Biomechanical Stability Analysis Of Transpedicular Screws Combined With Sublaminar Hook-Rod System On A Computed Finite Element Model

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Purpose:
Posterior stabilization and reconstruction of the anterior spine column is, according to the majority of authors, the method of choice for stabilization of unstable spine. Our hypothesis is that by augmentation of posterior stabilization systems with another posterior hook-rod system new stabilization system is developed and has stiffness close to stiffness of combined anterior and posterior stabilization construct, using a single surgical approach.

Materials and Methods:
Finite element method is used for biomechanical analysis. Testing are performed for two scenarios, first the scenario of L1 corporectomy and second scenario of L1 spondylectomy. Each scenario is subsequently modified in three ways by adding the stabilization constructs: combined anterior and posterior, only posterior and combined posterior. Range of motion and strain analysis are performed.

Results:
Comparing the stiffness of the three tested stabilization construct in scenario of spondylectomy showed that combined anterior and posterior stabilization construct is the stiffest construct except in the case of lateral bending when combined posterior stabilization showed to be stiffer. Strain analysis showed that posterior stabilization construct is significally unloaded when augmented with hook-rod system especially in the cranially posted screws. Significant concentration of strain is calculated in the cranially posted hooks especially in the case of lateral bending and torsion.

Conclusion:
Comparable stiffness is shown at combined posterior stabilization construct and combined anterior and posterior stabilization construct. Strain analysis showed luxation tendency in the cranial posted hooks, especially in the movement of lateral bending and torsion what would most likely lead to construct failure.