Classification of Growth Friendly Spine Implants

David L. Skaggs, Behrooz Akbarnia, John Flynn, Karen Myung, Paul Sponsellar, Michael Vitale

Approved by:
Chest wall and Spine Deformity Study Group
Growing Spine Study Group
POSNA
SRS Growing Spine Study Committee

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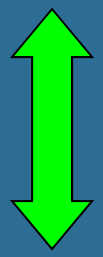
Growth Friendly Implant Classification

1. Distraction based
   - Growing Rods
   - VEPTR
   - Magec & Phenix



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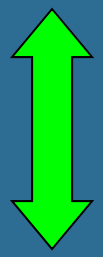

2. Guided Growth
   - Luque-Trolley
   - Shilla

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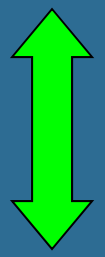

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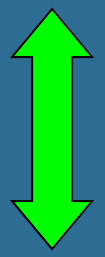

Only VEPTR FDA Approved for Spine*

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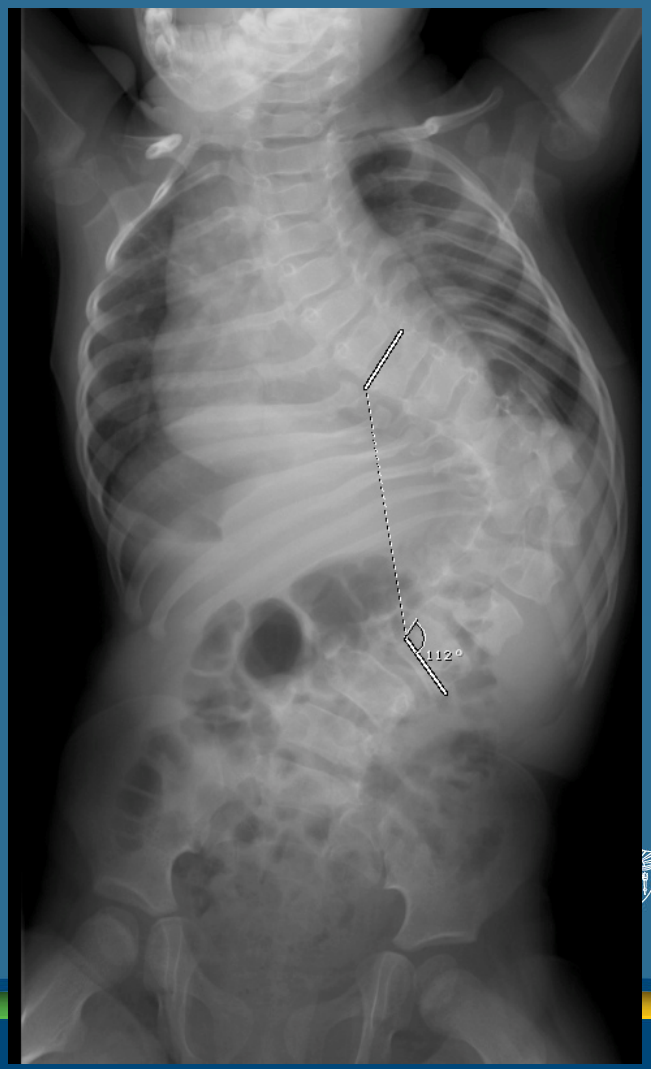
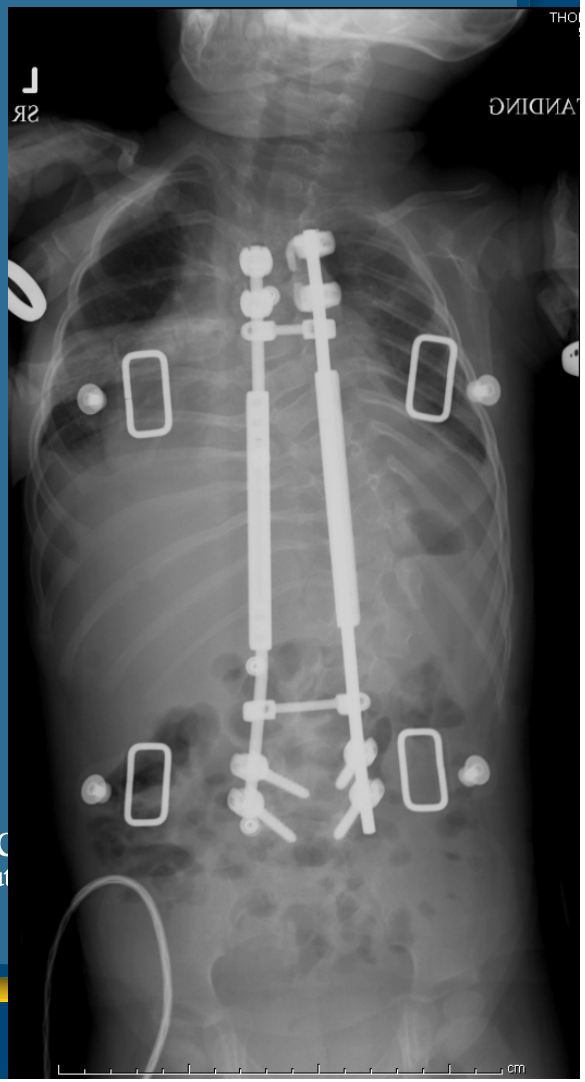
Distraction Based – Traditional Growing Rods

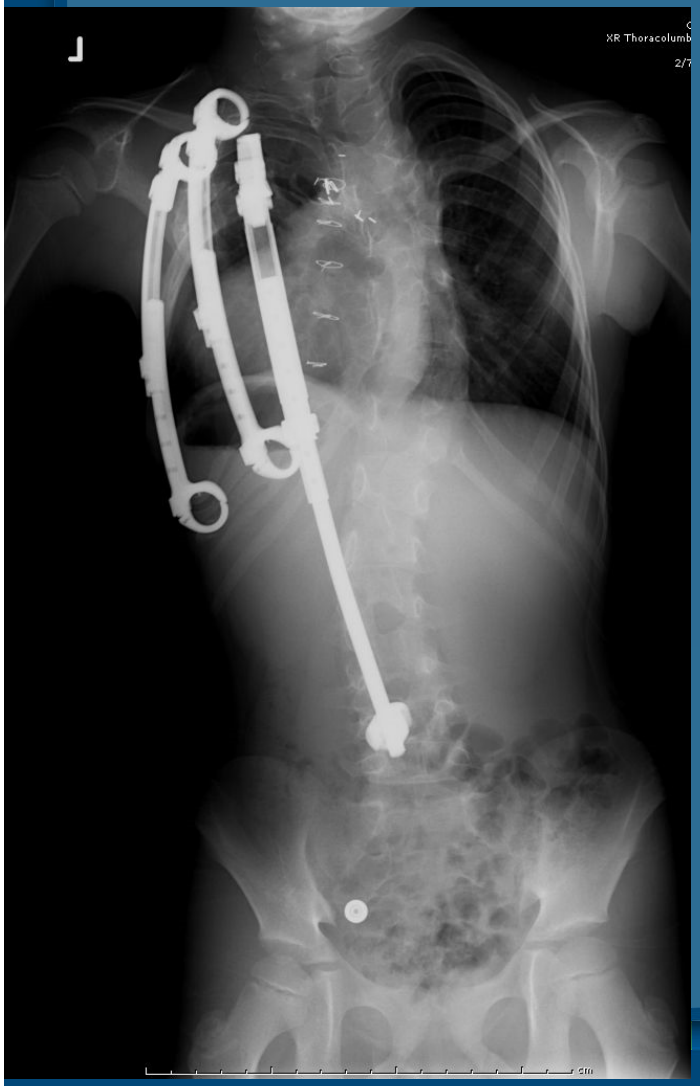
- Spine Anchors
- Fusion at Anchors
- Surgical Distraction
  - @ 6-9 months
- Final Fusion

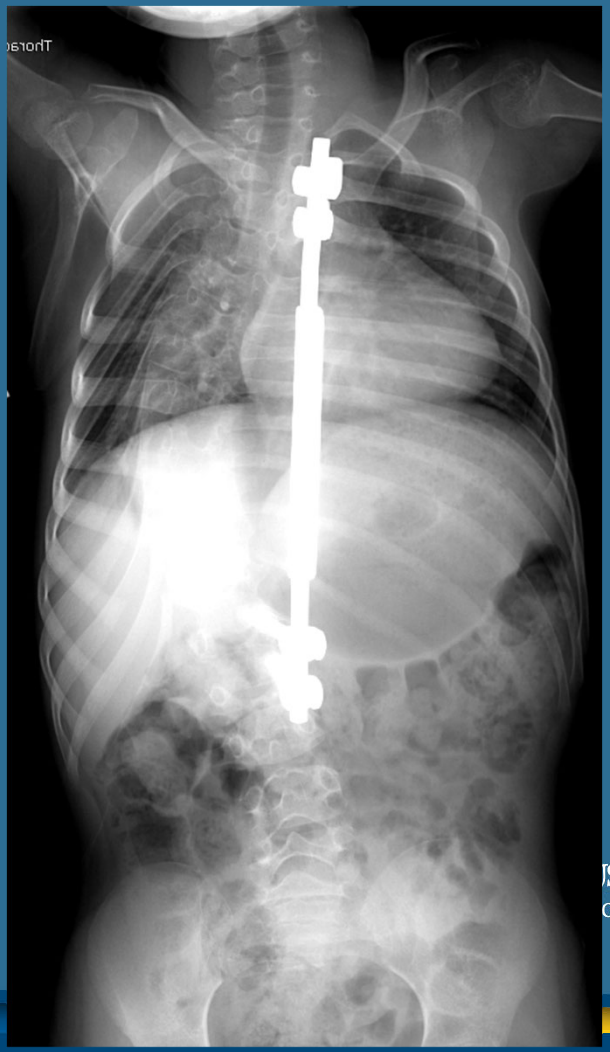


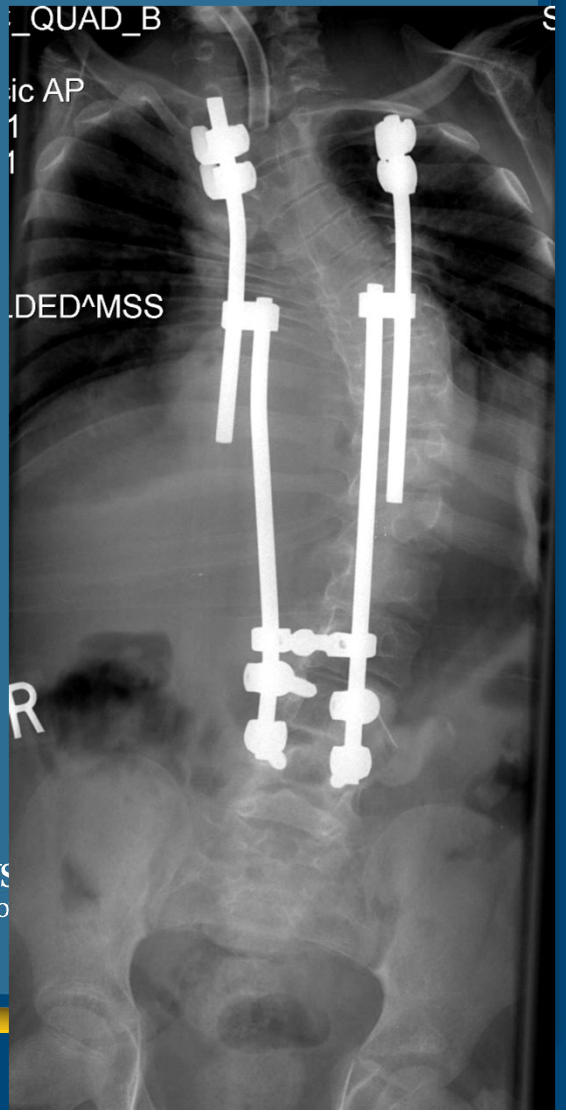


Distraction Based – Rib Anchors

Thorocotomies less common

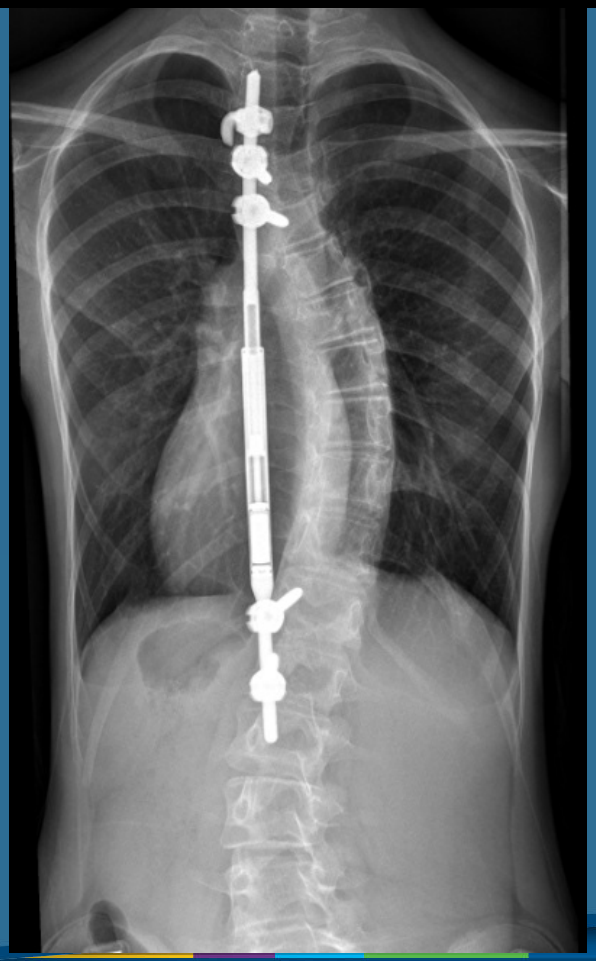




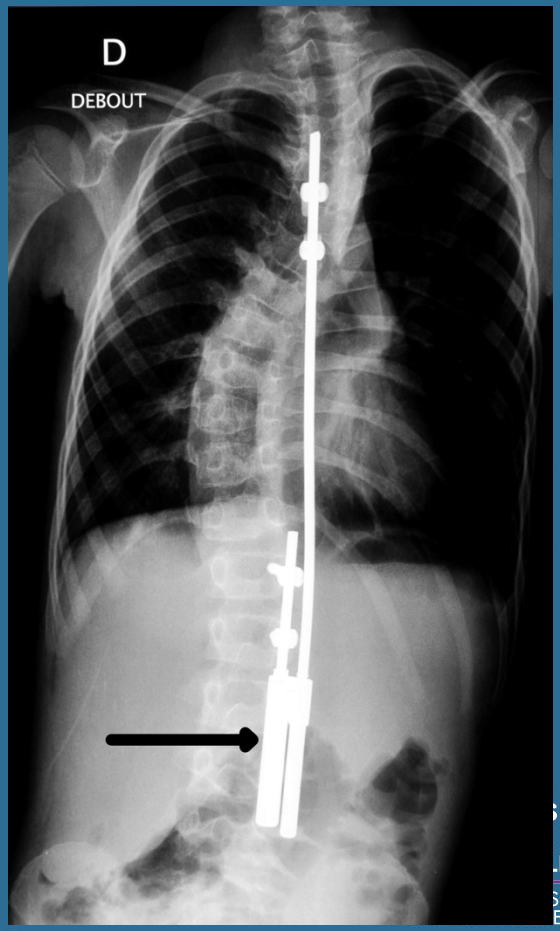


Distraction Based Magnetically Controlled Growth Rods

Magec
Magnetic Expansion Control



Phenix



"Drive" T1-S1 Growth

Normal Growth	0-5 yrs	2.0 cm/yr
	5-10 yrs	1.2 cm/yr
Dual Growing Rods, 2005,2008, 2009	5 + 6 yrs 39 mo f/u	1.1 -1.8 cm/yr
VEPTR, Congenital JBJS, 2003	3 + 3yrs 50 mo f/u	0.83 cm/yr Thoracic only
Distraction Based Rib Anchors 85% congenital	3 + 1 yrs 37mo f/u	**Unilat -0.65 cm/yr** ***Bilat-1.2 cm/yr***

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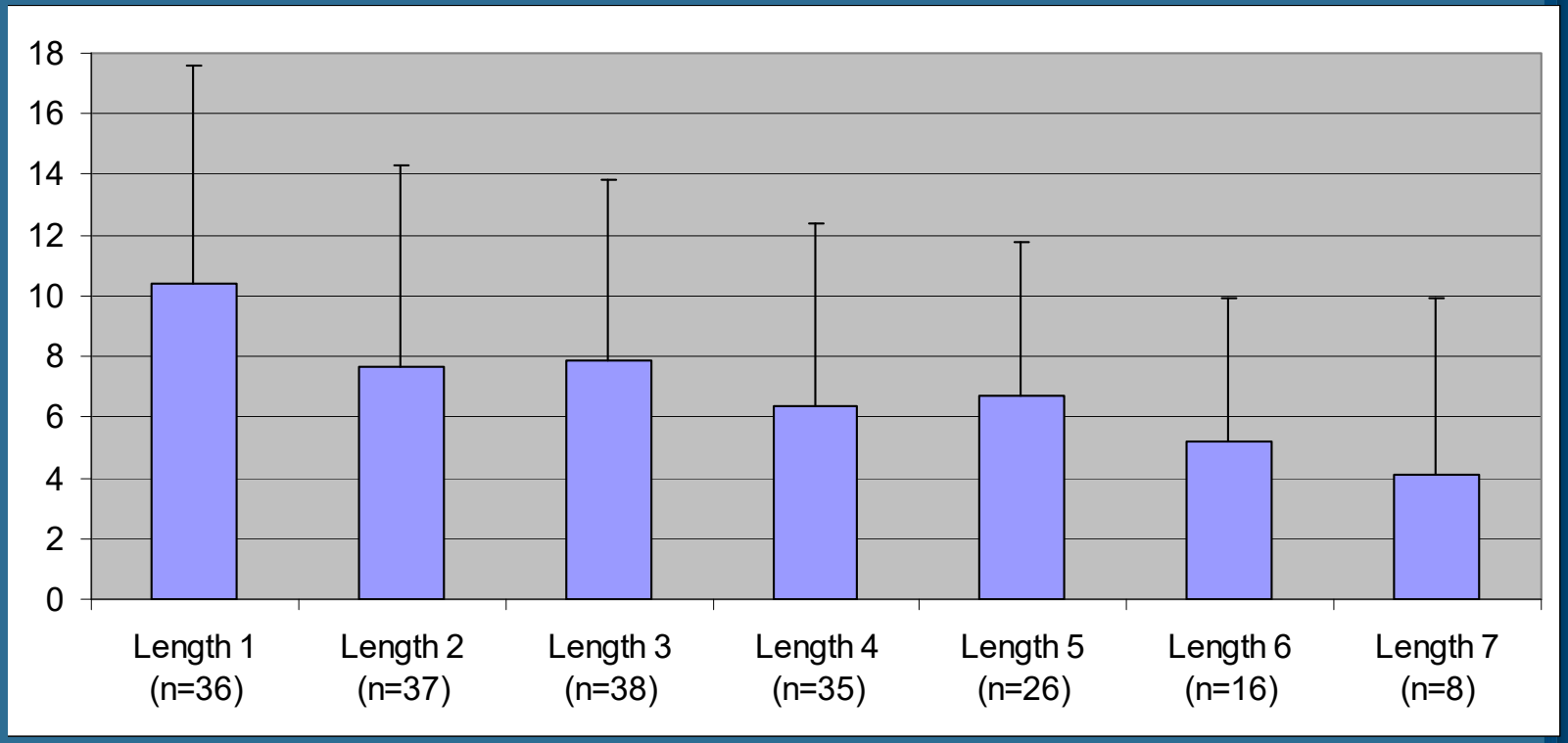
Law of Diminishing Returns



Spine 2011

Does not include gain at initial implant surgery

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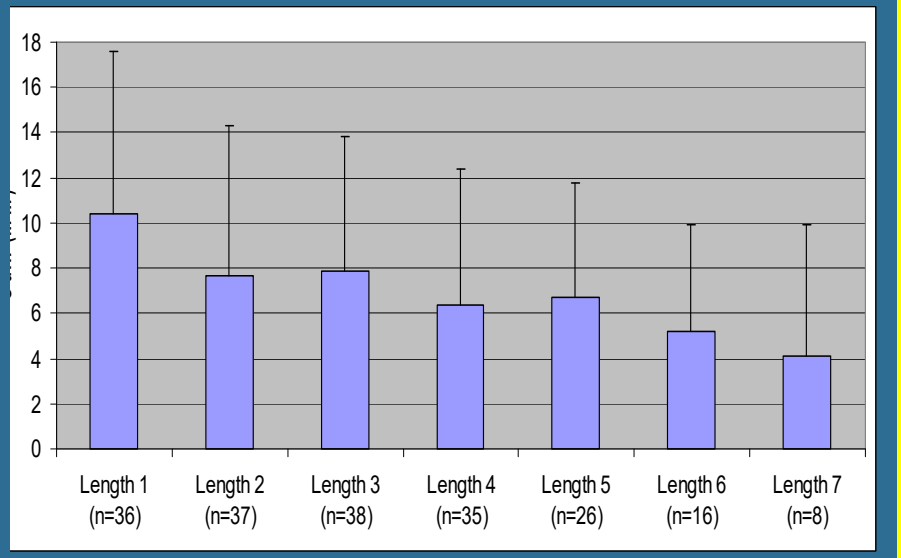
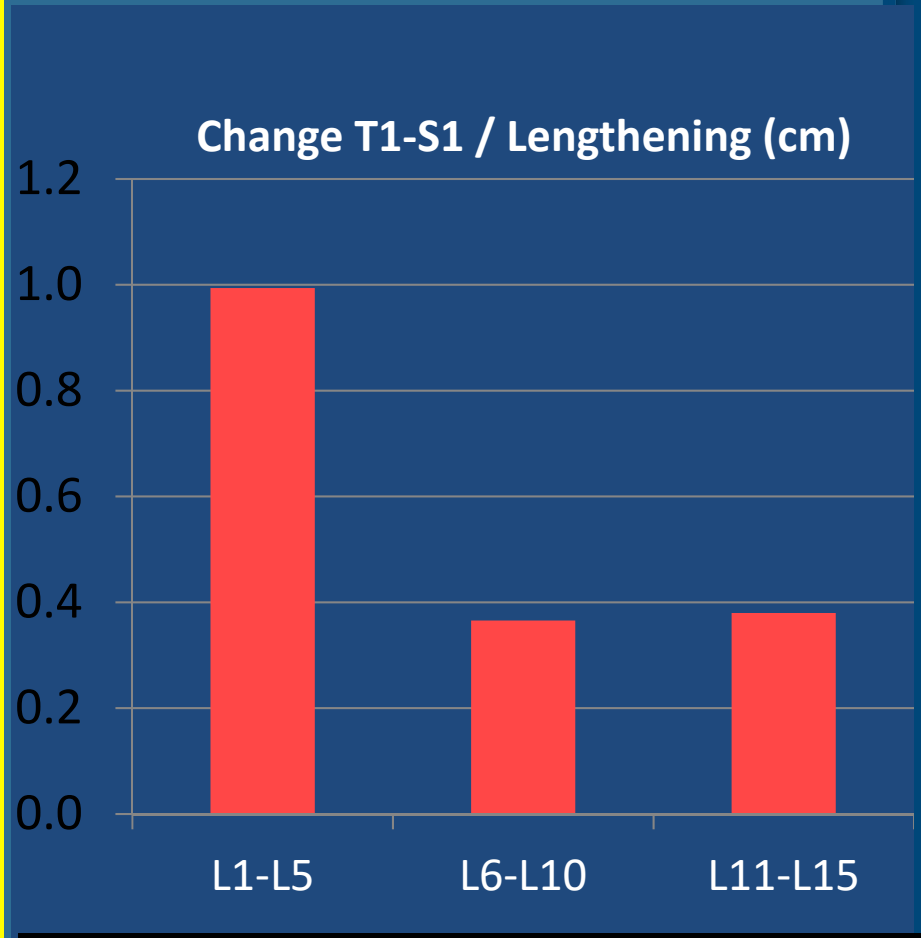
Traditional Growth Rods Get Stiff Over Time



T1-S1 Gain vs. # of Lengthenings

? Smaller Effect with rib anchors?



But continued gain even at L11-L15

Complications of Growing-Rod Treatment for Early-Onset Scoliosis

Analysis of One Hundred and Forty Patients

By Shay Bess, MD, Behrooz A. Akbarnia, MD, George H. Thompson, MD, Paul D. Sponseller, MD, Suken A. Shah, MD, Hazem El Sebaie, FRCS, MD, Oheneba Boachie-Adjei, MD, Lawrence I. Karlin, MD, Sarah Canale, BS, Connie Poe-Kochert, RN, CNP, and David L. Skaggs, MD

- 24% increased risk of complications with each additional procedure
- 13% decrease in complications for each year surgery is delayed

JBJS 2010

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Outcome of Distraction Based Implants (rib and spine based)

- Decreased Cobb Angle
- Increased Spine length
- Increase weight gain

- Unproven Pulmonary Effects

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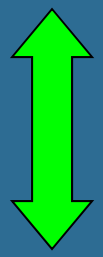

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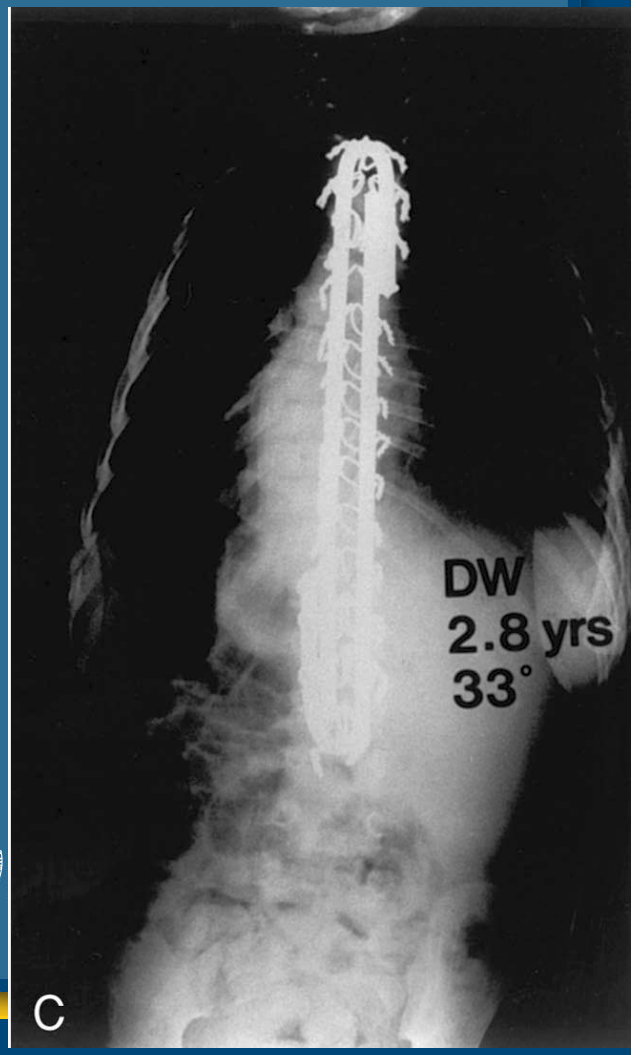
Guided Growth Construct
Luque Trolley (no apical fusion)

- All fused spontaneously
- 9 pts. 9 years old
- All required further surgery
- 7/9 instrument failure
- Pre-op curve 50^{0} - Final curve 51^{o}
- Little growth of instrumented area – vague



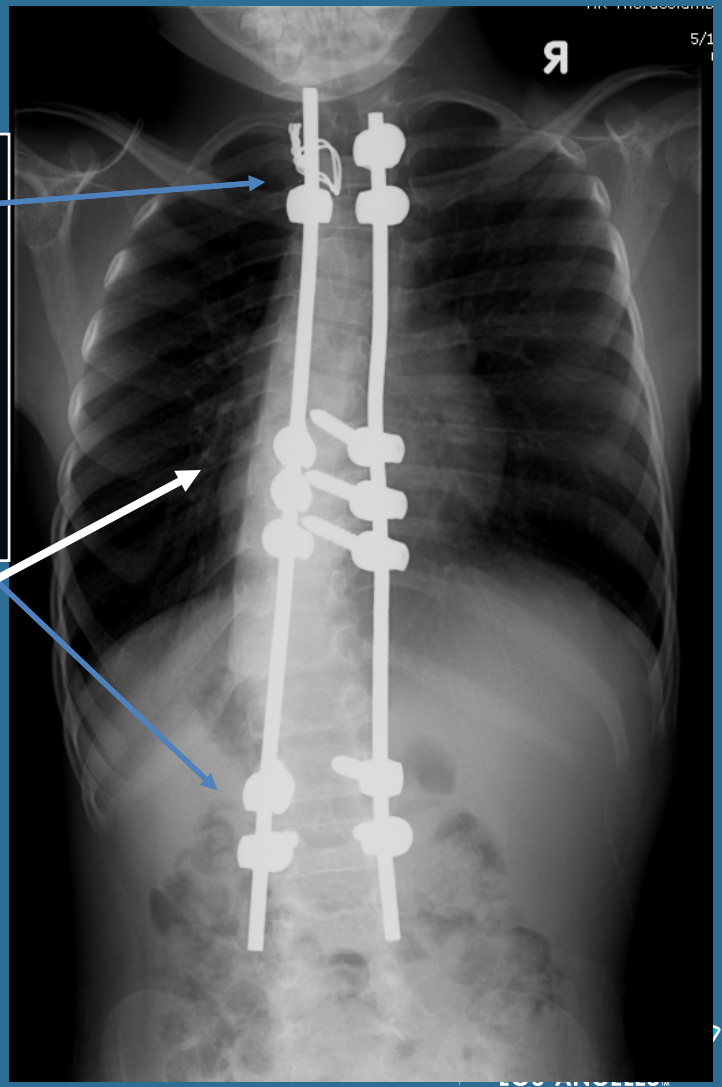
Lubicky, Spine, 1992

Guided Growth - Shilla

Open Screws – no fusion

no bone exposed allow
rod to slide
multiaxial

3 level fusion
compression
distraction



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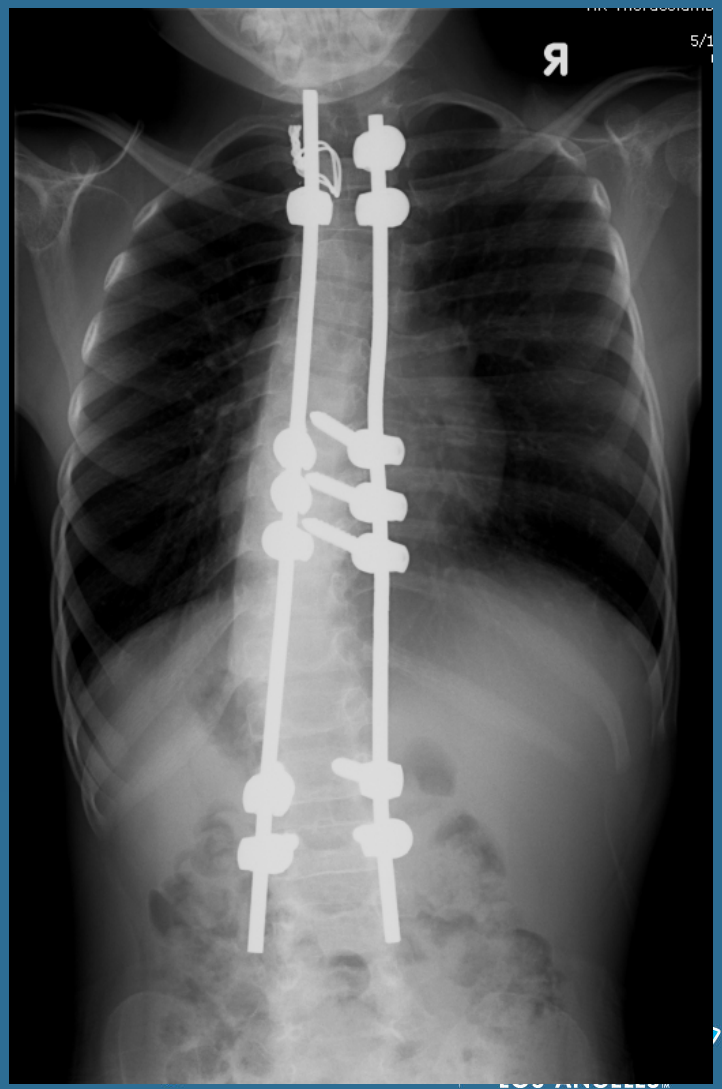
Guided Growth - Shilla

Earliest cases suggest:

1. Less surgeries than distraction based growing rods
2. Less Cobb correction
3. Less spine growth



Andras, et al, ICEOS, 2013

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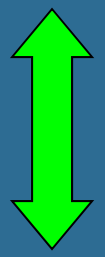

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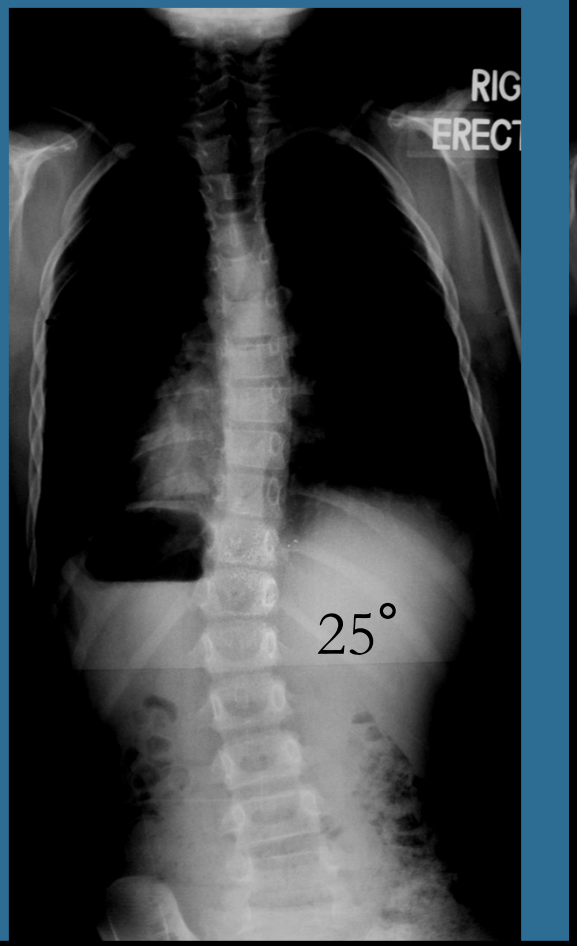
Compression Based - Staples

Best for curves <35°
With growth remaining



8 yo female 3 year f/u
Courtesy Dr. Betz

Nov. 2002

March 2005

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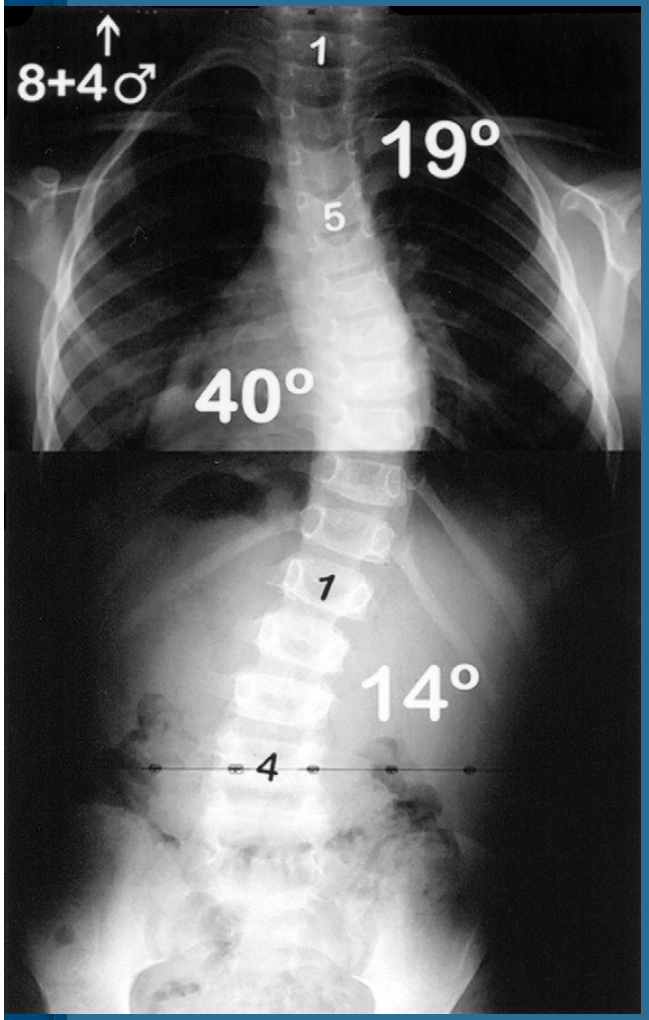
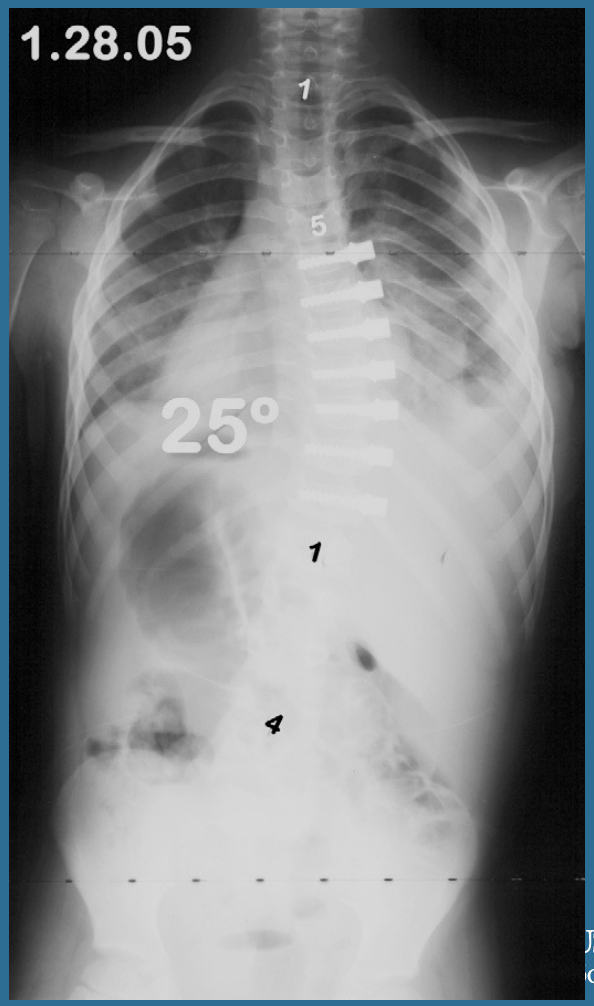
Compression Based: Tether

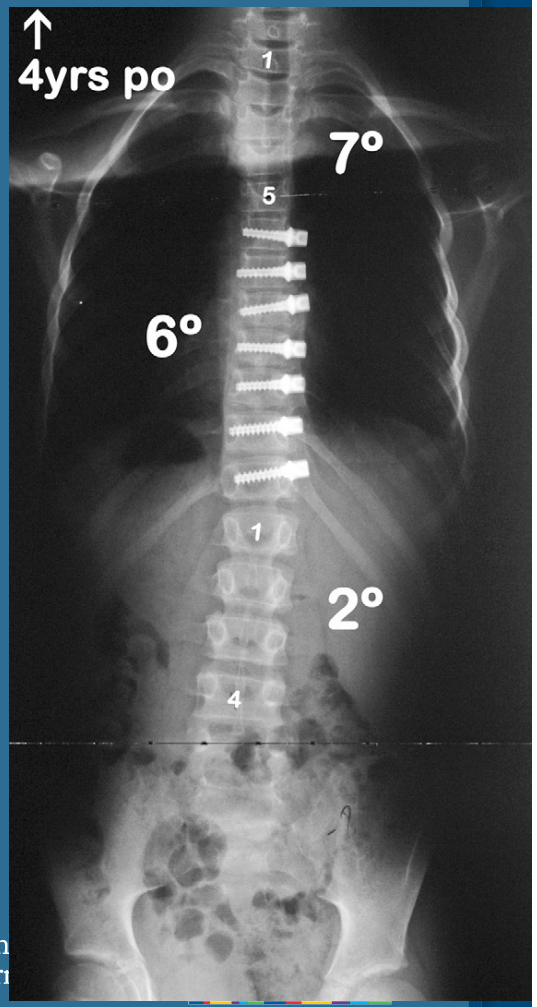
Pre

Post

4 yrs Post







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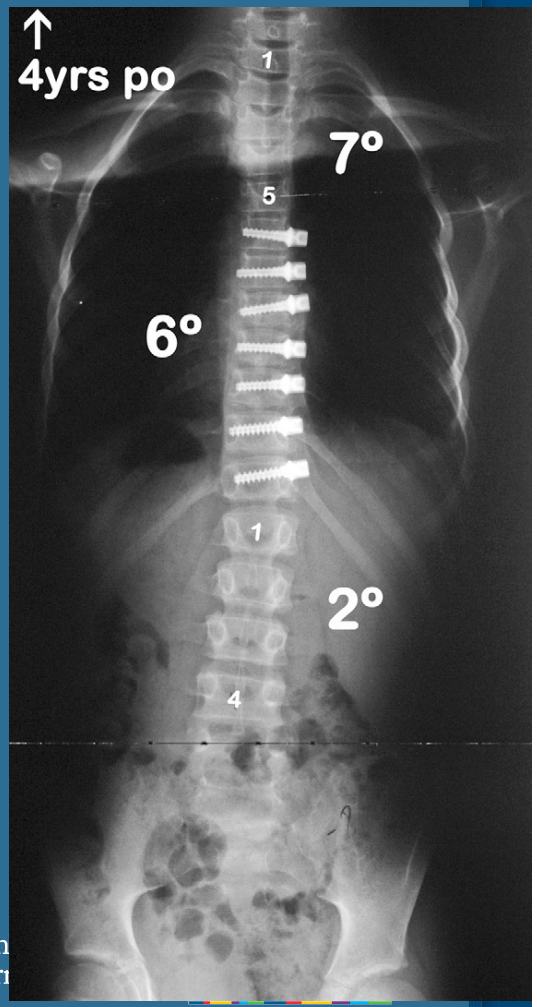
Lenke, JBJS, 2010

Compression Based: Tether

4 yrs Post

HOPE
Anterior compression systems may restore physiologic kyphosis



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Lenke, JBJS, 2010

When to Use What?

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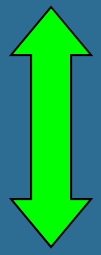
   - Hybrid
   - VEPTR
   - MCGR



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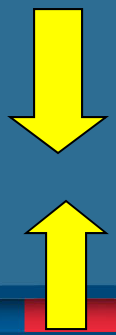

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Thank You

Thank You!

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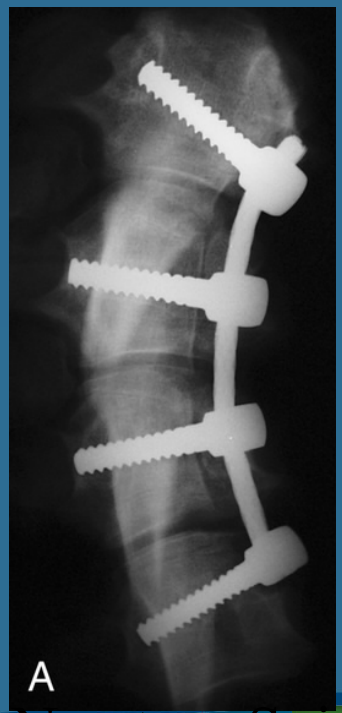
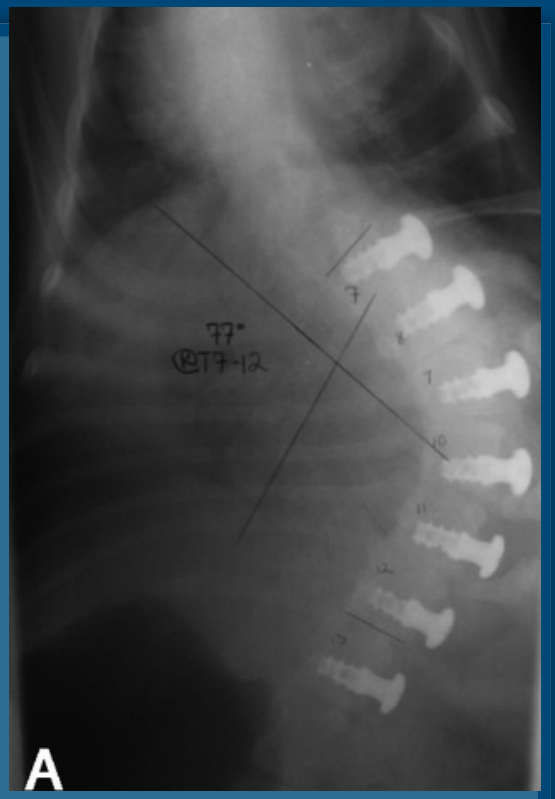
Thank You

Tethers

- Animal models
- Problematic
- Future ?



Newton, Spine, 2005



Braun, JBJS, 2006

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Backpain:
When to Worry

David L. Skaggs, MD
Professor and Chief
Children's Hospital Los Angeles
University of Southern California
Children's Hospital Los Angeles

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