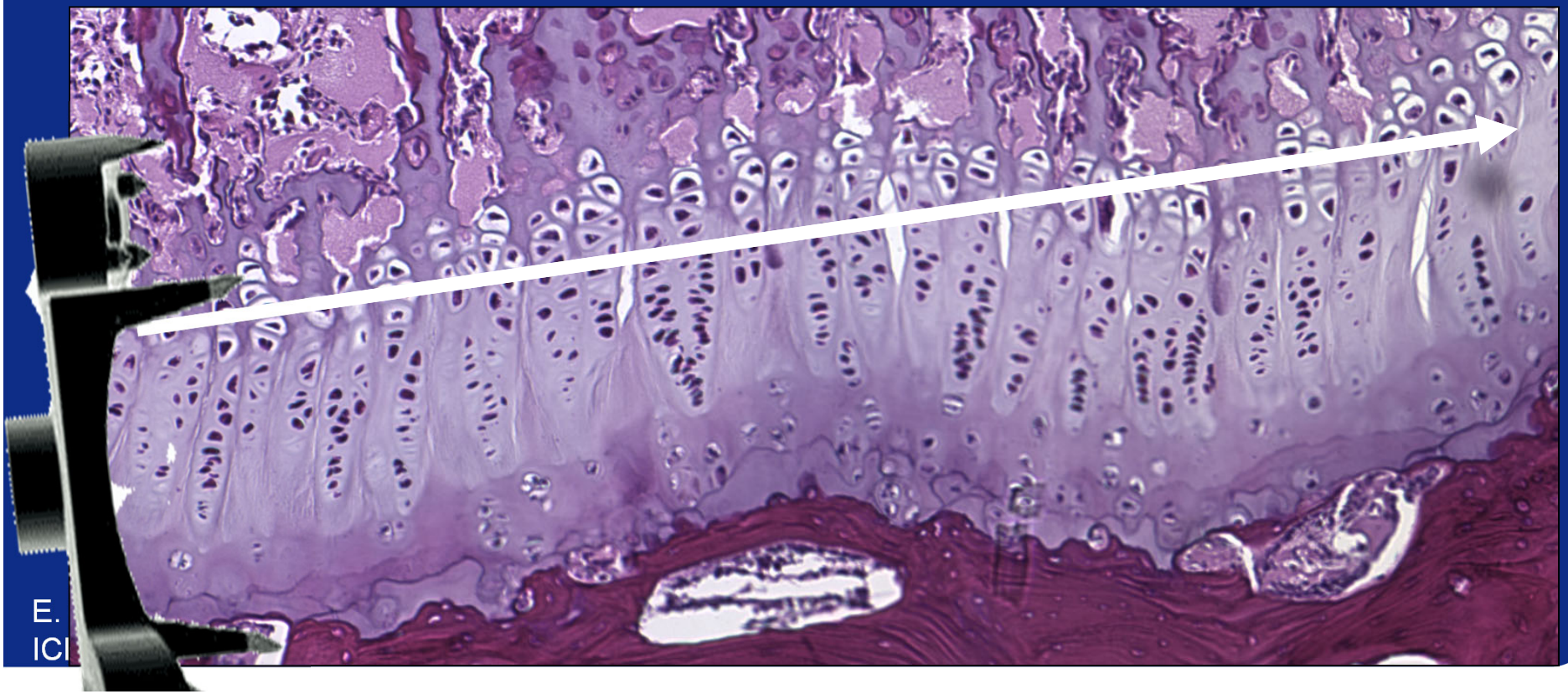
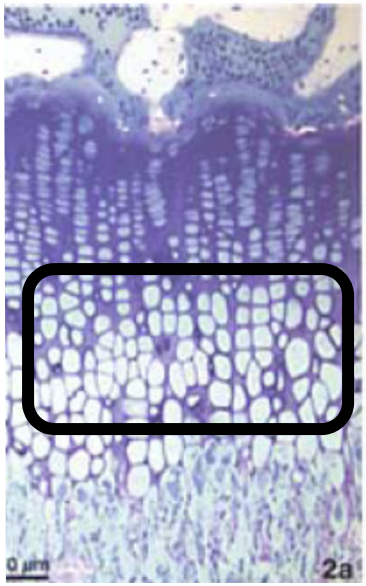
Purpose

To test the hypothesis that the growth plate and cell size effect are directly related to distance from implant.

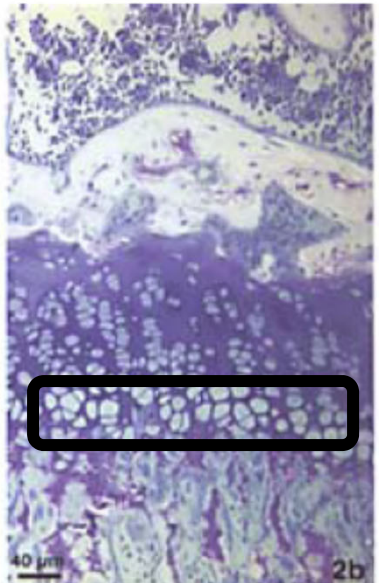


Stapling tibial growth plate

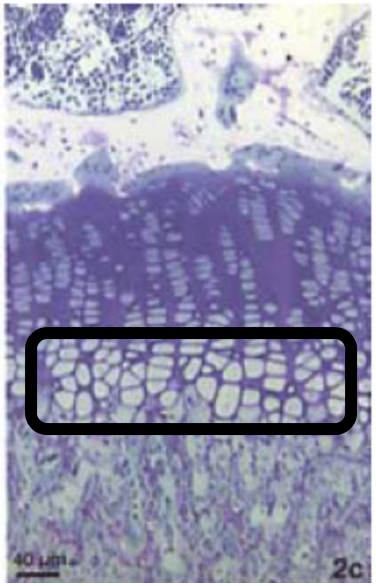
Farnum et al. *Cells, Tissues, Organs:* 2000



Control



Under staple

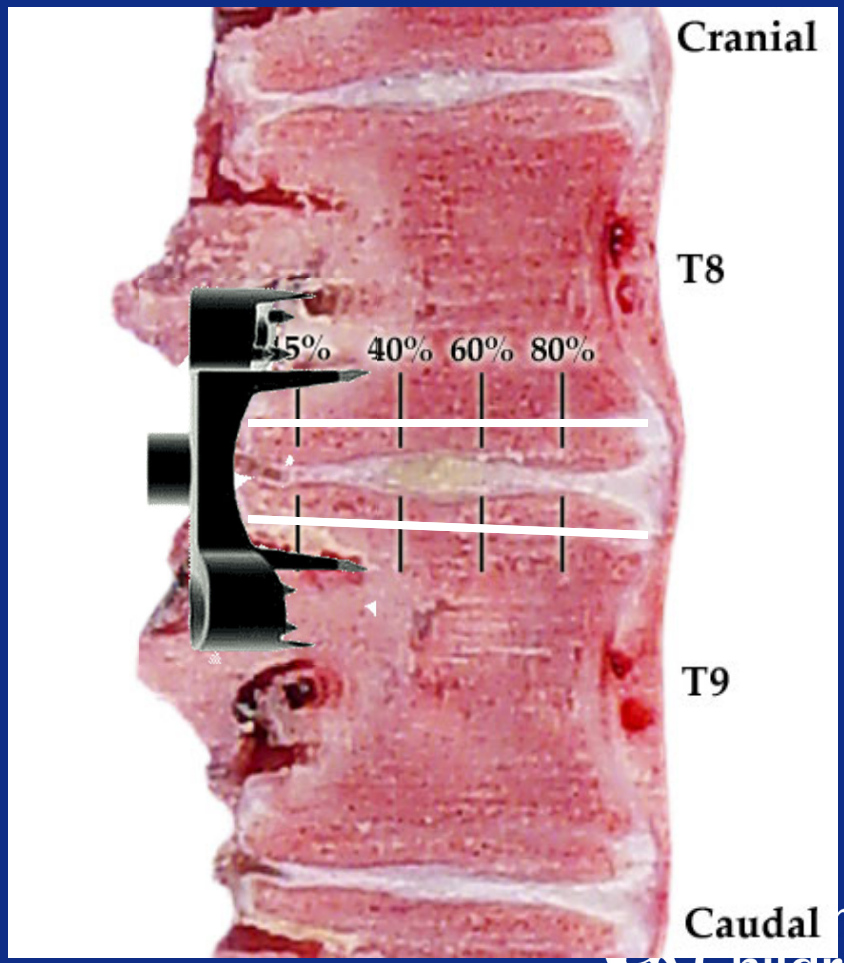


Opposite staple

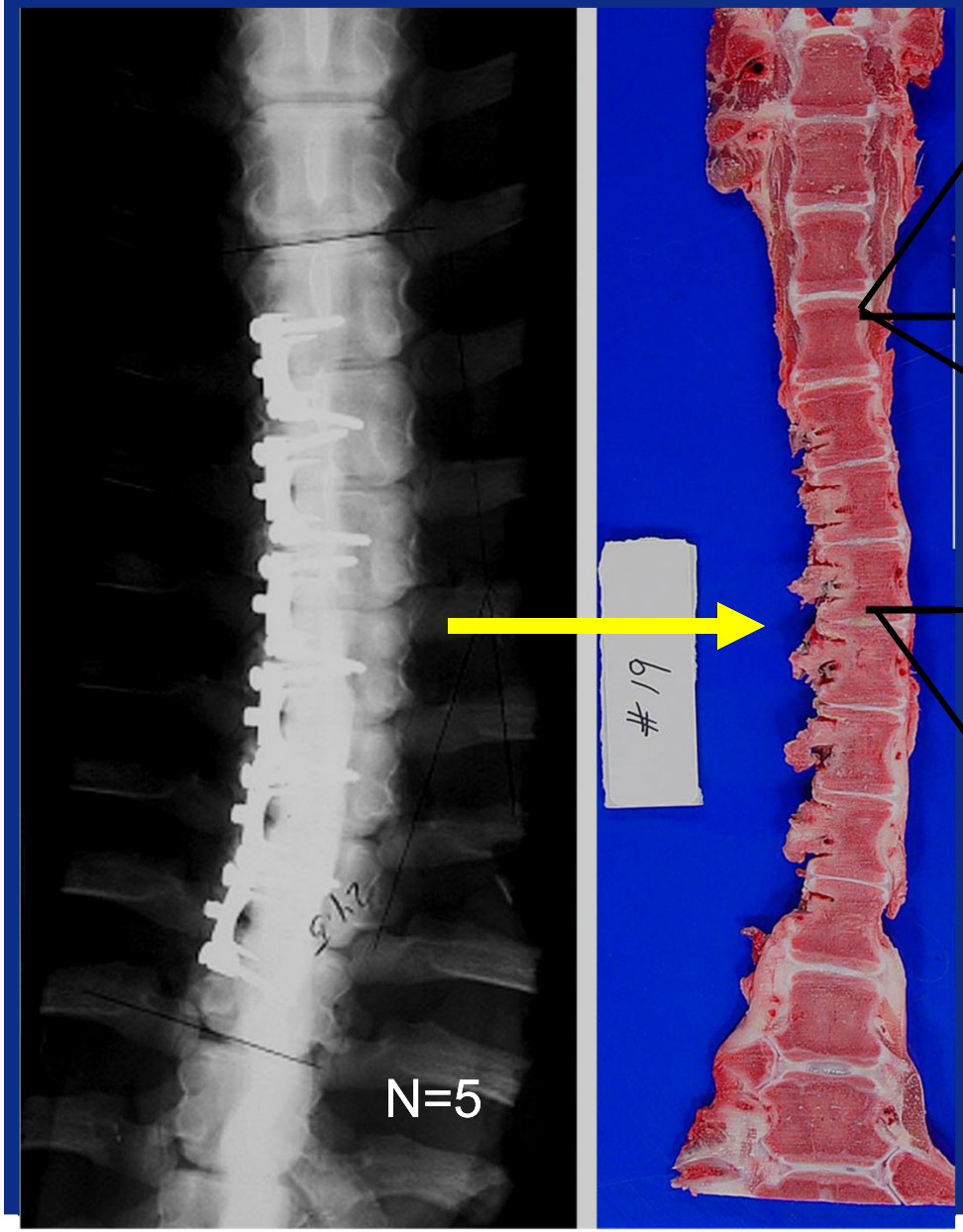
Increase in cell volume during hypertrophy was *the* variable that correlated most significantly with bone growth

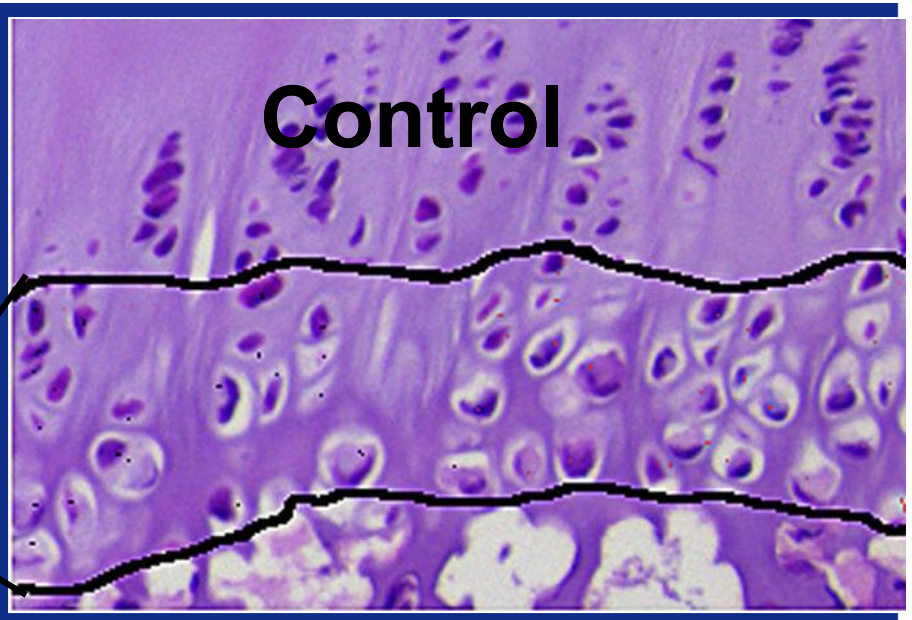
BIG QUESTION

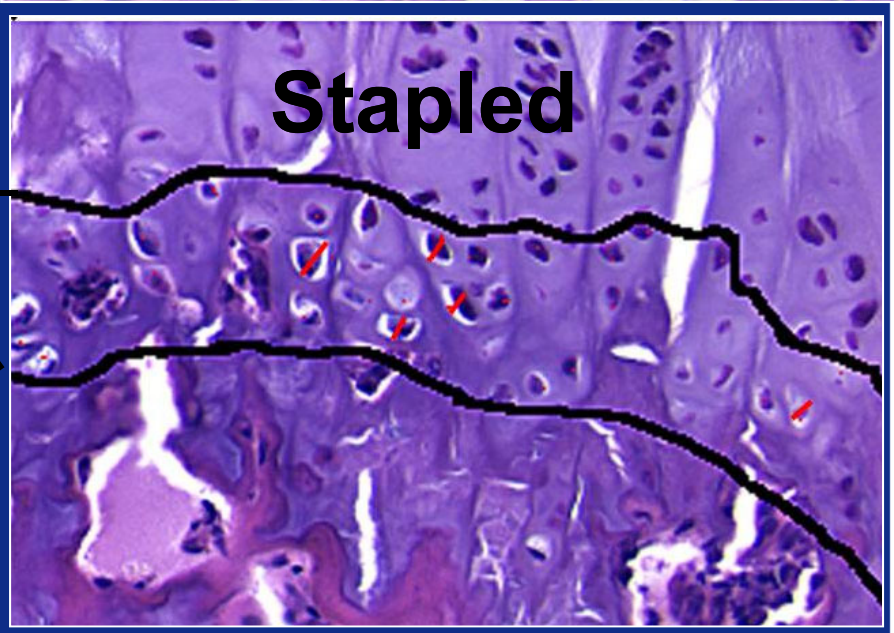
- Are we actually modulating growth, or just compressing the disc?



Research Methods







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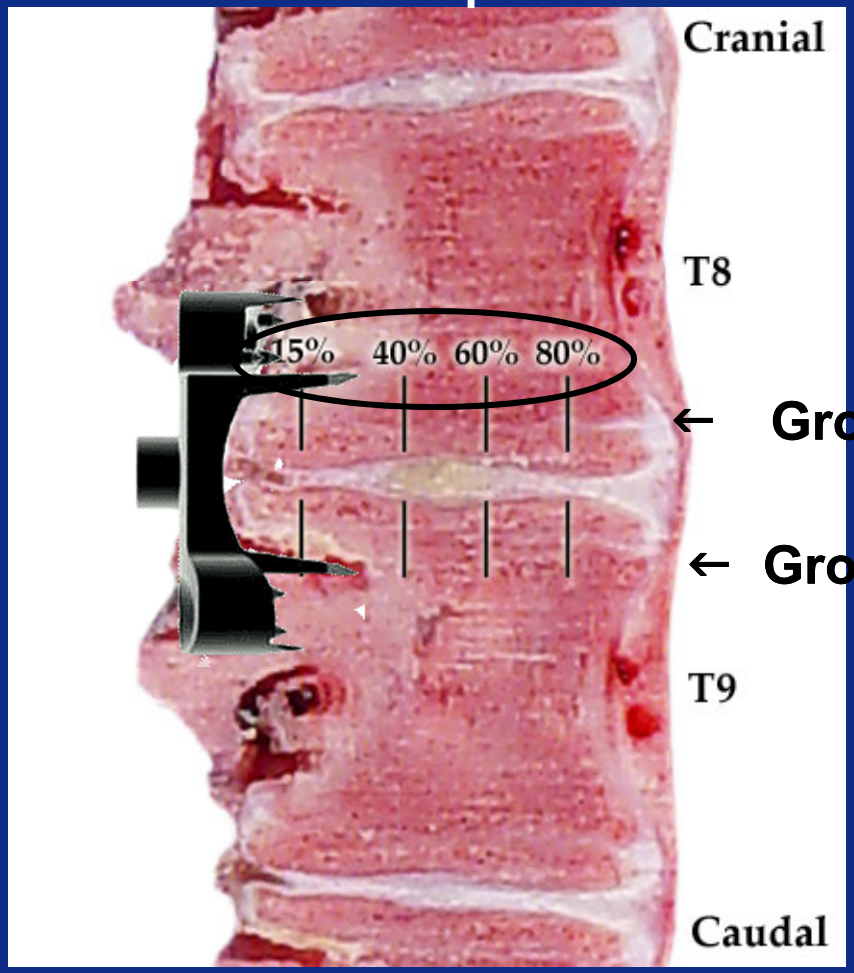
Measurement Locations

Stapled



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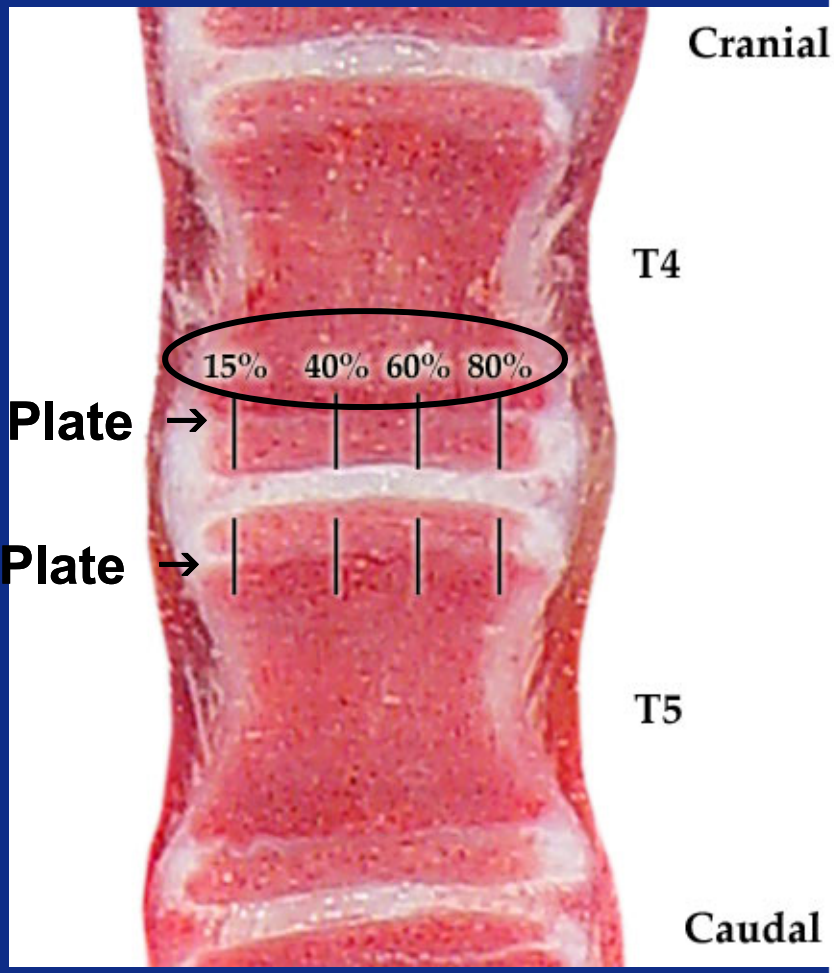

← Growth Plate →

← Growth Plate →

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ICEOS, Madrid 11/07

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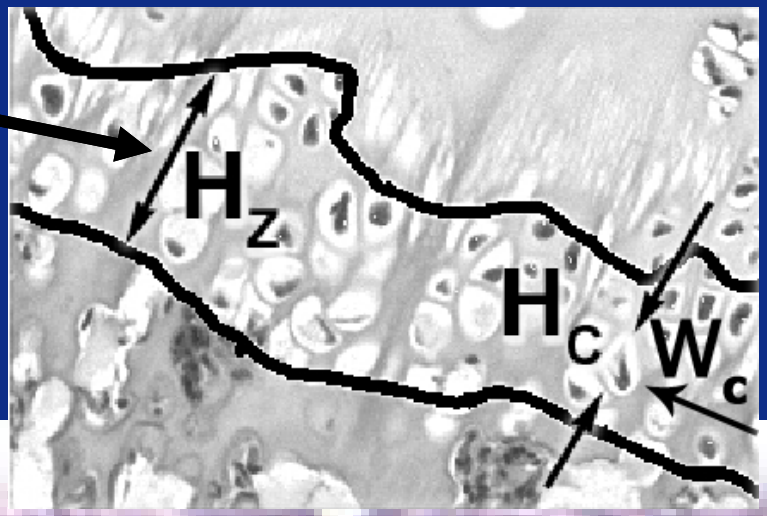
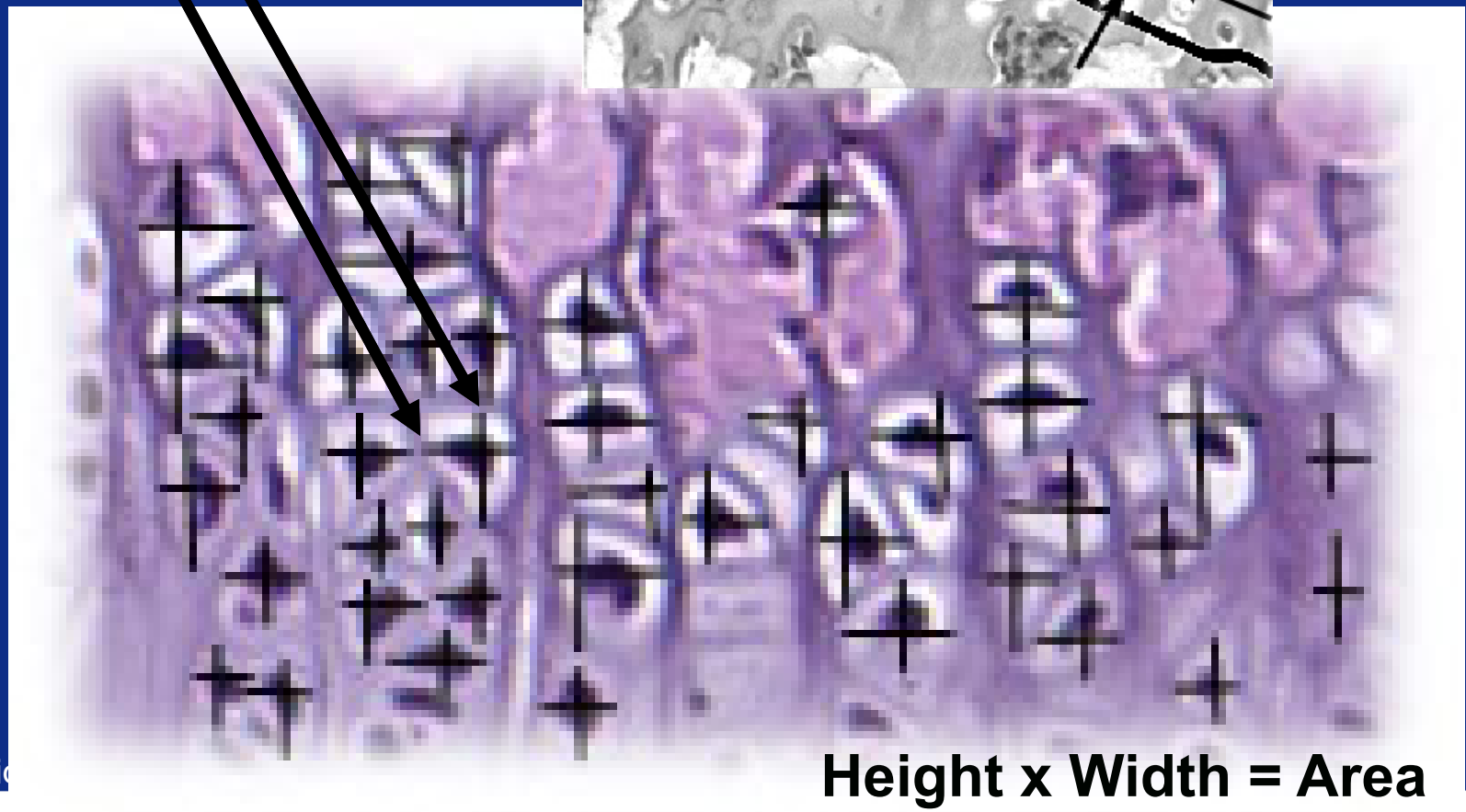
Variables Measured

- Hypertrophic Zone Height
- Cell Height
- Cell Width





Height x Width = Area

E. Wall
ICEOS, Madri

Statistics

- **T-test (MS Excel)**
  - ✓ Two tailed distribution, two sample equal variance
  - ✓ Stapled 15% vs Control 15%
    - ✓ $\alpha = 0.05$
- **Analysis of variance (SAS)**
  - ✓ Tukey's studentized range test
- **Regression**
- **Correlation (Pearson's)**

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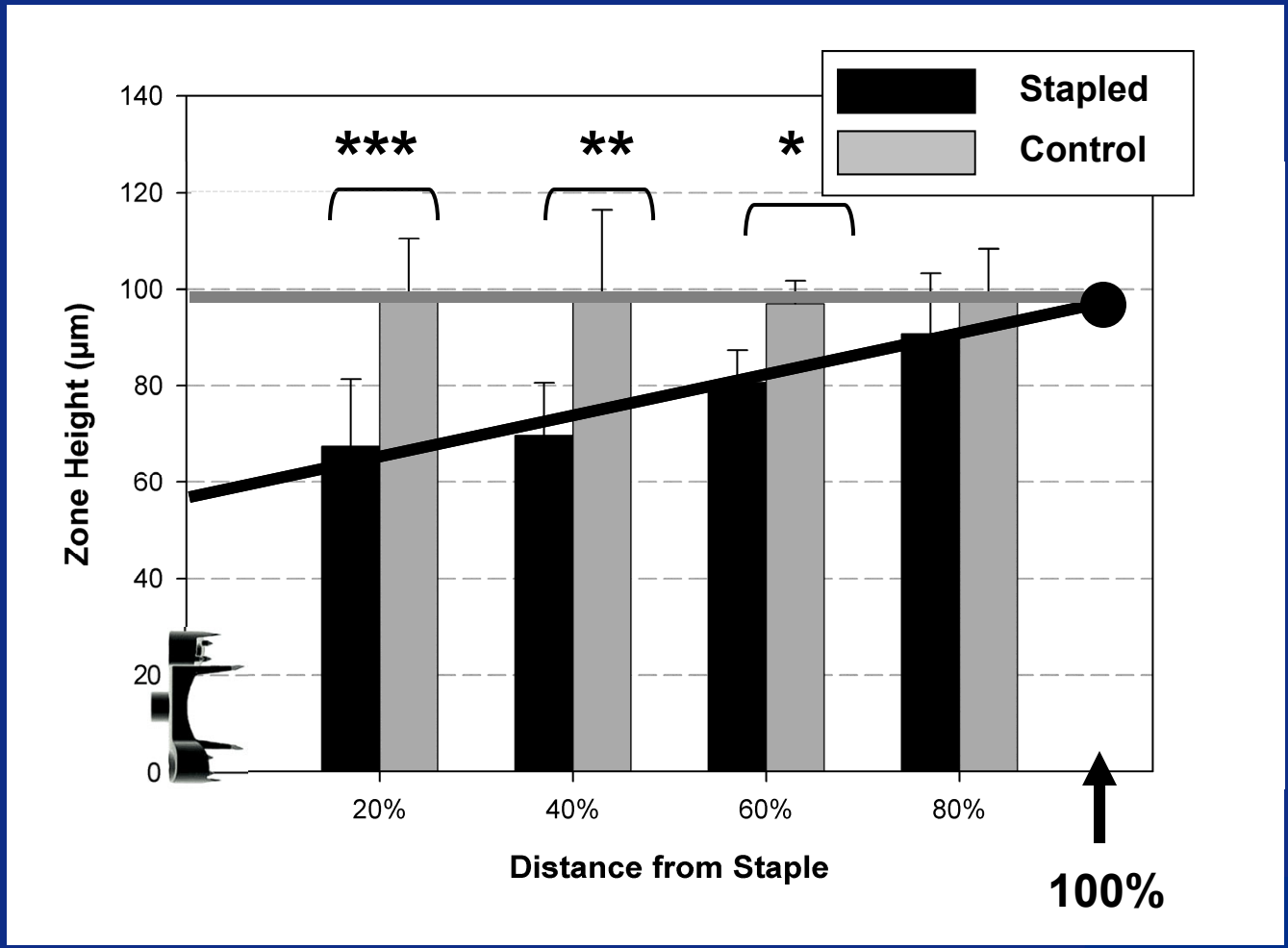
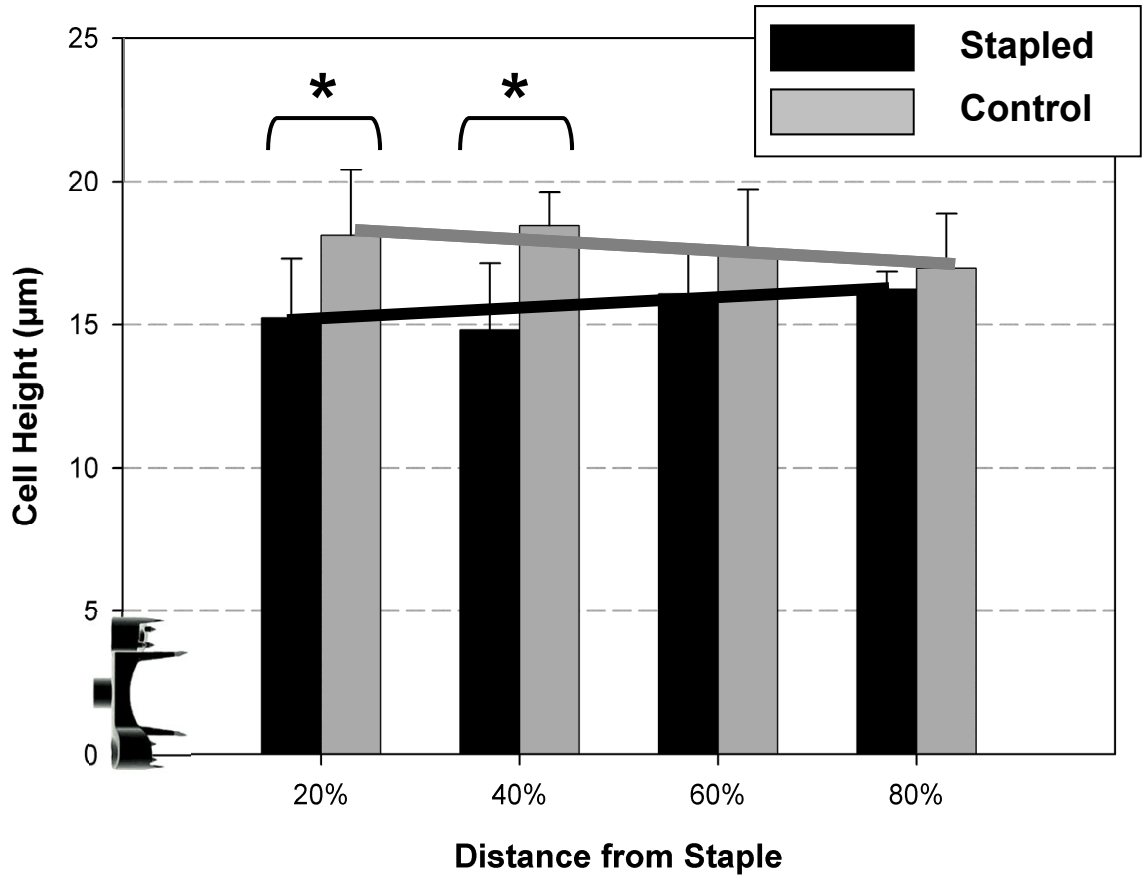
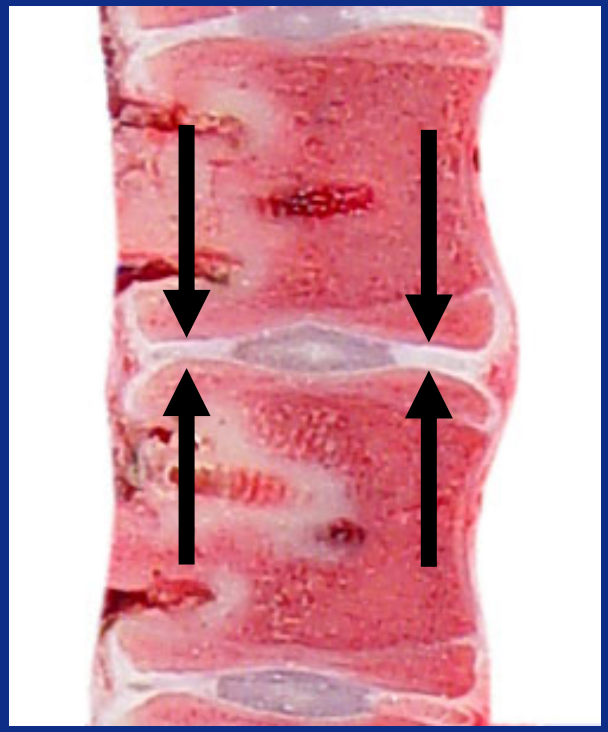
Zone height (h_z)



Cell Height (h_c)

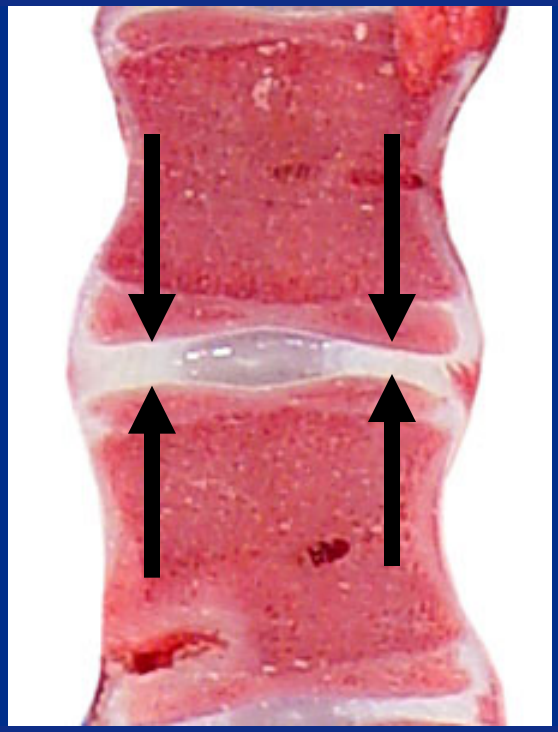


Disc heights



Stapled

60% of control



Control

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Can Fusionless Scoliosis Surgery Reverse the Heuter-Volkmann Effect?

John Braun et. al., SRS 2007

- Ipsilateral growth inhibited 24%
- Contralateral growth inhibited 22%

"Neither implant modulated growth according to Heuter-Volkmann Law".

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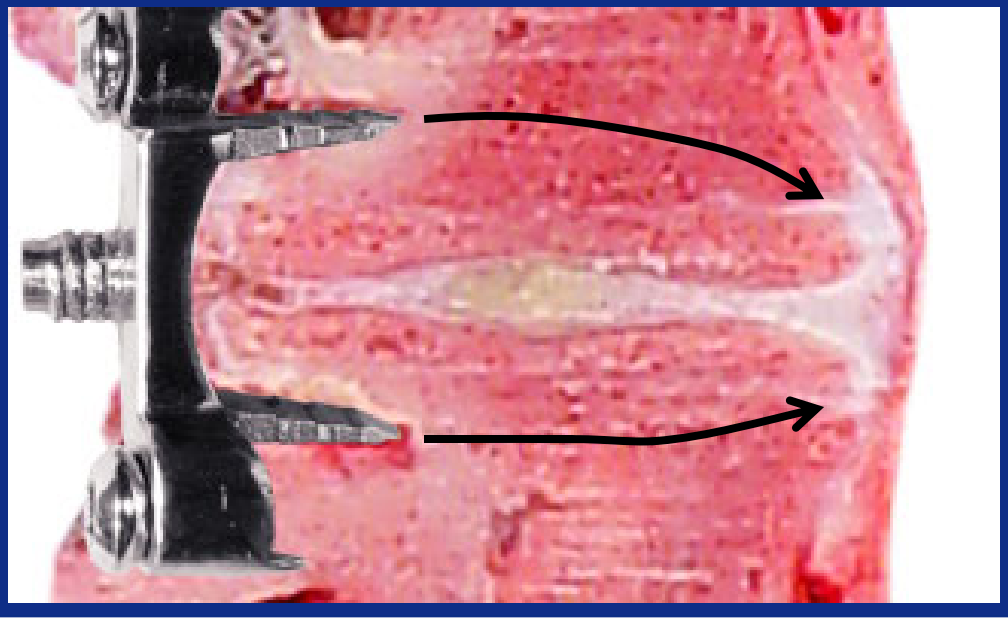
Conclusions

- Spine staple hemiepiphysiodesis significantly altered vertebral growth plate structure
  - Consistent with transmission of a compressive stress gradient to physes (Heuter-Volkmann)
    - Despite disc compliance
    - Similar to stapling of long bones

Conclusion

- Heuter-Volkmann modulated growth, with uninhibited growth on opposite side.
- Further study needed to examine for Depelch acceleration of growth on opposite side



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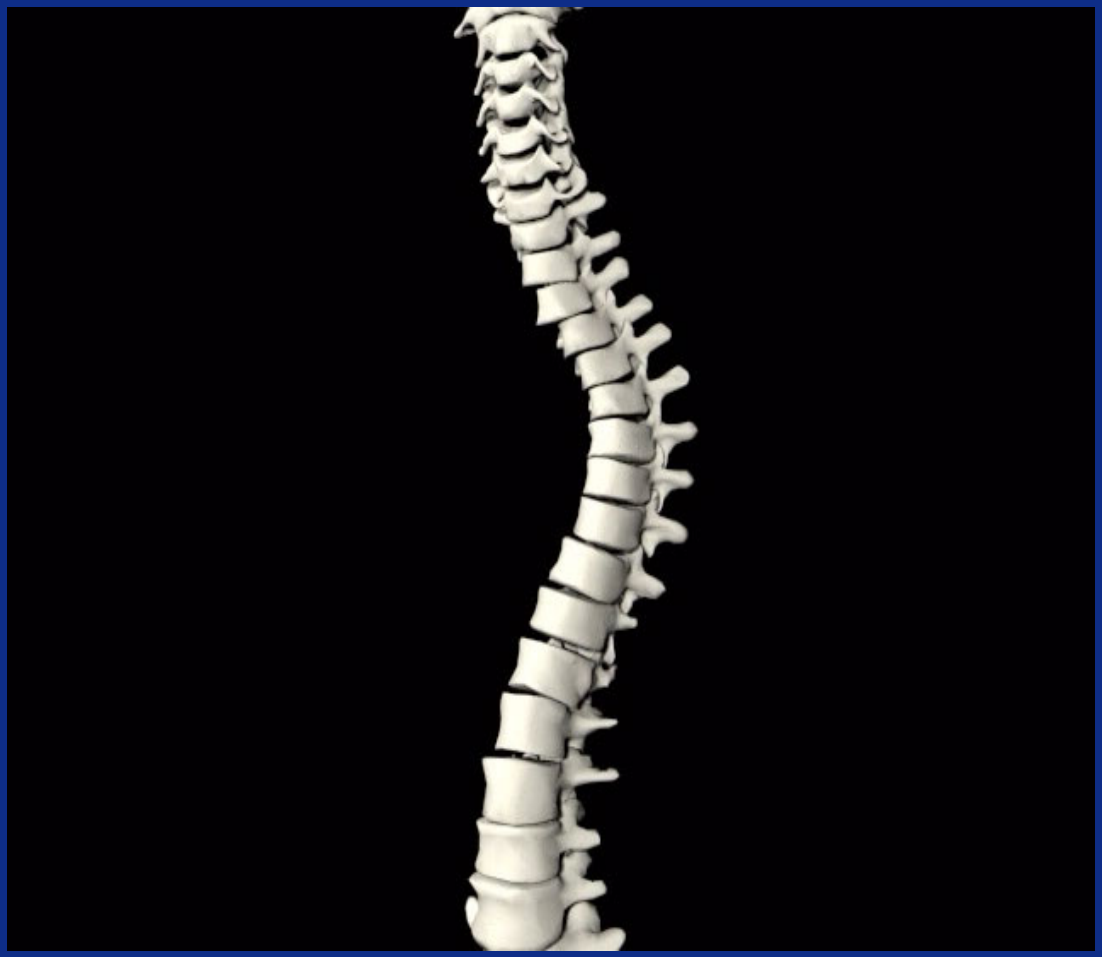
- **Scoliotic curves may be modulated by selective growth inhibition similar to Blount staple of knee, despite presence of disc**



Thank you from Cincinnati, USA