The future of standing 3D spine imaging in Spine Surgery: how we can use this new tool to better treat our patients?

Stefan Parent, MD, PhD

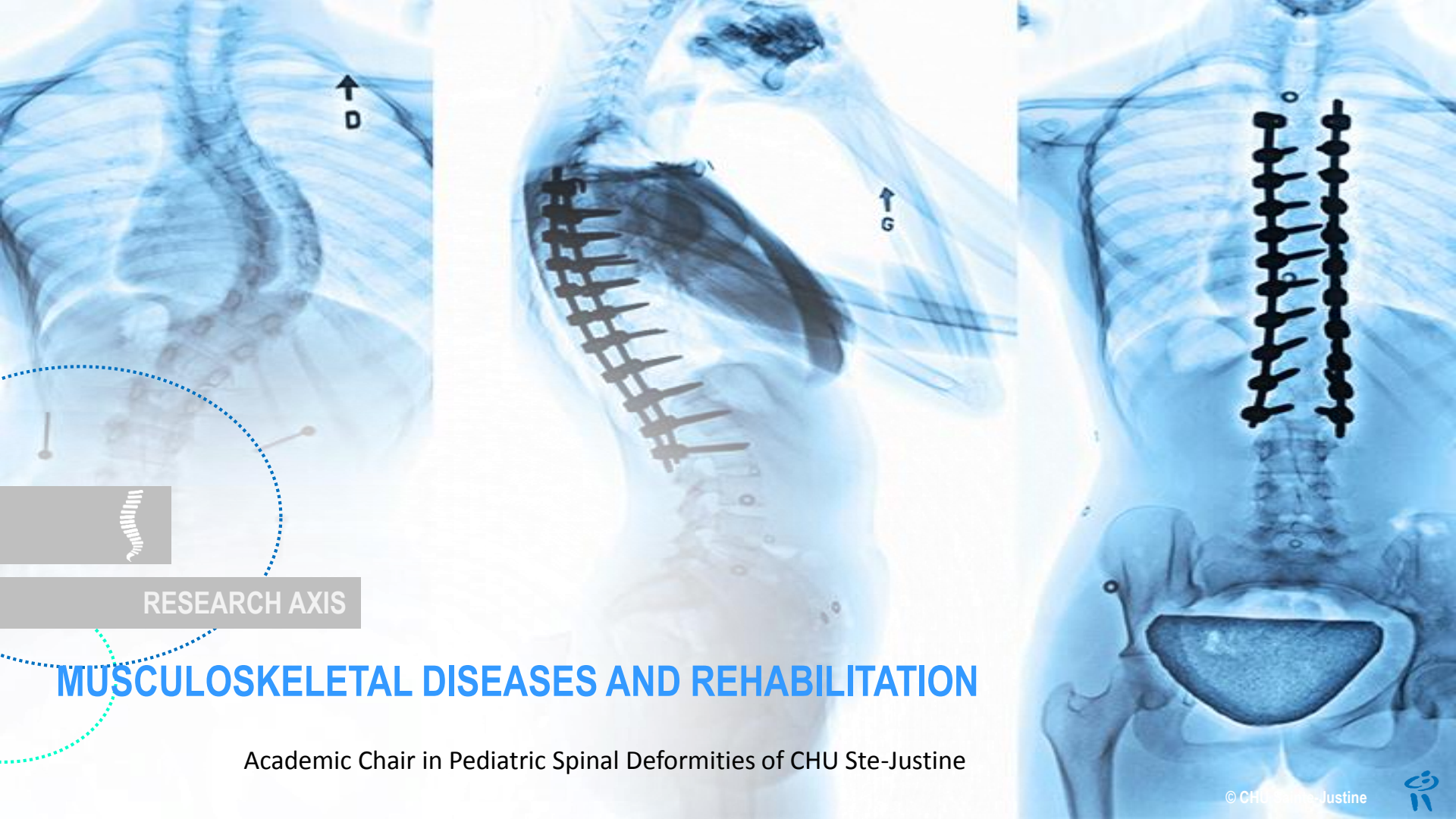
Atlantic Canada Spine Meeting

October 20th, 2018

Disclosures

- Depuy Synthes spine (a, b),
- Canadian Institutes of Health Research (a),
- Scoliosis Research Society (a),
- POSNA Biomet Spine Research Grant (a),
- Natural Sciences and Engineering Research Council of Canada (a),
- Orthopedic Research and Education Foundation (a), Setting Scoliosis Straight Foundation (a),
- Medtronic (b),
- EOS-Imaging (a, b, c, d, e) including Royalties
- Spinologics (c)

(a) Grants/Research Support
(b) Consultant
(c) Stock/Shareholder
(d) Speakers'Bureau
(e) Other Financial Support



RESEARCH AXIS

MUSCULOSKELETAL DISEASES AND REHABILITATION

Academic Chair in Pediatric Spinal Deformities of CHU Ste-Justine

Debating Dr Muharrem Yazici

- Difficult task
- Articulate
- Good looks
- Mesmerizing
- Perfect!

But then I found something…

- Wait…

And then…

September 2018 <<< Return to Newsletter

Nominating Committee Update

Kenneth MC Cheung, MD
Nominating Committee Chair

The nominating committee met on two occasions via conference calls in March and April.

The following have been nominated by the committee:

Vice President:
Muharrem Yazici

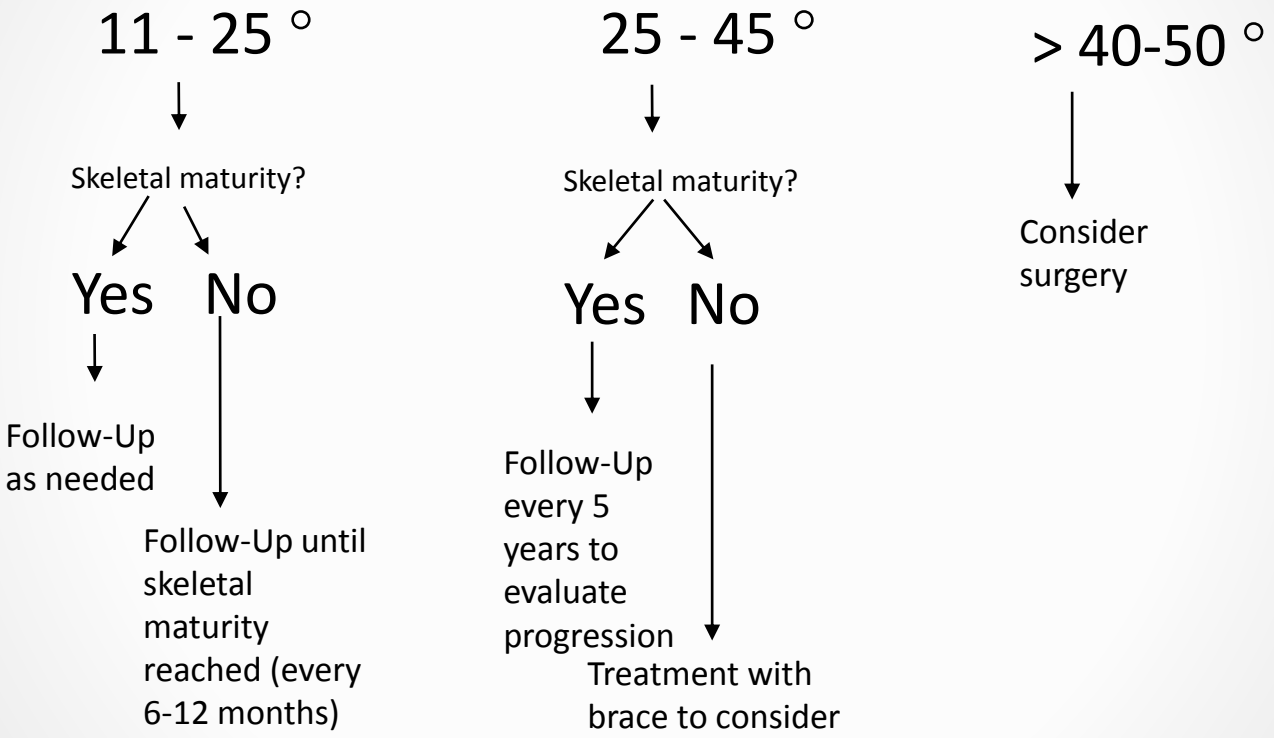
I guess I will try to behave…

Growth Modulation

A new approach in the the treatment of Idiopathic Scoliosis

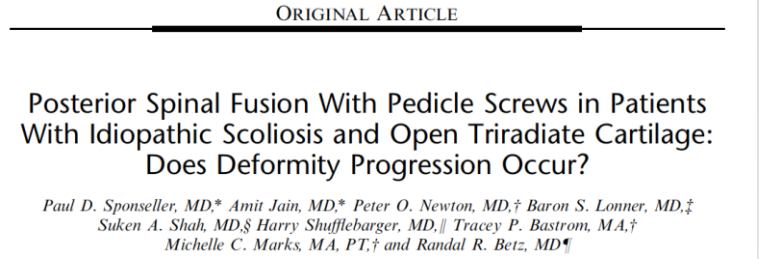
For patients with significant growth remaining

AIS Treatment algorithm



Adapted from Parent et al. ICL 2005

PSF in the immature patient



ORIGINAL ARTICLE

Posterior Spinal Fusion With Pedicle Screws in Patients With Idiopathic Scoliosis and Open Triradiate Cartilage: Does Deformity Progression Occur?

Paul D. Sponseller, MD, Amit Jain, MD,* Peter O. Newton, MD,† Baron S. Lonner, MD,‡ Suken A. Shah, MD,§ Harry Shufflebarger, MD,‖ Tracey P. Bastrom, MA,† Michelle C. Marks, MA, PT,† and Randal R. Betz, MD¶*

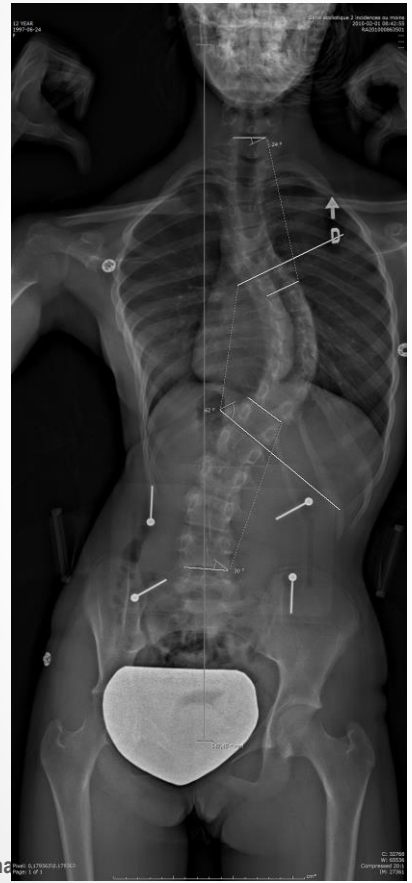
Open TRC

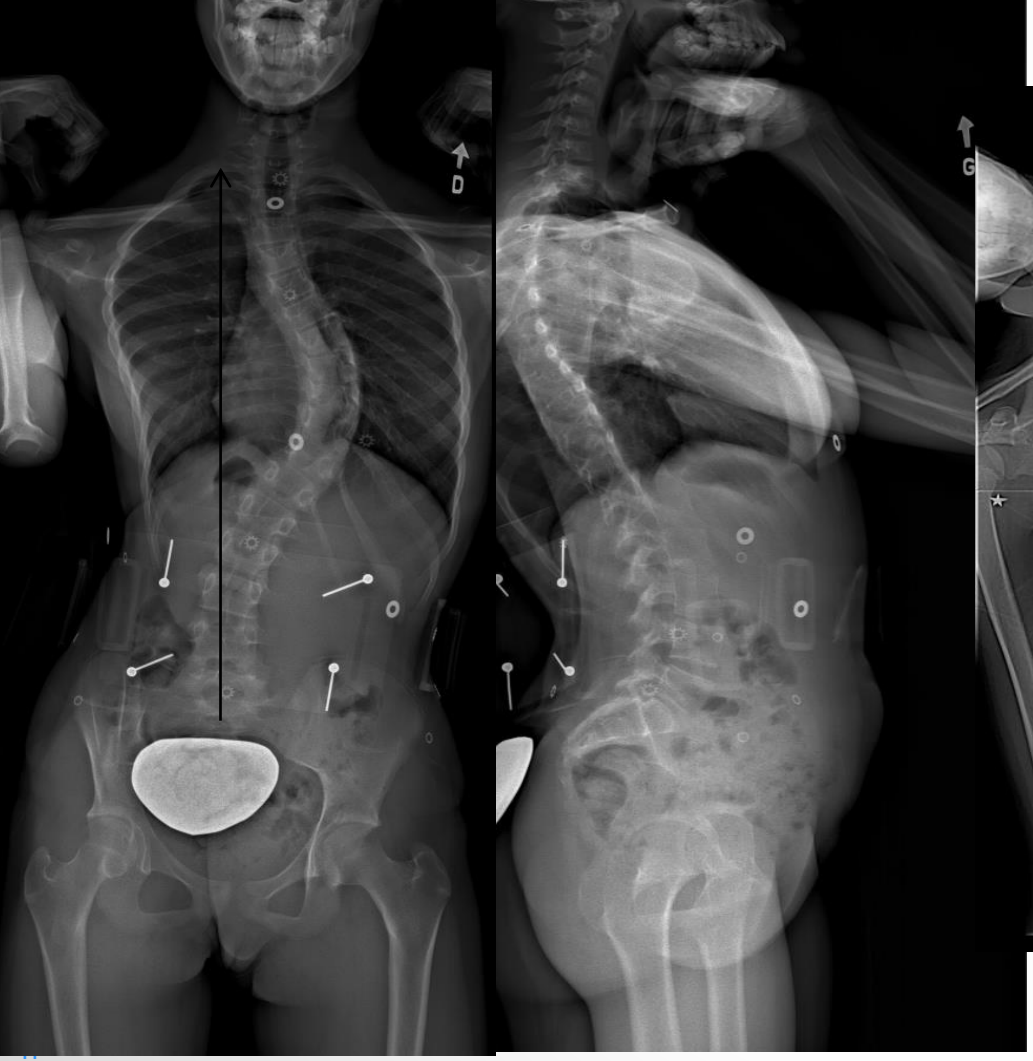
- More likely to progress distally (crankshaft)
- Anterior/posterior fusion recommended
  - Sponseller et al. JPO, 2016

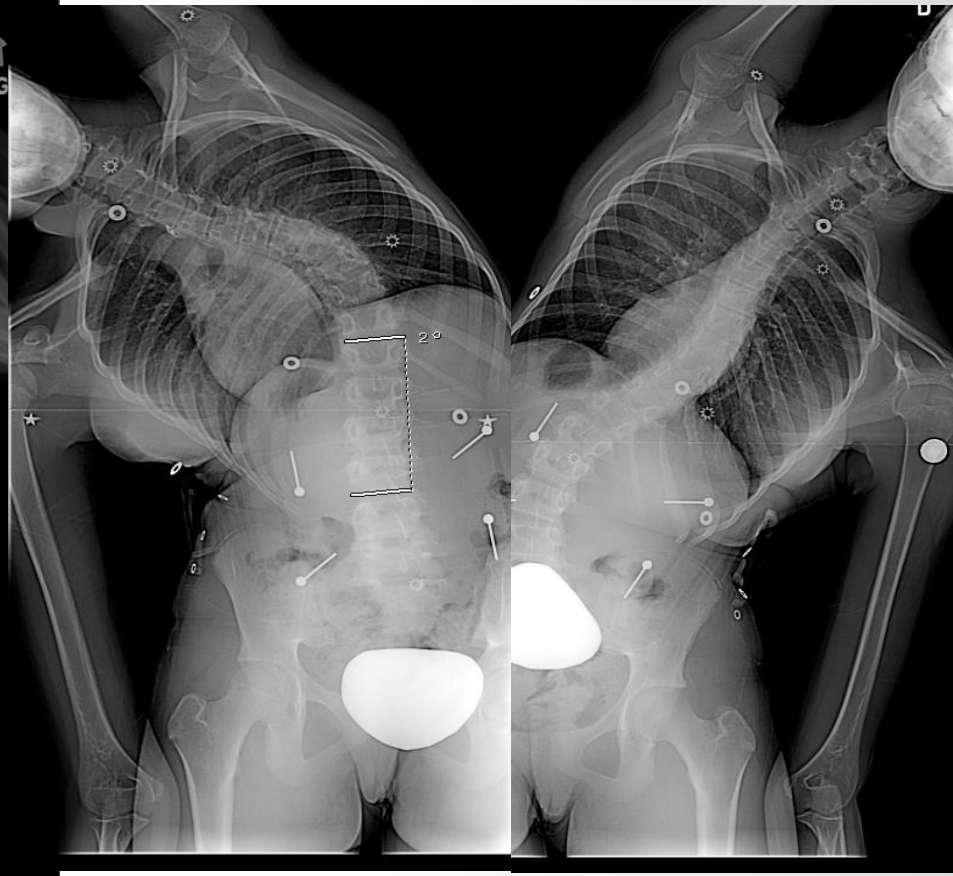
Closed TRC

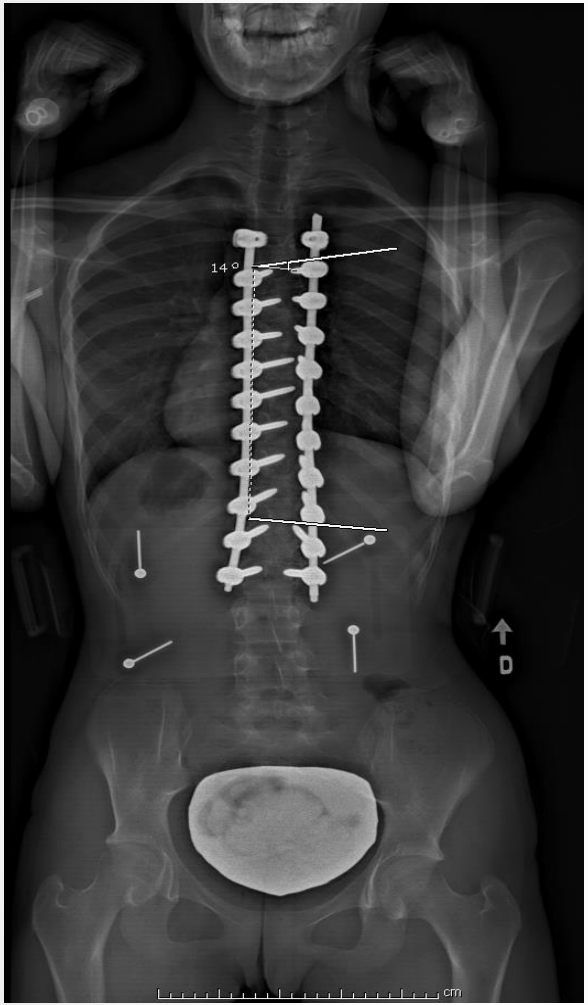
- PSF alone seems reasonable
- but fusing short of the stable vertebra was also a risk for adding-on
  - Sponseller JPO, 2016

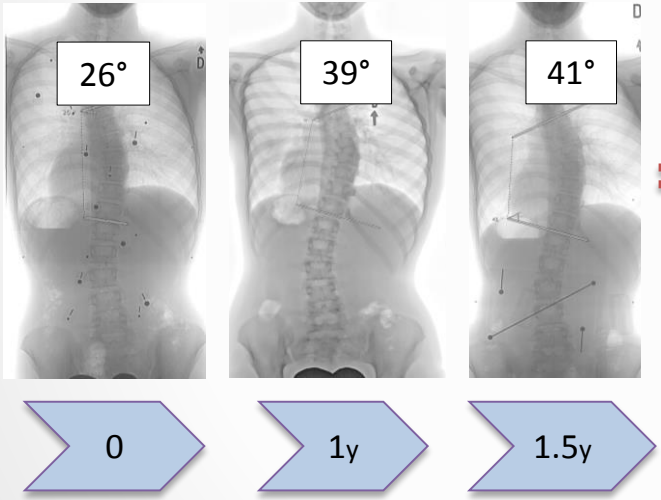
Traditional approach

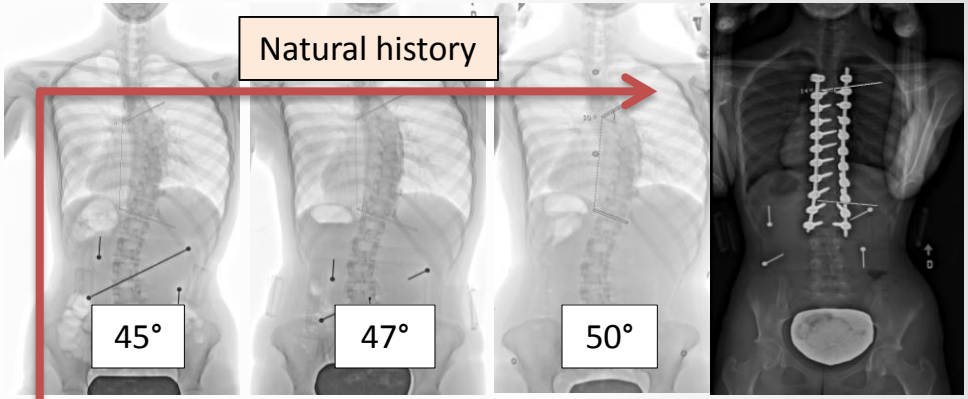


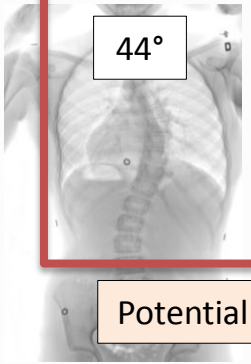












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A prolific author

2014 Update on the 'growing spine surgery' for young children with scoliosis

Ozgur Dede, Gokhan Demirkiran, and Muharrem Yazici

- What Muharrem thinks about Growth Modulation:
  - « Although recent animal studies using anterolateral spinal tethering have been encouraging, very limited clinical experince is present »
    - Sounds like we should be doing this procedure more often to find out
  - « The most attractive feature of this technique is the possibility of a definitive correction without final fusion surgery. However, unless the indications could be extended to more severe curve patterns, we find it unlikely that this technique would be adopted by most. »
    - This sounds like a challenge to do bigger curves…

Scoliosis pathomecanism

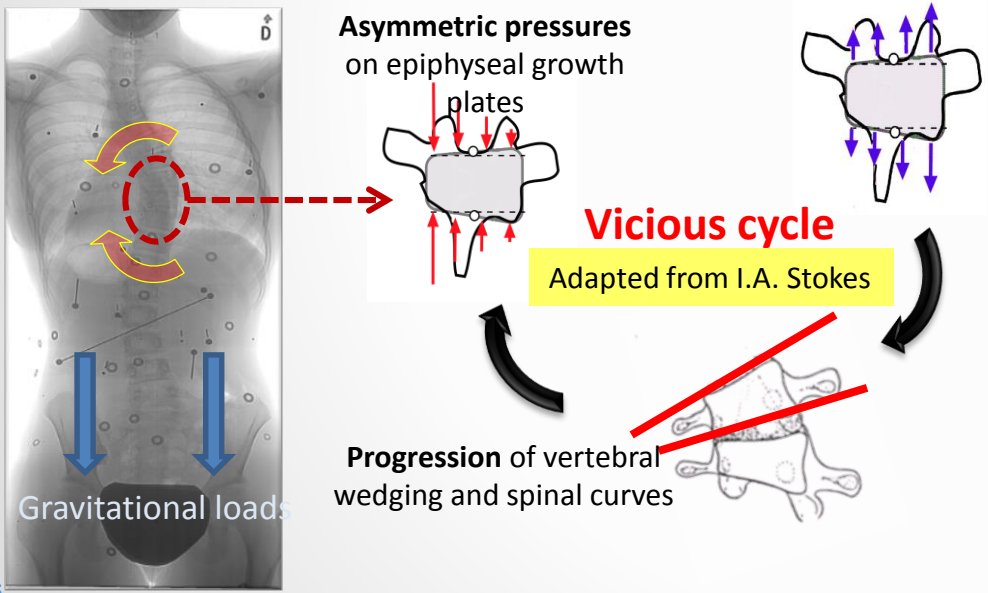
Hueter-Volkmann principle:

- Compressive loads on GP = growth inhibition
- Reduced loading on GP = accelerated growth

Mathematical algorithm (in vivo experiments)
Growth rate linear response to loadings at GP
(Stokes 2006, 2007, Villemure 2009)

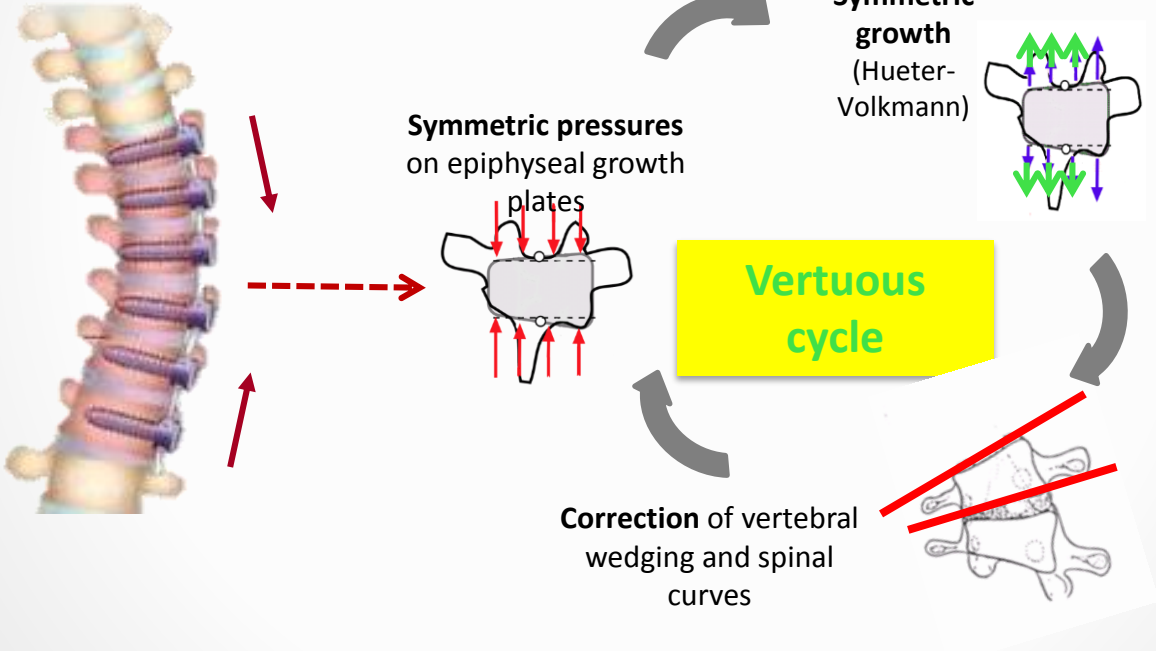
$$G = G_m [1 - \beta (\sigma - \sigma_m)]$$

σ_m = normal stress
σ = stress in pathologic spine / AVBT
β = bone sensitive factor (0.4 – 2.3 MPa^{-1})
G_m = growth rate (0.8-1.1 mm/year)



Growth modulation – Fusionless treatments

Fusionless treatments



Adapted from I.A.F. Stokes

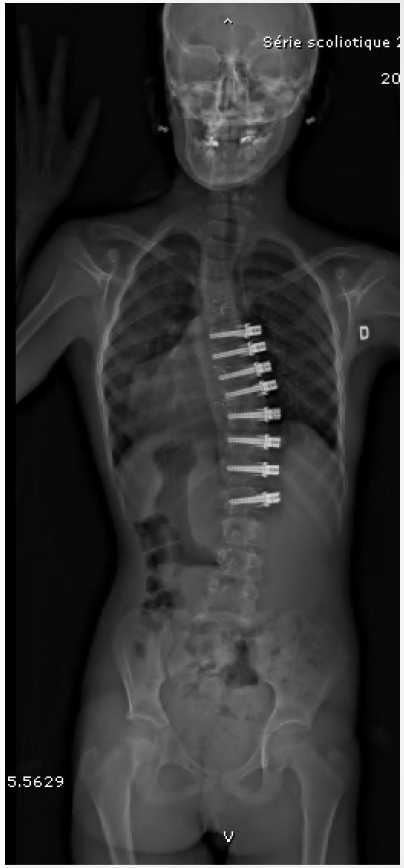
16

What are the current challenges for Growth Modulation

- Overcorrection is a risk
  - Too much growth
- Undercorrection is a concern
  - Not enough growth
- What levels to instrument (or tether)?
- How much tension to apply?

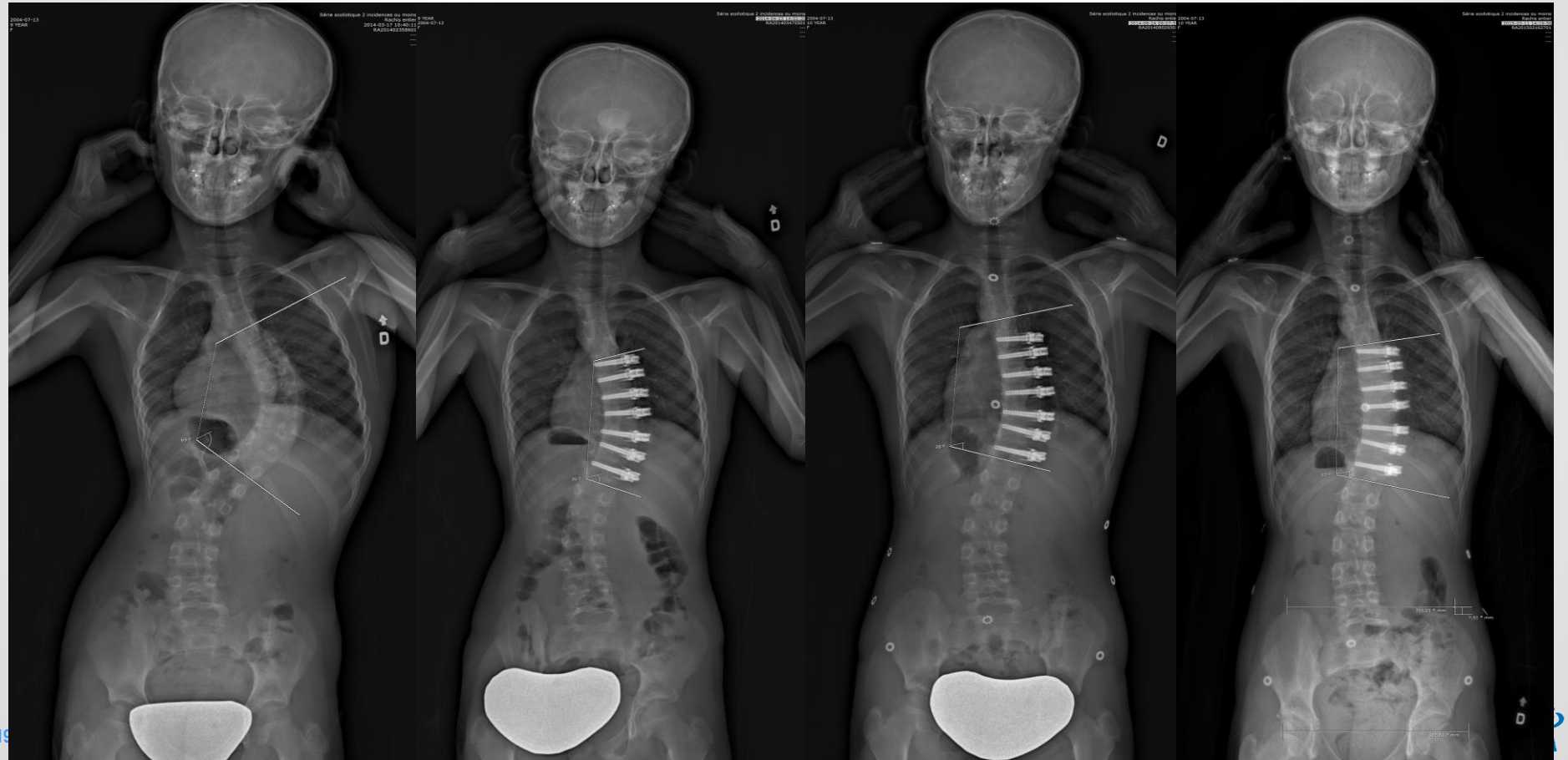
57°

24°



16°

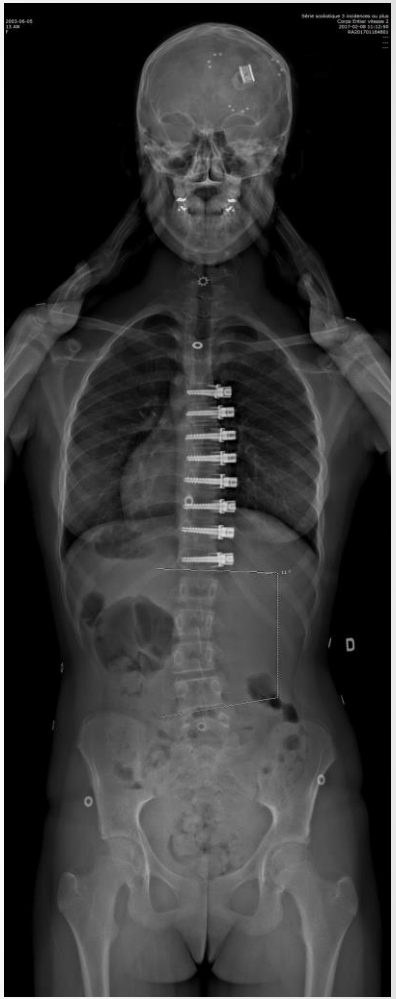
Does this work even in large curves??



Pre-op

Post-op

6 months



24 months

Current indications

- AIS, Lenke 1A, 1B preferred (1C possible)
- 40° - 70°
- Pre-menarchal
- Risser 0 or 1
- Open TRC and Risser 0 preferred
- Older than 8-9 years or > 30 kg
- Patients and families are told this is EXPERIMENTAL

Benefits

- Less blood loss
- Shorter hospitalization
- Retaining spine flexibility
- Potential to correct spine without fusion

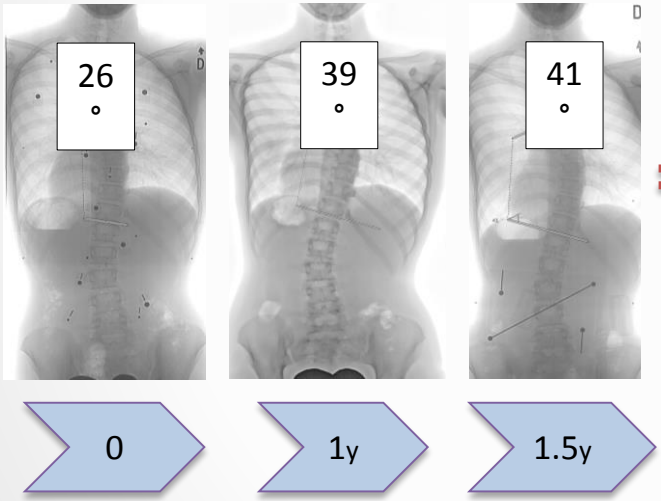
Limitations

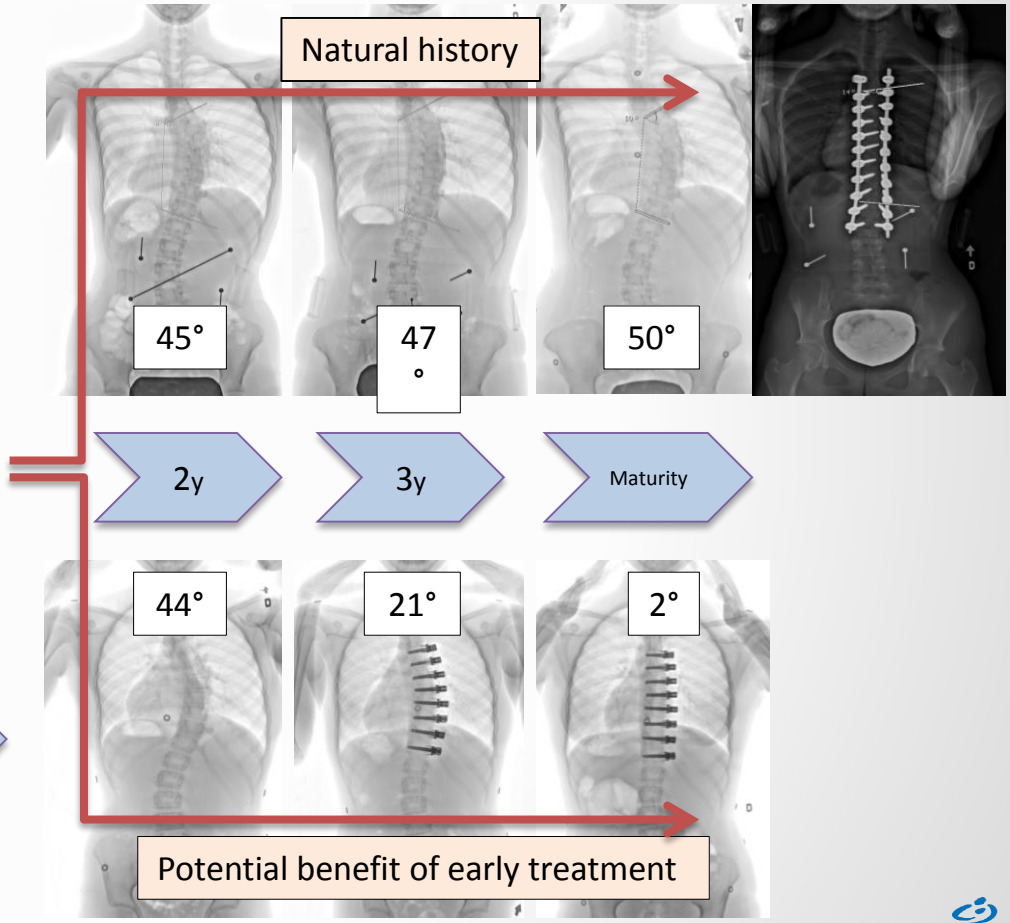
- Over-correction
  - Risk greater for smaller curves that are younger
- Patients are told that there will be at least one other surgery to remove material
- No long-term outcomes
  - Don’t know what the impact on the disk will be
- Is it really better than bracing/traditional surgery

Is growth modulation for everyone?

- Probably not…
- But if significant growth remaining AND
- Flexible curve AND
- Curve can be expected to correct with amount of growth remaining

- This option may be explored with the family.





Questions?