TEXAS SCOTTISH RITE HOSPITAL FOR CHILDREN
www.tsrhc.org

Asymmetrical Flexible Tethering of the Spine in an Immature Porcine Model

Neil Saran
Hong Zhang
Charles E. Johnston

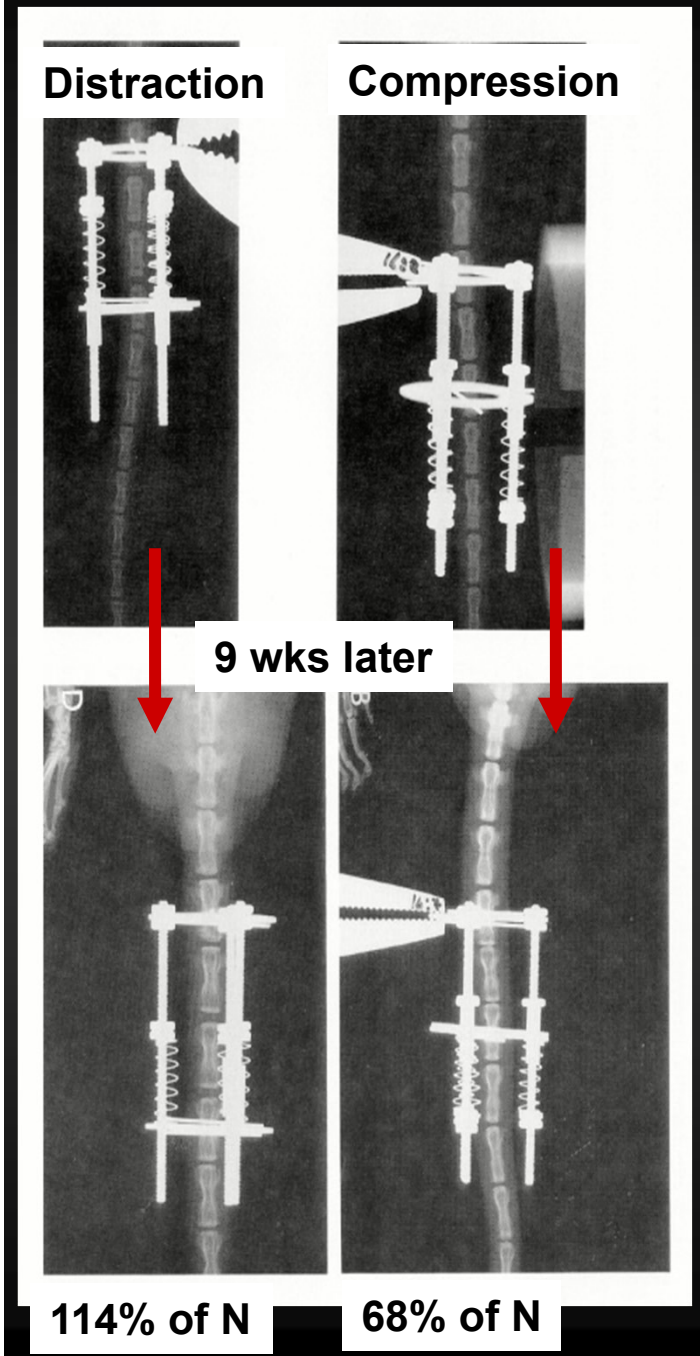
Disclosures

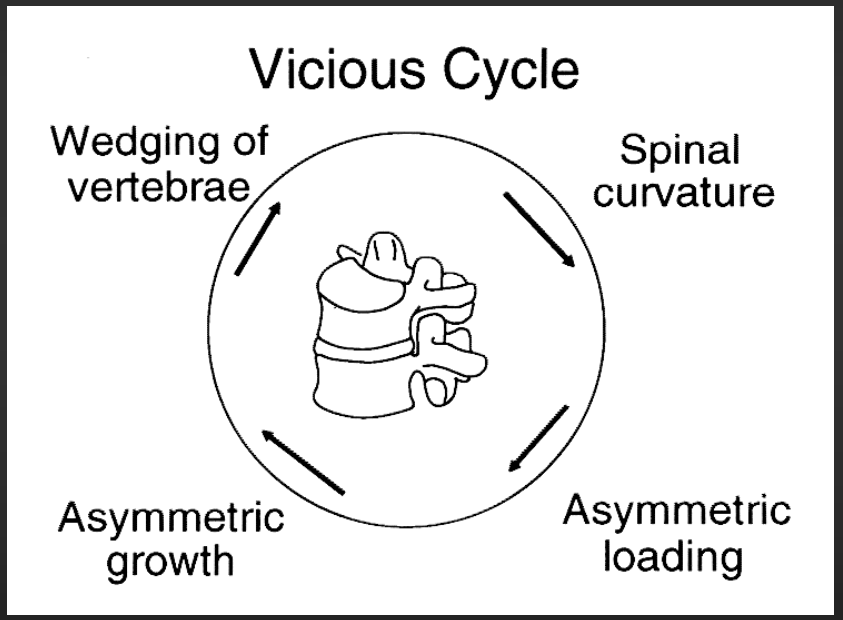
- None

Hueter-Volkmann

- 1862
- Compression across the physis results in growth inhibition
- Tension/Distraction across the physis results in growth acceleration

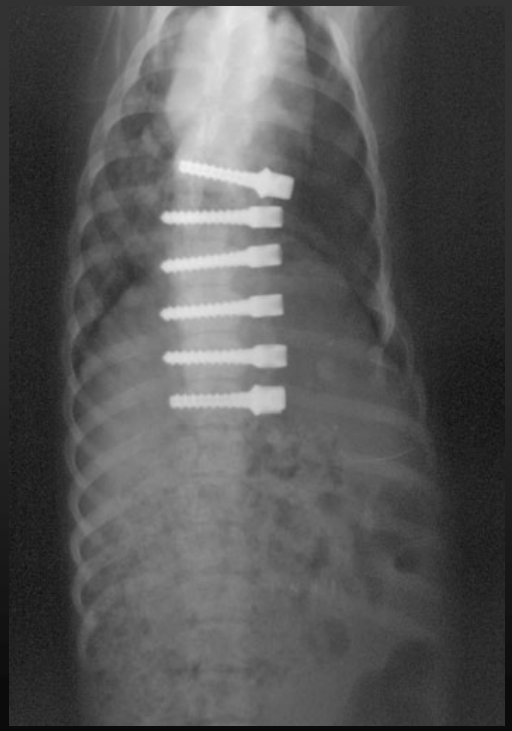
Stokes et al. Spine 1996





Previous work

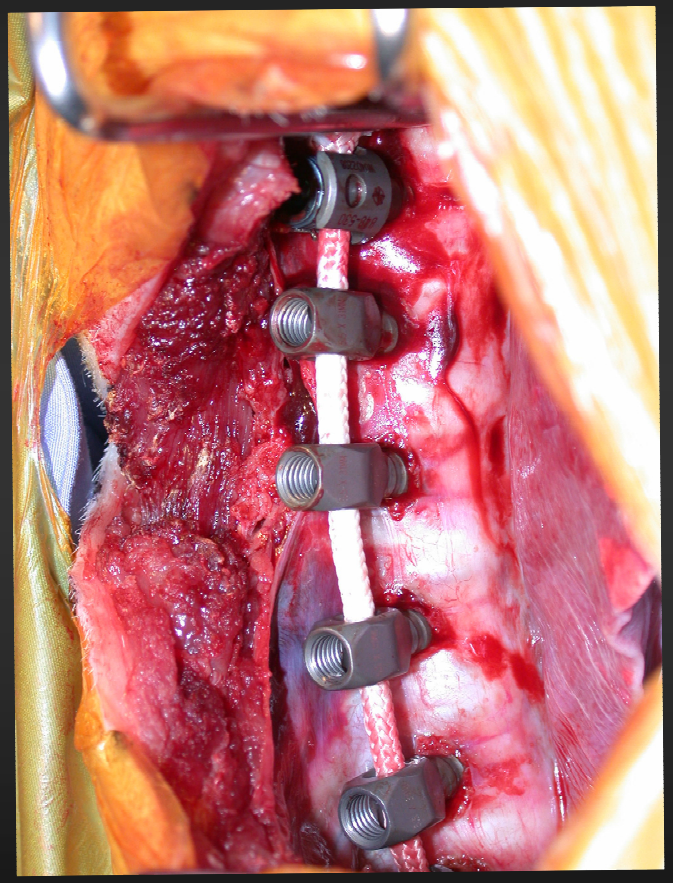
- Flexible cable free to slide between the anchors



- Significant plowing
- Deformity at fixed anchor points

Goal

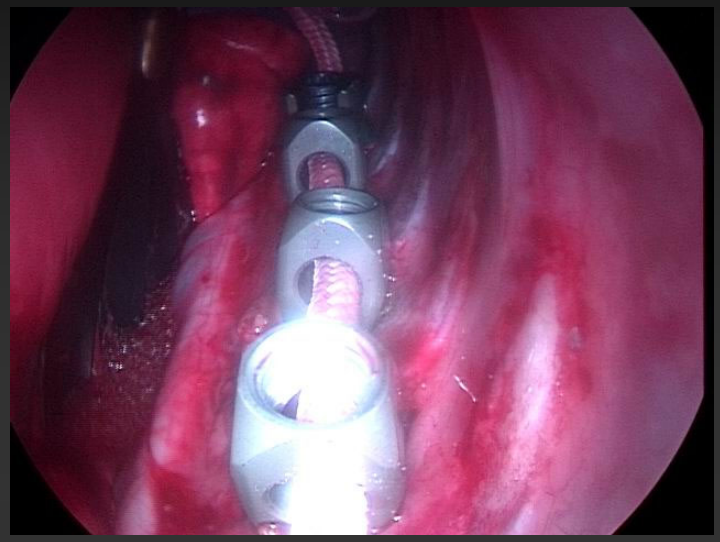
- Fusionless kyphoscoliosis
  - Stay away from posterior elements
- Reversible hemiepiphysiodesis
- Segmental anterolateral flexible tethering
  - Distributing stress among all segments and multiple screws
  - Create apical wedging

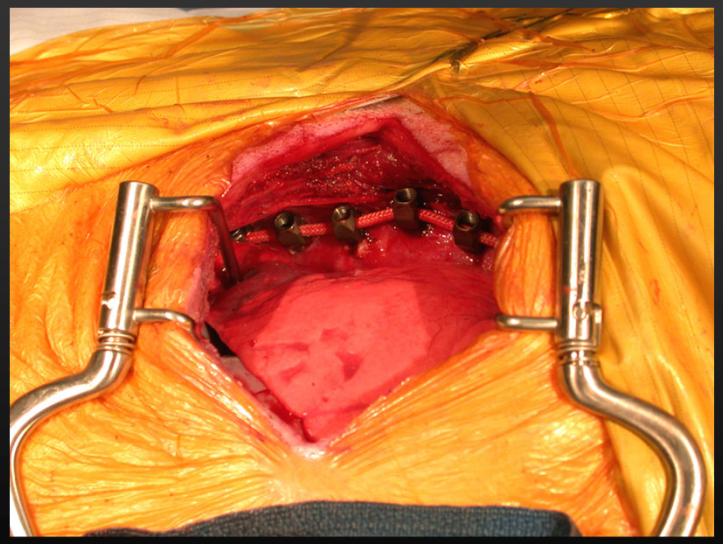


Methods

- Six 2-month old pigs

- 3 open thoracotomy
- 3 thoracoscopic





Methods

- Single vertebral body screws T7-T12
- 5 motion segments
- Segmental Tether
- Flexible polyethylene cable

- Survival 6 months
- Gross/radiologic/histologic analysis at 6 months

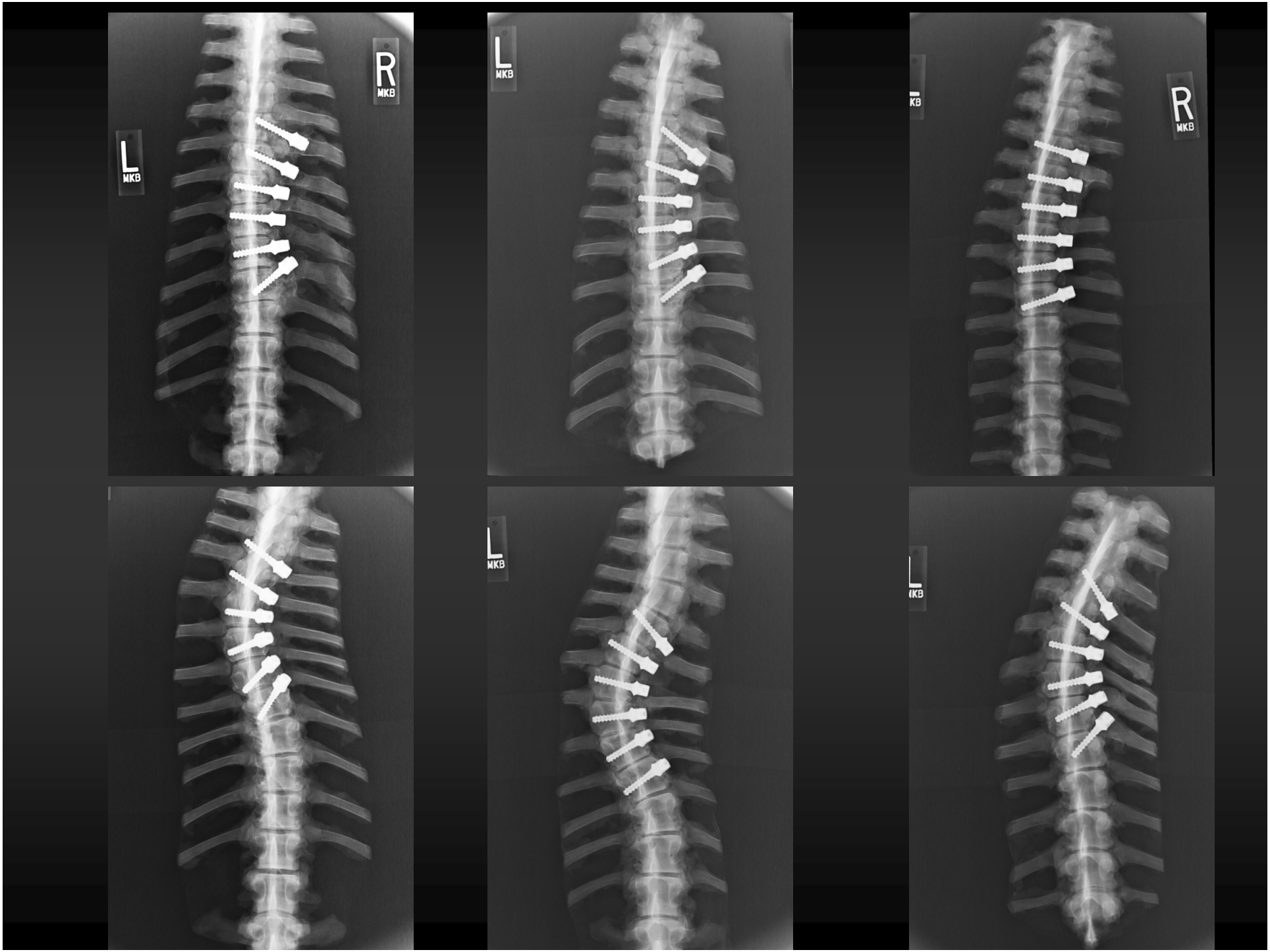
Parameters

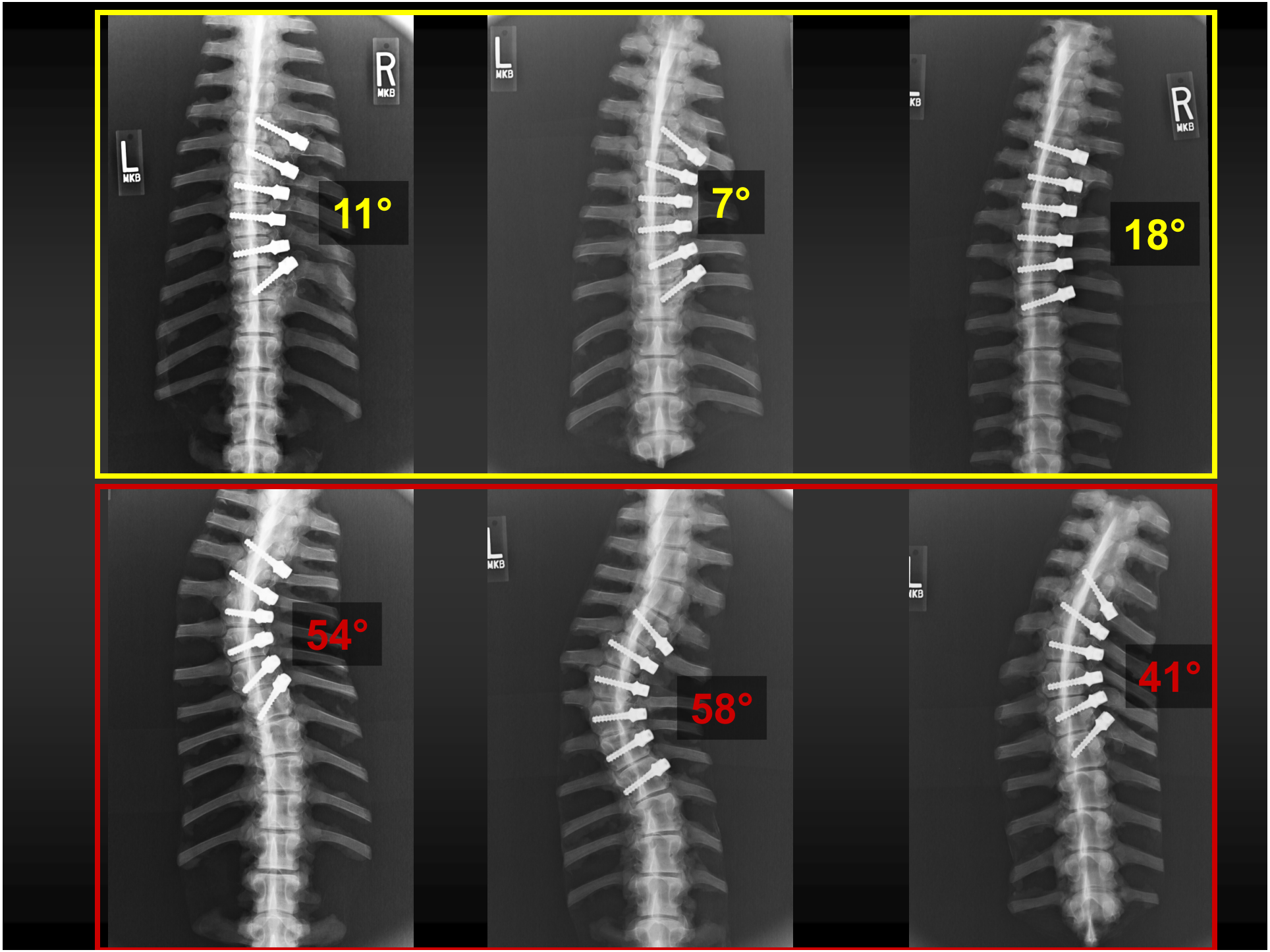
- Gross
  - Motion in sagittal and coronal planes
  - Vertebral body heights
  - Apical wedging
- Radiographic
  - Cobb angles
- Histologic
  - Vertebral body endplate heights
  - Disc heights
  - Annulus fibrosus widths
  - Posterior facet cartilage thickness

Results

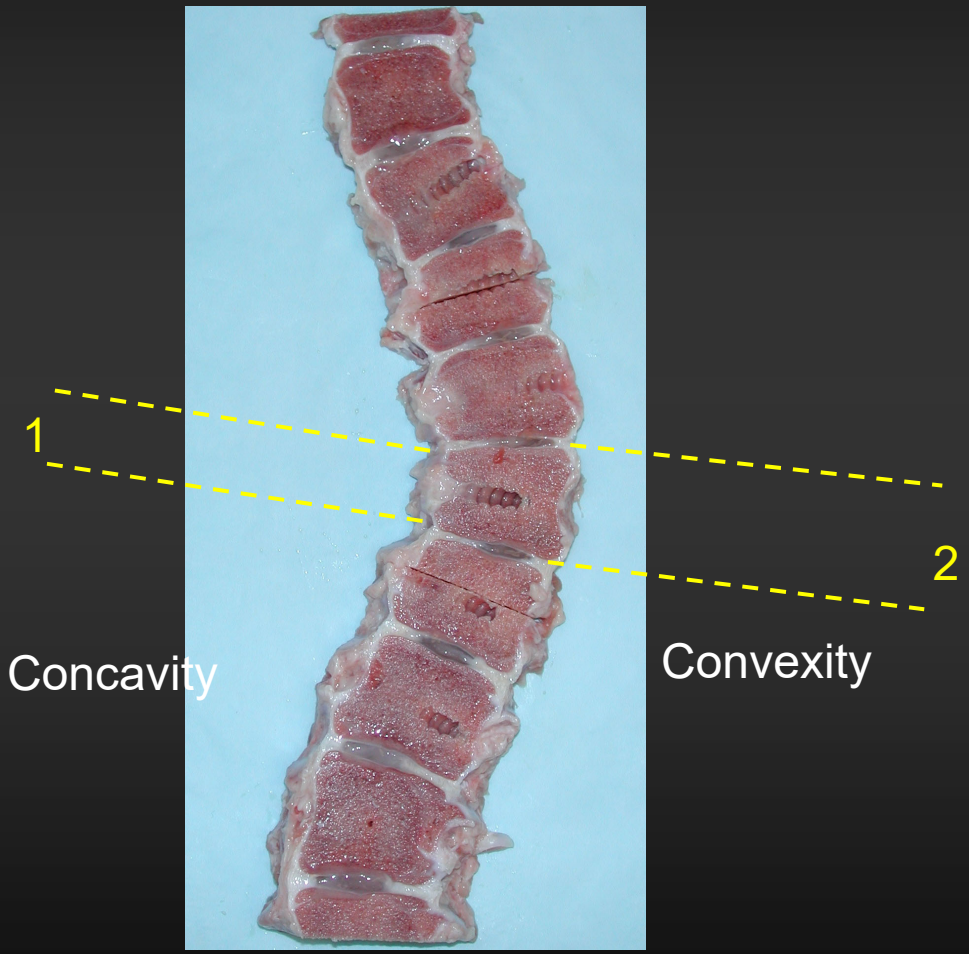


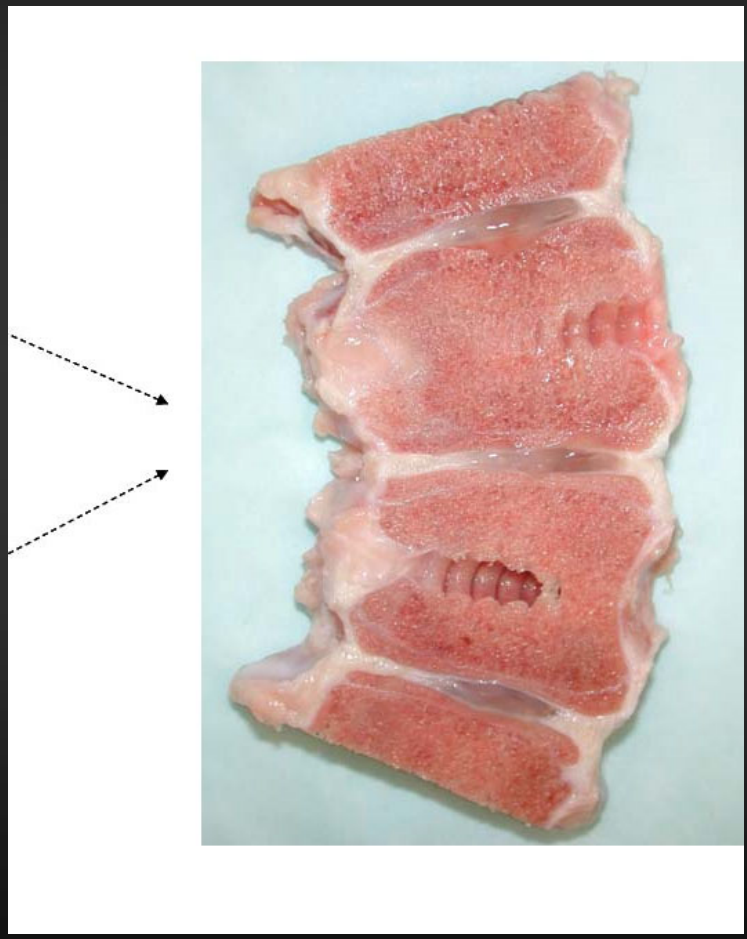




L
MKB
R
MKB
L
MKB
R
MKB
L
MKB


11°
7°
18°
54°
58°
41°

Vertebral body heights/wedging



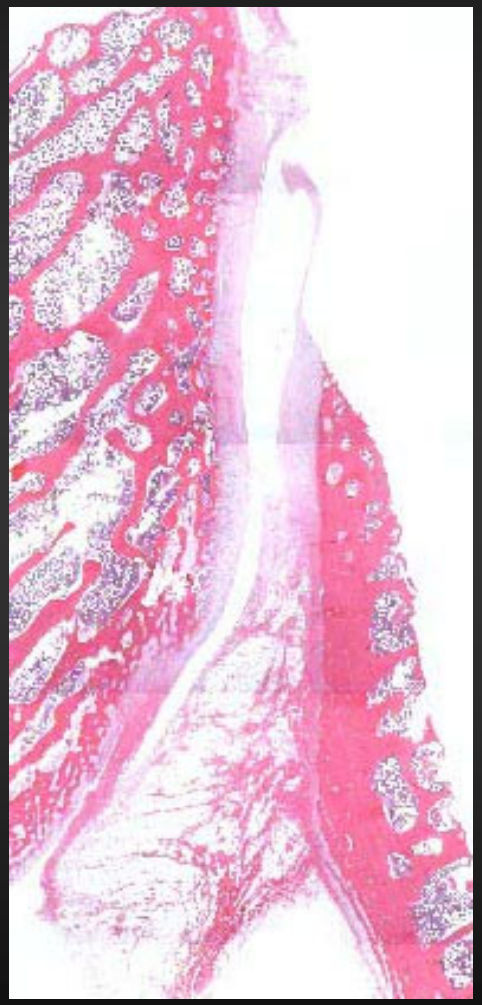


Vertebral Wedging

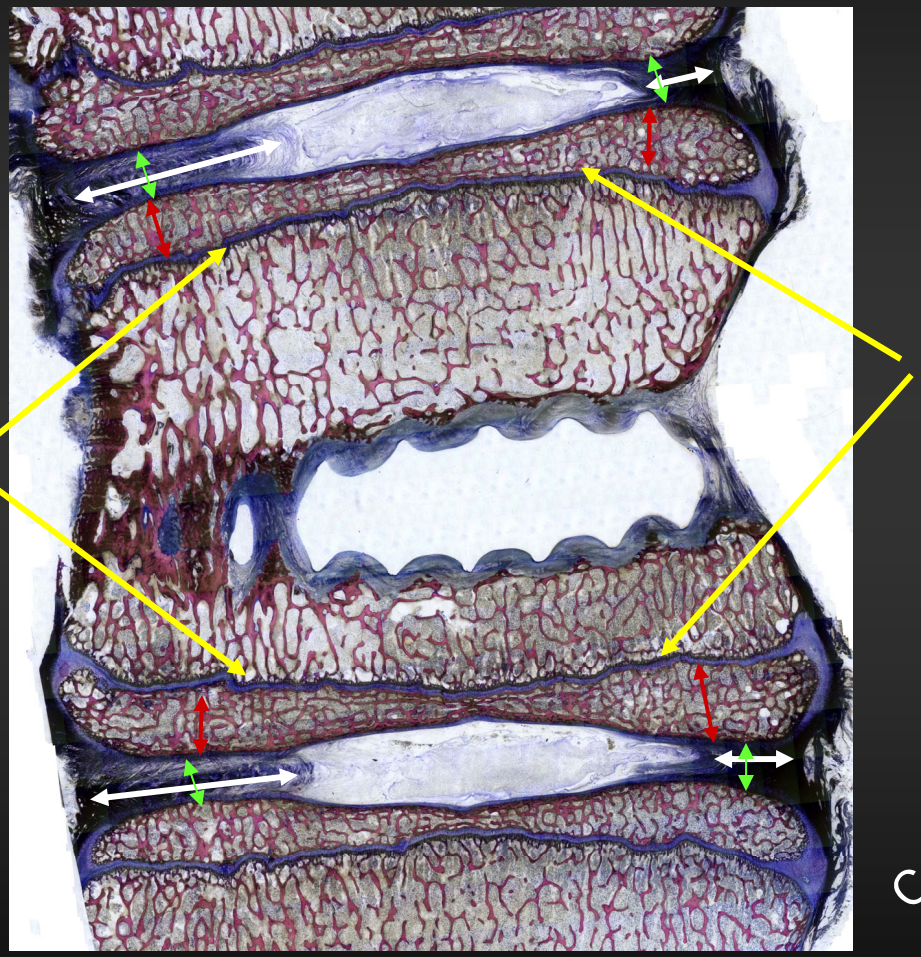
Vertebral Wedging		Concave	Convex	**p-value**
EV	Non Scoli	23.47	23.70	0.394
	Scoli	25.37	24.60	0.208
Apical	Non Scoli	22.97	24.53	**0.049**
	Scoli	23.55	27.05	**0.012**

Facet Histology

- Cartilage thickness
- convex vs concave sides in both scoliotic and non scoliotic curves
- Paired t tests revealed no significant difference



Histologic Measurements



Physeal height

End plate height

Annulus fibrosis width

Disc height

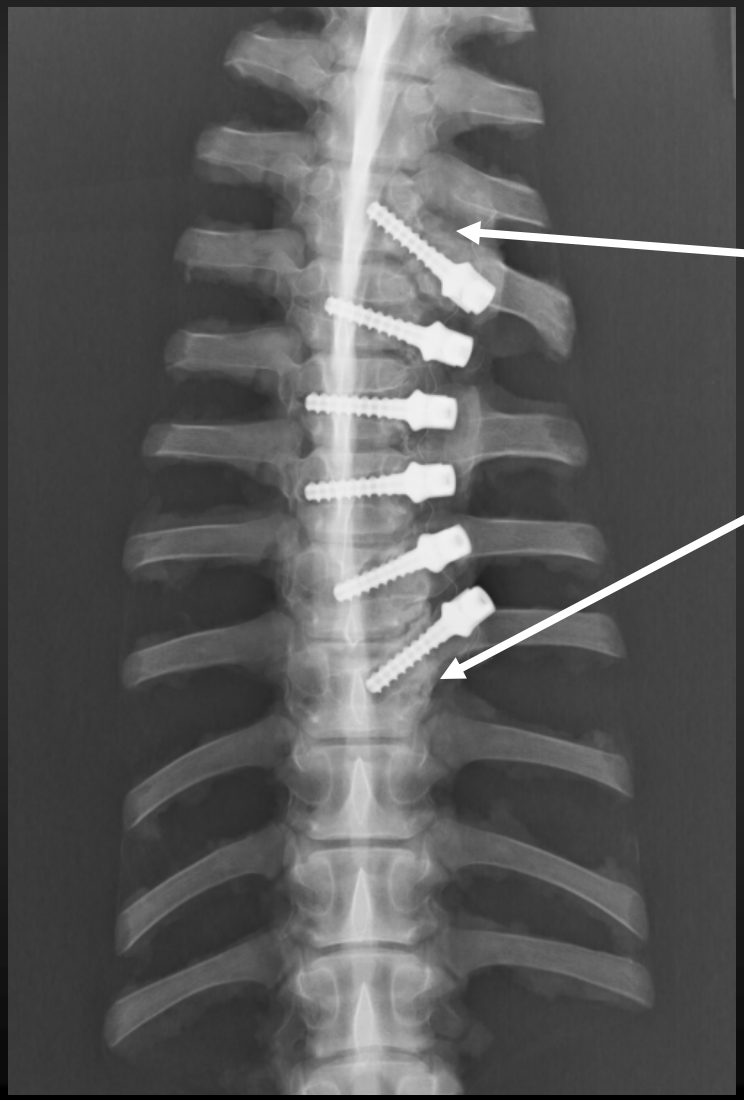
i1

	Non Scoliotic			Scoliotic		
Parameter	Concave	Convex	p-value	Concave	Convex	p-value
Superior Physeal Ht	2048 ± 354	2061 ± 277	0.5777	1858 ± 546	2165 ± 464	**0.0280**
Inferior Physeal Ht	367 ± 74	450 ± 423	0.1086	346 ± 83	466 ± 479	**0.0457**
Superior Endplate Ht	353 ± 68	360 ± 80	0.7776	317 ± 67	340 ± 65	**0.0001**
Inferior Endplate Ht	2037 ± 349	2032 ± 313	0.9296	1936 ± 571	2316 ± 448	**<0.0001**
Disc Ht	1811 ± 426	1799 ± 247	0.8825	1896 ± 298	2304 ± 230	**<0.0001**
Annulus Width	7930 ± 1745	7724 ± 1804	0.3467	9199 ± 875	4784 ± 1312	**<0.0001**

Slide 18

i1 alternate slide
IS, 3/11/2009

Issues



TEXAS SCOTTISH RITE HOSPITAL FOR CHILDREN
www.tsrhc.org

Conclusion

- Using a flexible segmental tether, a scoliotic deformity was produced in 3/6 animals by compressive inhibition of concave apophyseal growth and disc height without apparent arthrodesis or physeal damage

- With improved bone-screw interface stability, this model may be useful in motion-preserving deformity correction