Thoughts on the genesis of PJK

Richard H Gross, MD
Hai Yao, PhD
Yongren Wu, PhD

Medical University of South Carolina
Charleston, SC
6+4 year old boy, spastic quadriparesis, ventilator dependent. PJK 111 degrees.

Total Bending moment: 752.1 N.cm. Gravity center: y = 12.6 cm
Age 8+11, sublaminar hooks, kyphosis, 122 degrees

Hooks failed. Kyphosis 143 degrees

Total Bending moment: 812.8 N.cm. Gravity center: y = 13.6 cm
Supplemented with pedicle screws. Kyphosis 118 degrees

Total Bending moment: 553.7 N.cm
Gravity center: y = 9.3 cm

Rib construct inserted. Kyphosis 113 degrees despite displacement of 2 superior hooks. Died 6 months after this radiograph.
Relationship of occiput to sacrum indicates deforming forces were neutralized.

Total Bending moment: 1109.4 N.cm. Gravity center: y = 18.6 cm

Total Bending moment: 374.3 N.cm. Gravity center: y = 6.3 cm
12 y o boy with mitochondrial phosphorylation defect

Total Bending moment: 832.9 N.cm. Gravity center: $y = 13.9$ cm
Instrumentation failed over 3 years. Note increased cervical lordosis – becoming fixed
With fixed cervical lordosis, deforming forces actually INCREASED after thoracolumbar spine aligned.
Scheurmann’s kyphosis - osteoporosis
Total Bending moment: 503.8 N.cm
Gravity center: y = 8.4 cm

Total Bending moment: 385.6 N.cm
Gravity center: y = 6.5 cm
Summary

- The weight of the body mass proximal to the superior instrumentation will place a kyphotic deforming force at the junction of fixed and unfixed spine,
- The amount of force is proportional to the distance of the center of that body mass relative to the superior fixation
- Fixed shoulder protraction places additional PJK deforming forces on the spine
- Correct thoracic deformity before cervicothoracic compensatory deformity becomes fixed