Vertebral Body Tethering (VBT): Quantifying Tension in a VBT System for Scoliosis Treatment

Phoebe Cain  
*Boise State University*

Christy Farnsworth  
*Rady Children's Hospital*

Jason Caffrey  
*Rady Children's Hospital*

Tony Olmert  
*University of California San Diego*

Salil Upasani  
*Rady Children's Hospital*

*See next page for additional authors*

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Abstract
The gold standard surgical treatment for children with adolescent idiopathic scoliosis is deformity correction with spinal instrumentation and fusion. However, there is associated significant, long-term morbidity in fusing multiple motion segments in a child. Pain, inflexibility, and degenerative arthritis are often sequelae of the surgery due to fusion sites being immobile [1], and longevity of the metal rods and screws is a long-term concern. However, an innovative approach, vertebral body tethering (VBT), was recently approved by the FDA and has since provided an alternate treatment option. VBT takes advantage of the natural growth of a child’s spine to modulate spinal growth and correct the deformity over time without spinal fusion. A flexible polyethylene tether is affixed to multiple spinal segments to apply compressive forces on the vertebral growth plates. Using a tensioner device, the amount of tension in the tether at each vertebral level is controlled, eventually correcting spinal curvature as the patient grows. Recent data shows 74% of patients treated with VBT achieve clinical success [2]. The tensioner device has tension settings of 0 to 5, though no data is available to correlate with the amount of tension generated in the tether at each setting. Furthermore, there are two different tensioner device designs that can be used in this medical device set (methods A and B), and it is unknown whether these different tensioners produce similar tension. Therefore, the purpose of this study was to quantify the forces generated with the two tensioner methods (A and B) at six categorical tension levels using current VBT instrumentation.

References

Comments
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Authors
Phoebe Cain, Christy Farnsworth, Jason Caffrey, Tony Olmert, Salil Upasani, and Erin Mannen
**BACKGROUND**

- Spinal Fusion is the current gold standard treatment for children with adolescent scoliosis.
- Vertebral Body Tethering (VBT) was recently approved by the FDA and has since provided an alternative treatment option.
- A tensioner device with setting 0-5 is used, but there is no public data on the amount of tension generated at each setting.
- Surgeons cannot fully analyze clinical data without access to and an understanding of the underlying biomechanical data.

**METHODS**

**Biomechanical Tensile Test System**

- Records the amount of tension and displacement
- Tensioner (ZimVie)
- Changes the amount of tension generated in the tether

**RESULTS**

**Biomechanical Tensile Test System**

- The data collected determined that both tensioner methods A and B exhibited linear relationships of the tension and setting number.
- Standard deviations were within 10% of the means.
- High coefficients of determination for both methods A and B.

**CONCLUSION**

- Tension in the tether of the VBT was quantified at each setting (0 to 5), finding that the relationship between tension and setting is linear for both tensioner methods.
- The method B tensioner resulted in greater force generation compared to method A in the tether at each setting which was unexpected since the settings (0 to 5) for each method were not different.
- This research will provide analytical data that may inform surgeons on how to specify VBT loads for each spinal segment and potentially allow patient specific VBT loading.

**FUTURE WORK**

- Adding inter- and intra- rater reliability and statistical comparisons of the two methods to the novel data set
- Coding all of the stored data from the MTS machine

**REFERENCES**:


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