

Neurocentral Synchondrosis Behavior in Cadaveric Vertebra in the Skeletally Immature

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Disclosures

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- a. Grants/Research Support**
- b. Consultant**
- c. Stock/Shareholder**
- d. Speakers' Bureau**
- e. Other Financial Support**

Introduction

- **Neurocentral synchondrosis (NCS) is the cartilaginous growth plate of the pedicle with the vertebral body**
- **Timing of closure of the NCS is controversial**
 - **Most agree that the NCS are open until 4 years of age**
 - **Subsequent closure remains unclear**
 - **The mid- to lower thoracic spine is the last to close**
- **Interference with the NCS growth at this stage may be responsible for asymmetrical spinal growth**

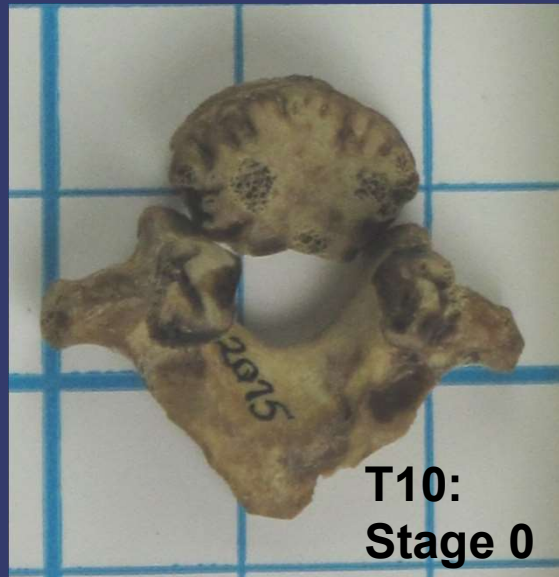
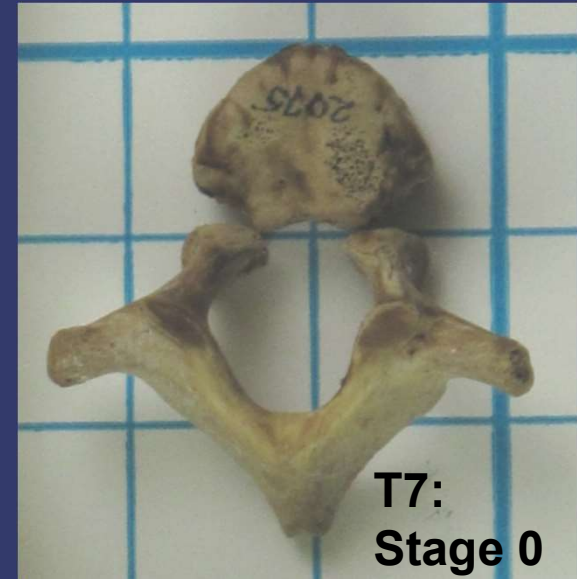
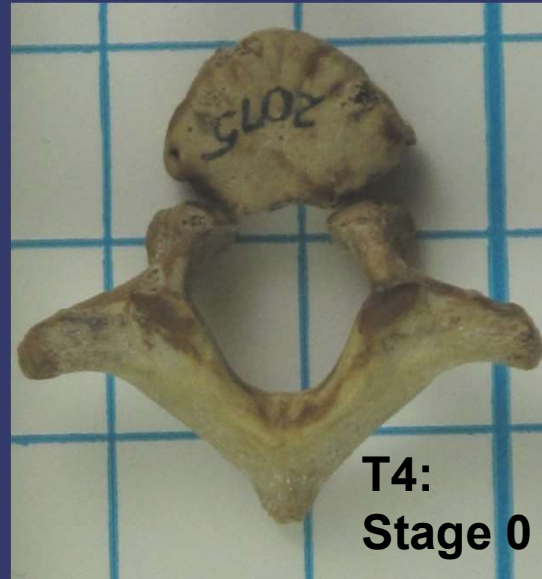
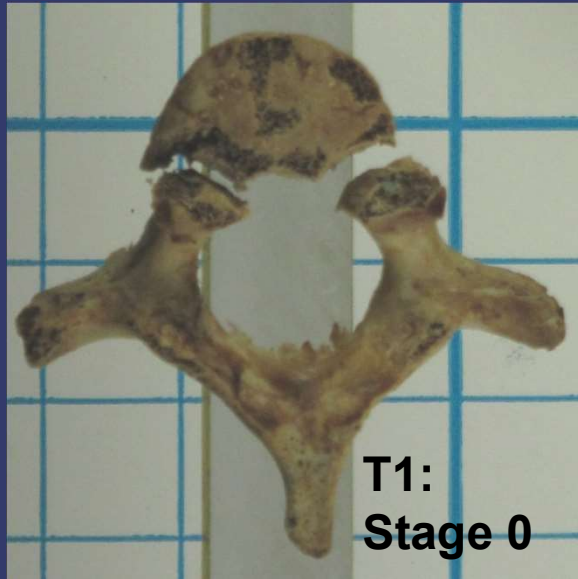
Methods

- Examined scalar measurements of cadaveric vertebrae from the Hamann-Todd Collection for neurocentral synchondrosis (NCS) during their developmental stages
- The cadavers from the Hamann-Todd collection:
 - Are greater than 75 years since death
 - Did not die of natural causes
 - TB, Diphtheria, Stills Disease, Lues
 - Demographics were known
- 13 specimens were examined. Age: 1 to 16 Years.
- Five vertebrae from each specimen were chosen for the study: (T1, T4, T7, T10 and L3)

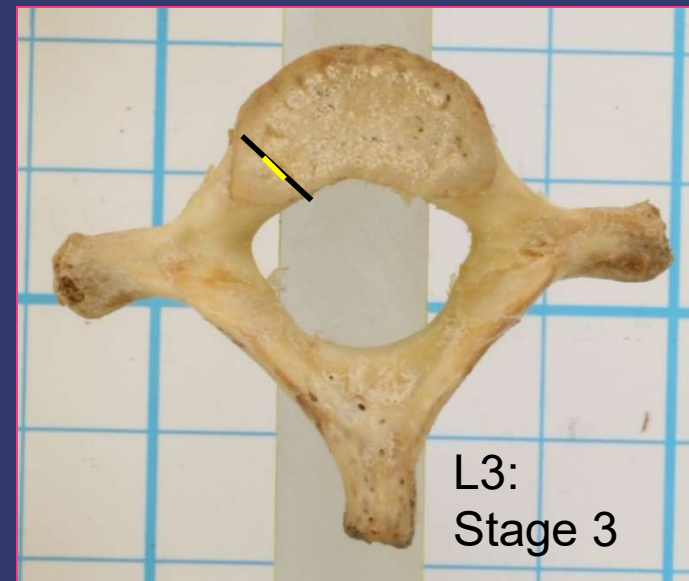
Methods

- Each vertebra was inspected for NCS maturity
- The percentage of open growth plate was compared to the full NCS length.
- A six point scale of percent of NCS closure^{1,2} was used
 - Stage 0: No Closure
 - Stage 1: Less than 25% Closure
 - Stage 2: 25-49% Closure
 - Stage 3: 50-74% Closure
 - Stage 4: 75-99% Closure
 - Stage 5: 100% Closure
- Findings were compared to recent published data

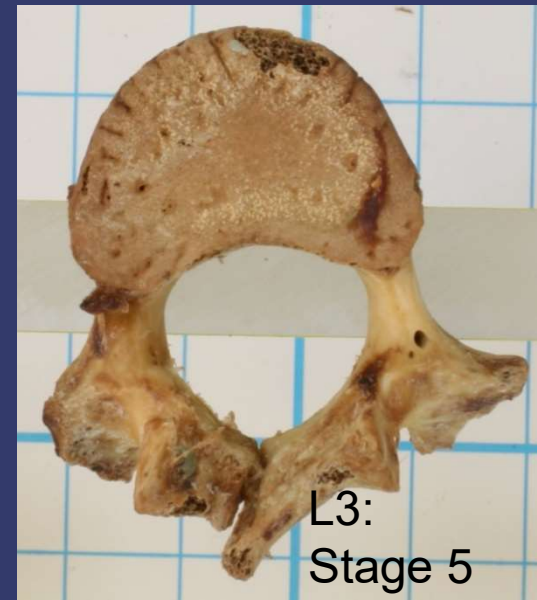
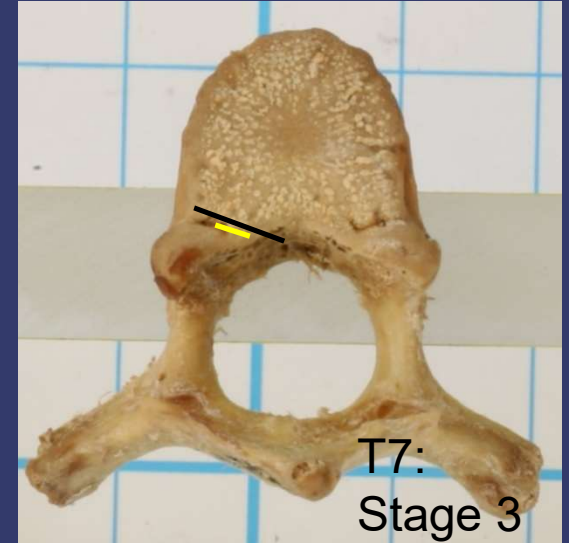
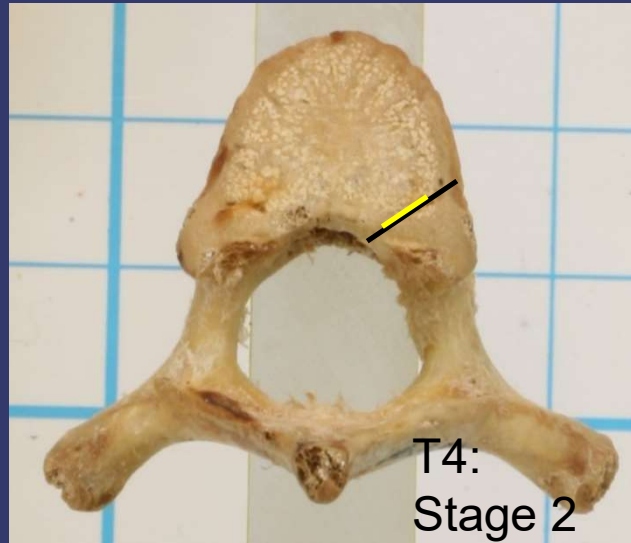
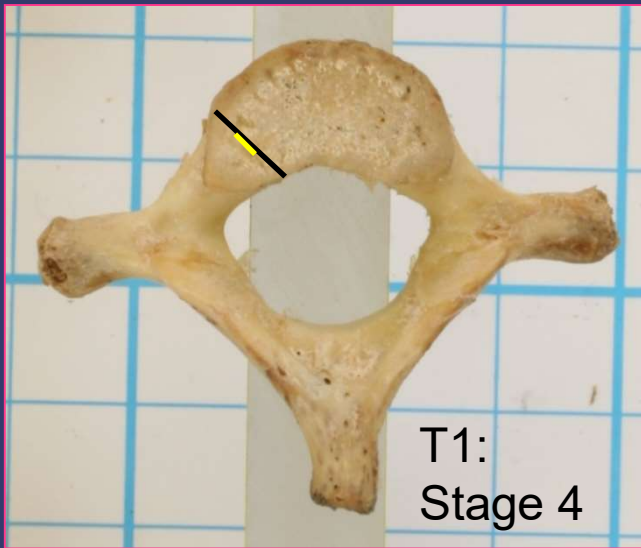
1 Year Old Black Male (2075)



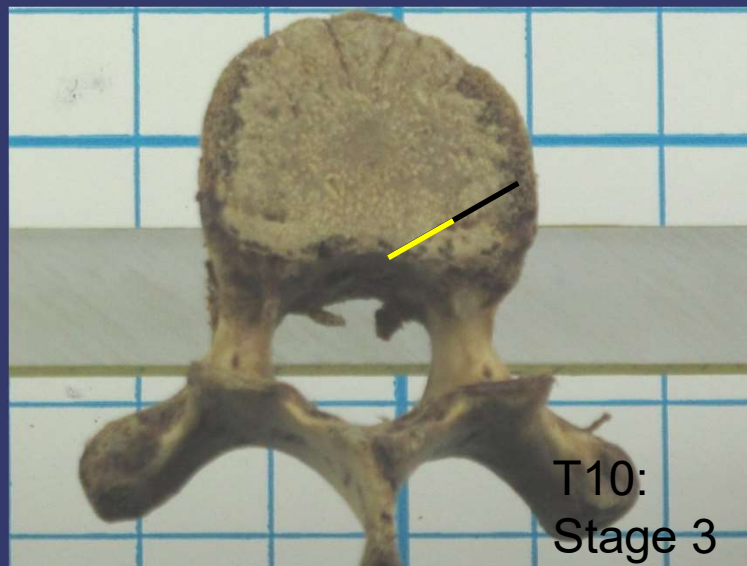
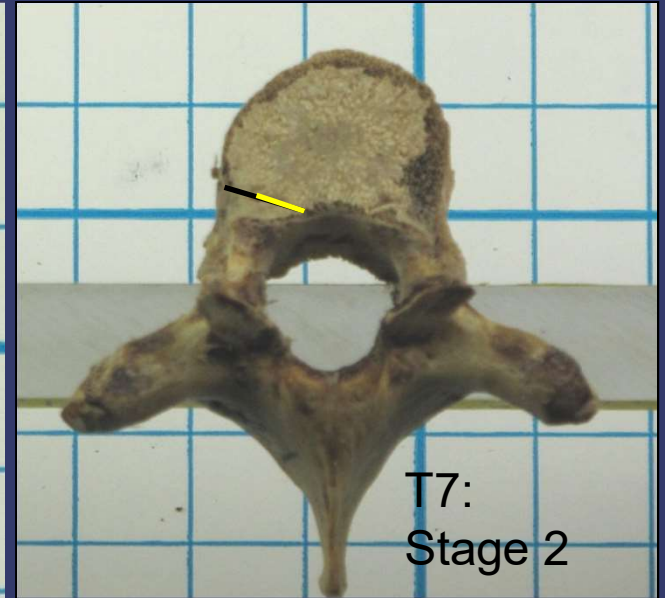
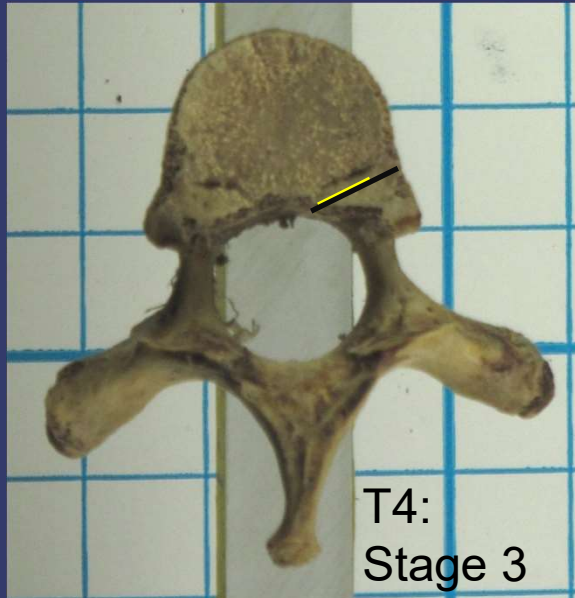
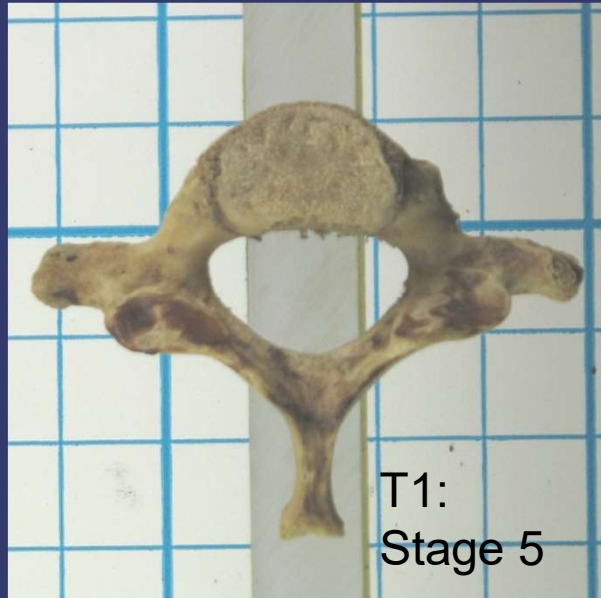
4 Year Old Black Female (2141)



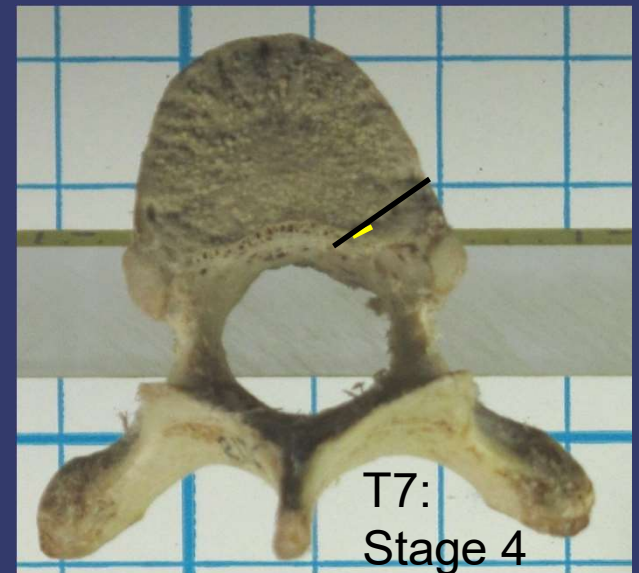
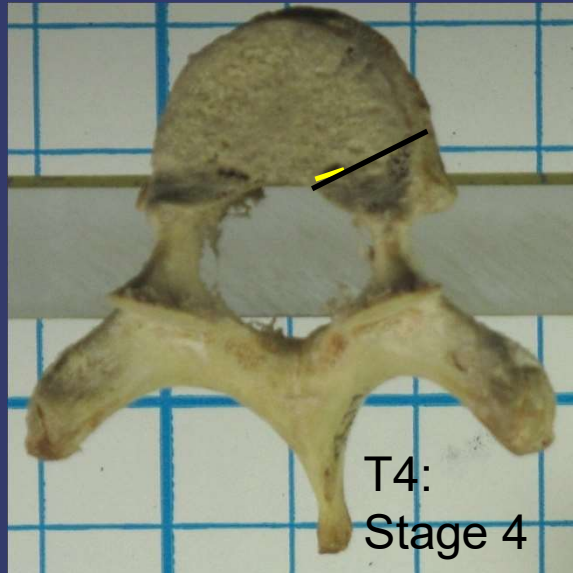
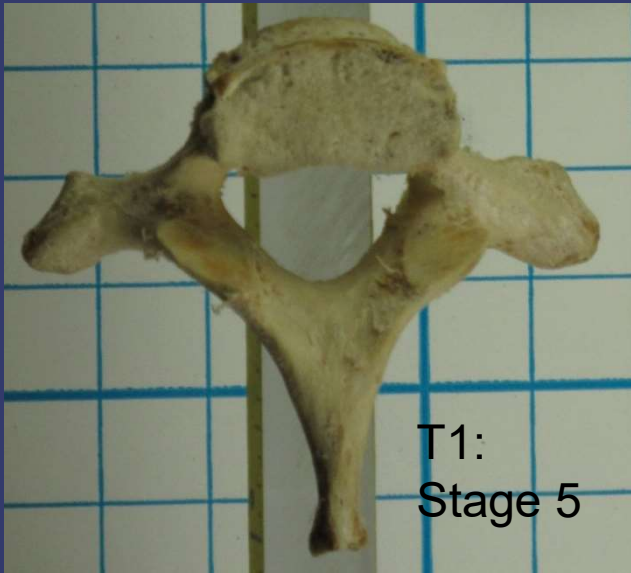
8 Year Old Black Female (2074)



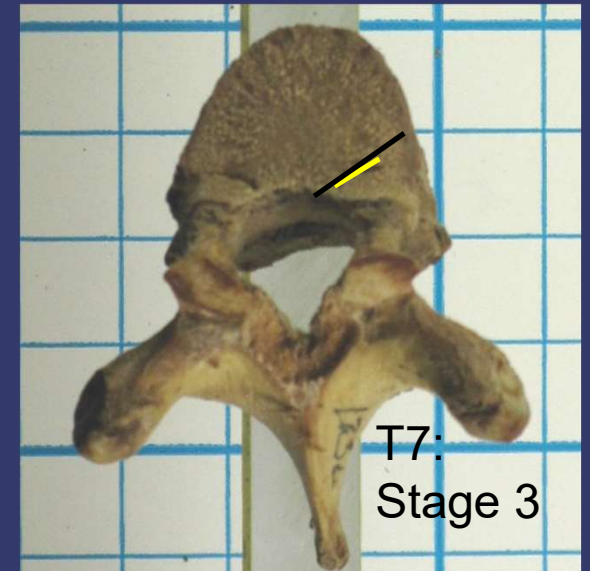
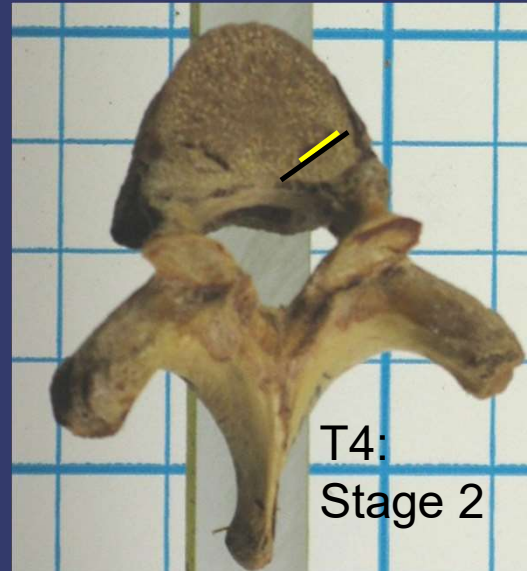
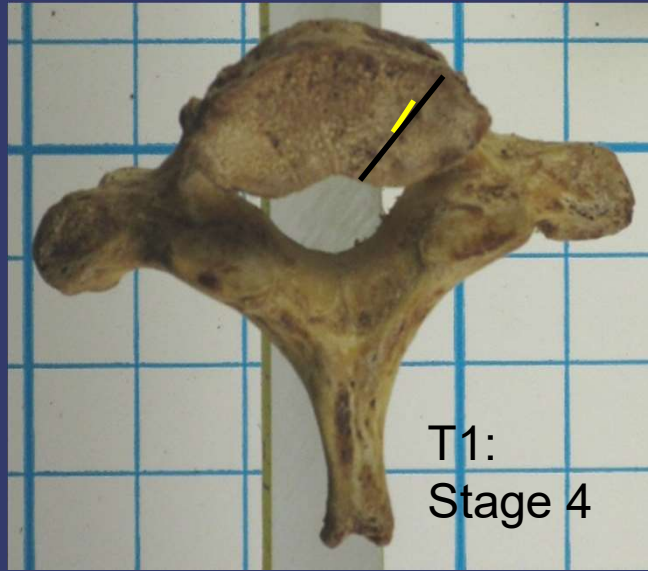
12 Year Old Caucasian Female (1240)



14 Year Old Black Female (2135)



16 Year Old Black Male (1232)



Results

- **Vertebrae with a Chronological Age 3 or Less:**
 - **No Evidence of NSC Closure (Stage 0) at Any Level**
- **Vertebrae with Chronological Age 4-8:**
 - **Lumbar Vertebrae Showed 50-100% NCS Closure**
 - **Other Vertebrae Showed an Average of <25% Closure**
- **Vertebrae with Chronological Age 9-12:**
 - **Upper Thoracic Vertebra (T1) Showed 75-100% NCS Closure**
 - **In the Middle Thoracic (T4, T7, T10), the NCS were All 50-74% Closed (Stage 3)**
 - **In the Lumbar (L3), the NCS were Closed (Stage 5)**

Results

- **Vertebrae with Chronological Age >12:**
 - **NCS in Upper Thoracic and Lumbar were Completely Closed (Stage 5)**
 - **The NCS in the Middle Thoracic were 50-100% Closed (Stage 3-5)**
- **The NCS were Symmetrical from Left to Right in All Vertebrae**

Conclusions

- The Results are in general agreement with recent MRI investigations into the characteristics of the NCS^{1, 2}
 - There was no closure of the NCS in any vertebra <3 chronological years
 - The lumbar vertebrae were starting to close the NCS in the 4-8 year age group, closely followed by the upper thoracic vertebrae
 - In the 8-12 year age group, the middle thoracic vertebrae (T4, T7, T10), the NCS were still only 50-74% closed

Conclusion

- Results may support the theory that:

If vertebral growth can be disturbed in the middle thoracic spine (at the age of maximal growth rate) this may contribute to adolescent idiopathic scoliosis.^{3,4}

References

1. Zhang H, Sucato DJ, Nurenberg P, McClung A. Morphometric Analysis of Neurocentral Synchondrosis Using Magnetic Resonance Imaging in the Normal Immature Spine. *SPINE* 2010; 35: 76-82
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4. Sanders JO, Browne RH, Cooney TE et al. Correlates of the Peak Height Velocity in Girls with Idiopathic Scoliosis. *SPINE* 2006; 31: 2289-95.



THANK YOU