Non-fusion Options
in the Treatment of
Early Onset Scoliosis

Muharrem Yazici, MD

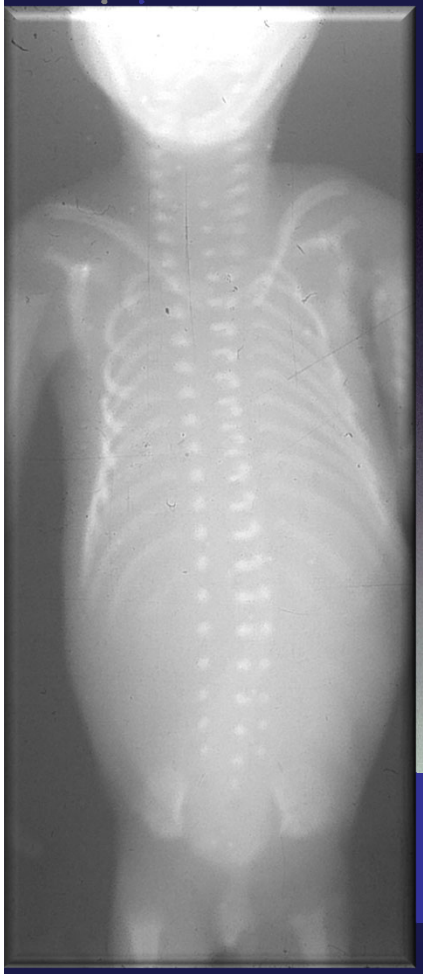
Hacettepe
Orthopaedics
Spine Unit

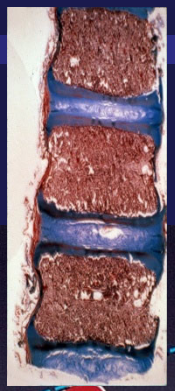
Surgery for Growing Spine Deformities

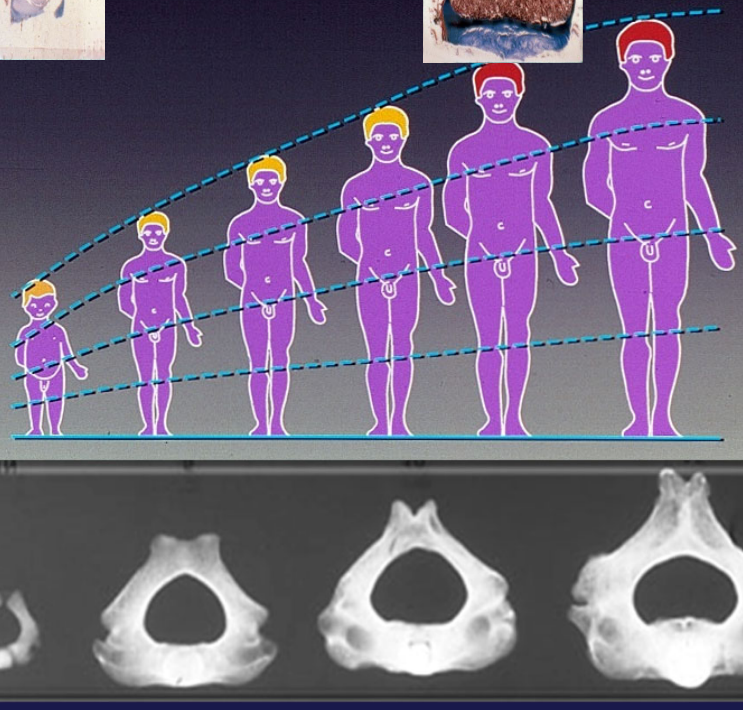
Big challenge!!

- Physical characteristics of small child
- Magnitude of deformity
- Size of vertebrae
- Purchase strength of implants
- Growth potential of spine
- Better anesthesia and ICU facilities
- More powerful instruments
- Smaller implants
- Better implant technology
- ?

Growth is a change in proportions!







From birth to skeletal maturity

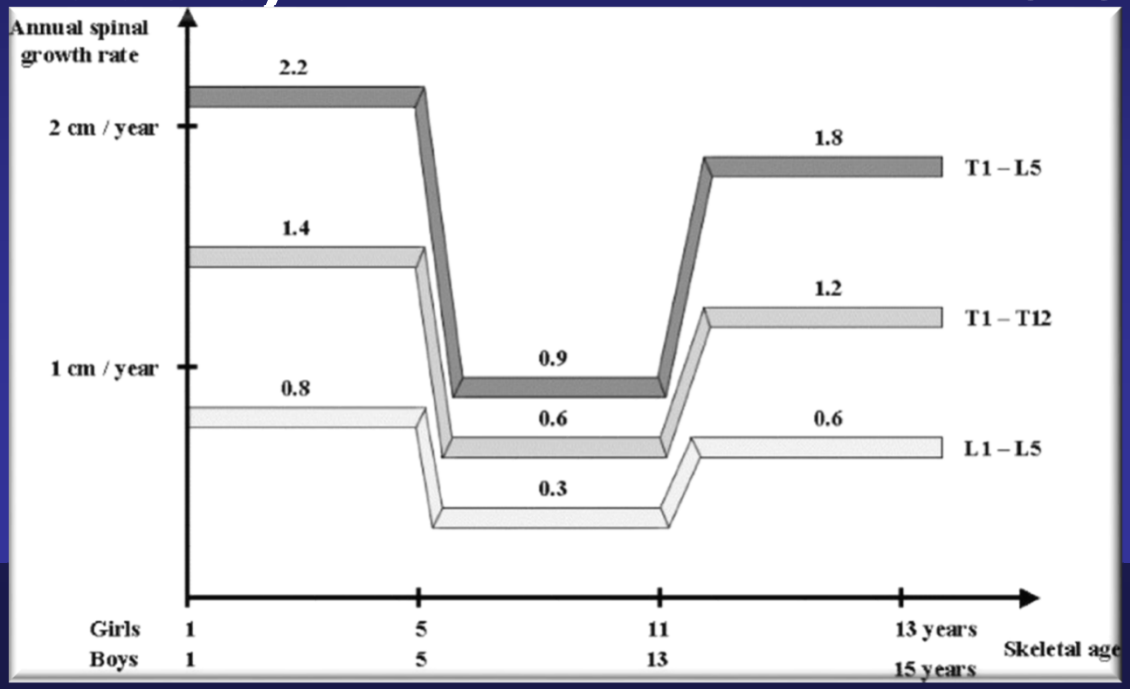
- Height increases by 350%.
- Weight increases 20 folds.
- Femur and tibia triple in length
- Spine doubles in length

Annual growth velocity T1 –L5

Birth – 5 y: **2.2 cm**

5 y – 10 y: **0.9 cm**

10 y – Puberty: **1.8 cm**



Growth

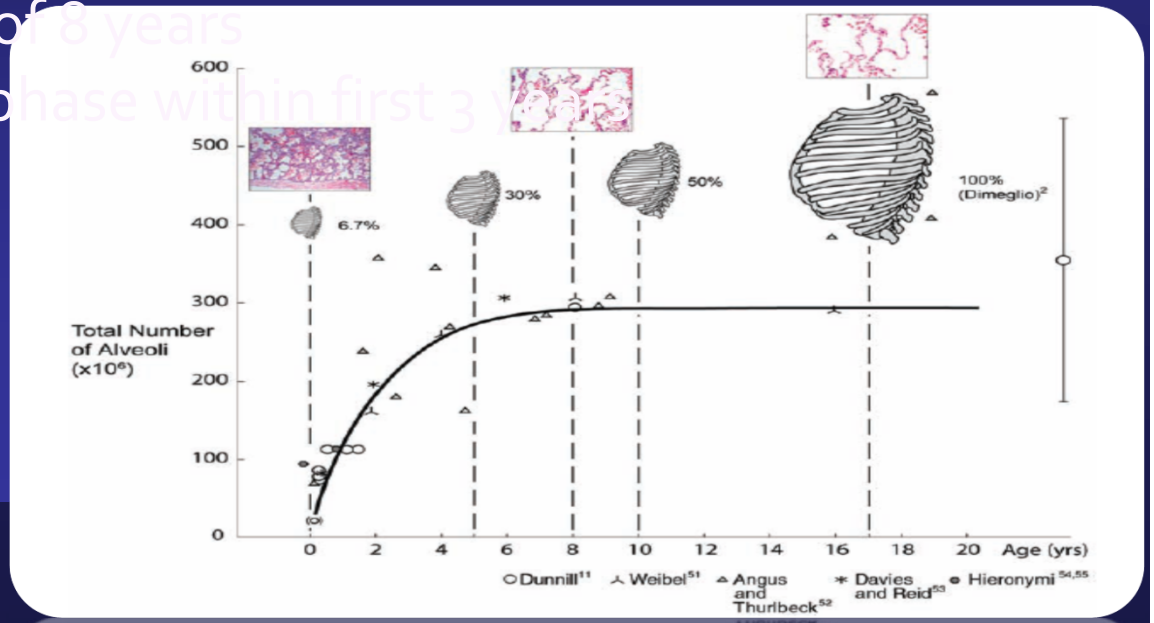
- Sitting height increases by 28 cm from birth to age of 5 years
- Remaining growth

	Age 5	Age 10
Sitting height	31/26 cm	20/12 cm
T spine	9,3 /7,8 cm	6/3,6 cm
L spine	5,6/4,7 cm	3,6/2,1 cm

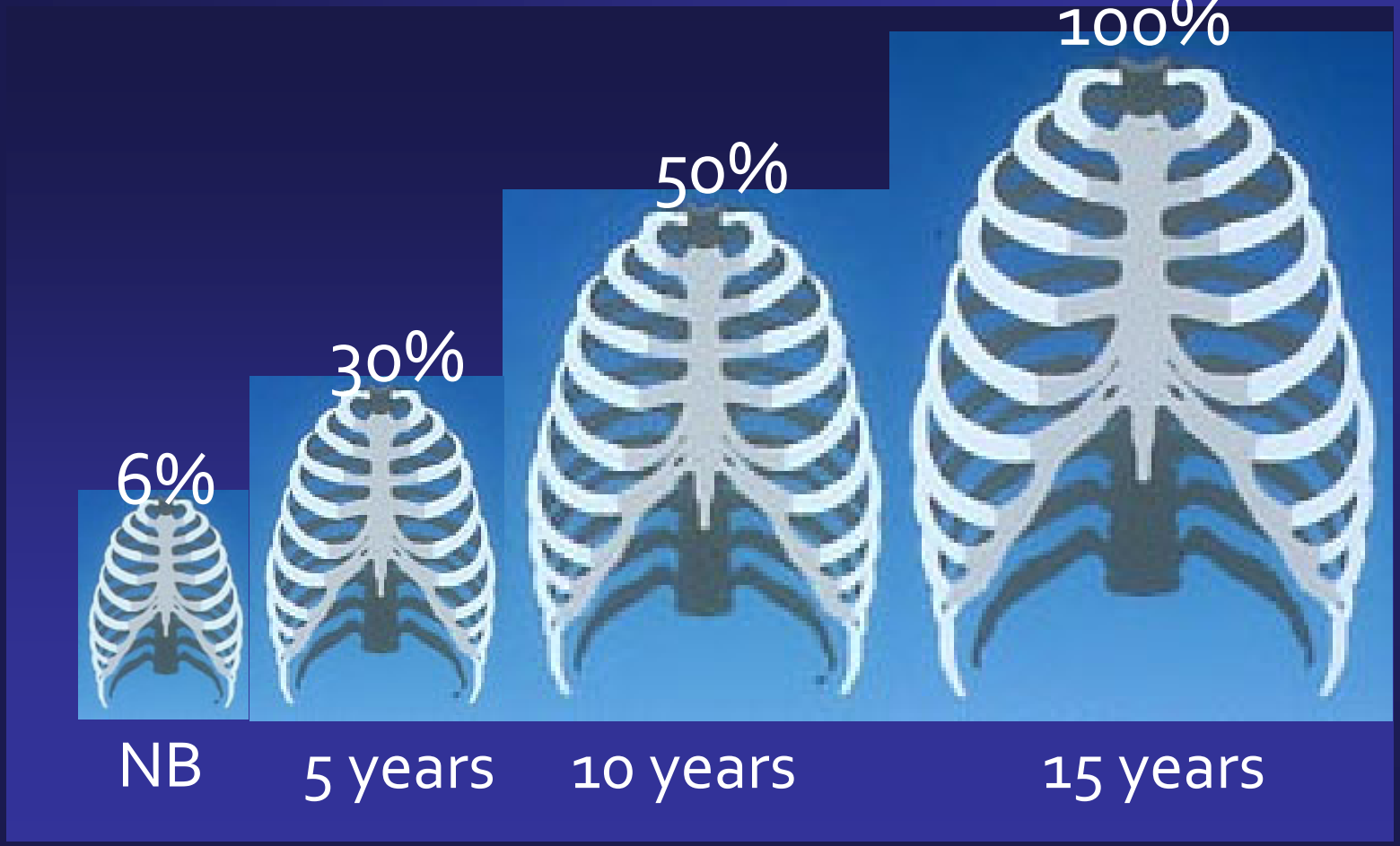
Courtesy Alain Dimeglio, MD

Lung growth

- Lung capacity
  - Newborn X 35 = Adulthood
- Lung weight
  - Newborn X 10 = Adulthood
- Alveolar multiplication
  - Till the age of 8 years
  - Most rapid phase within first 3 yrs



Lung volume



Lung growth

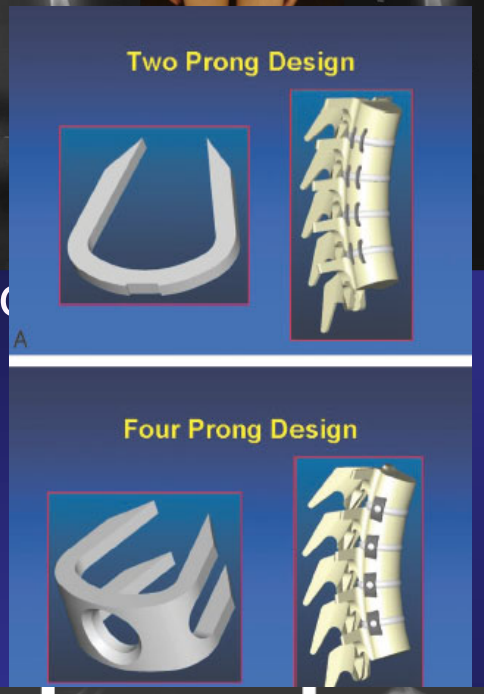
Courtesy David Clements, MD

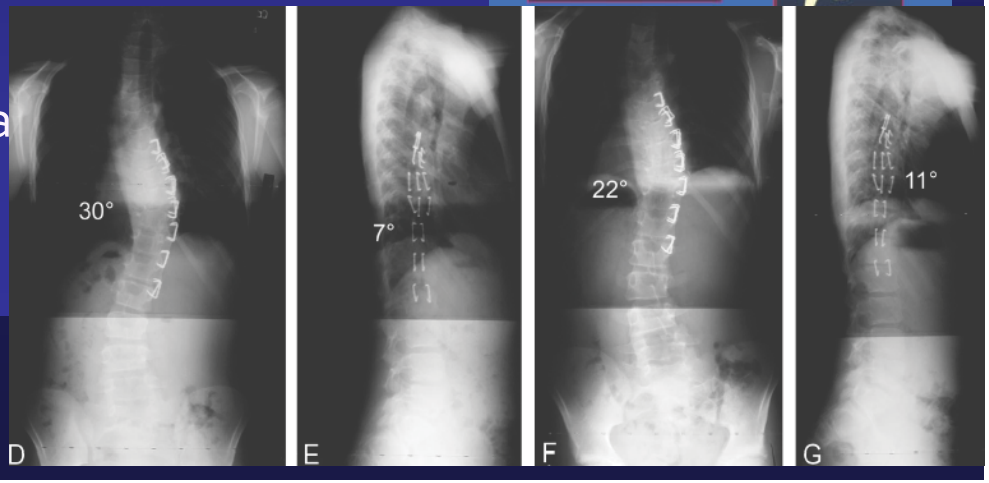
Treatment alternatives

- Growth inhibition
- Re-construction
  - Non-fusion
    - Vertebral wedge osteotomy
  - Fusion
- Growth modulation
  - Convex growth arrest
  - Stapling
- Growth preservation/stimulation
  - VEPTR
  - Growing rod

Growth modulation

- Stapling
  - Blount 's idea
    - Asymmetric control of physeal gr
  - Spine
    - Animal studies
      - Promising
    - Clinical
      - Conventional
        - » Failed
      - Memory meta
        - » Ongoing





Reconstruction without fusion

- Vertebra

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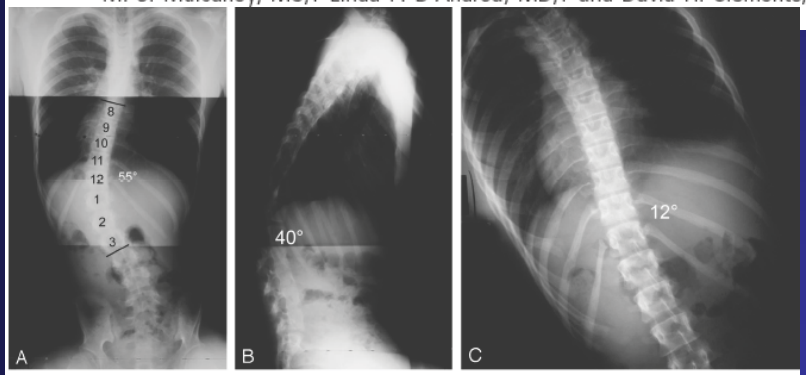
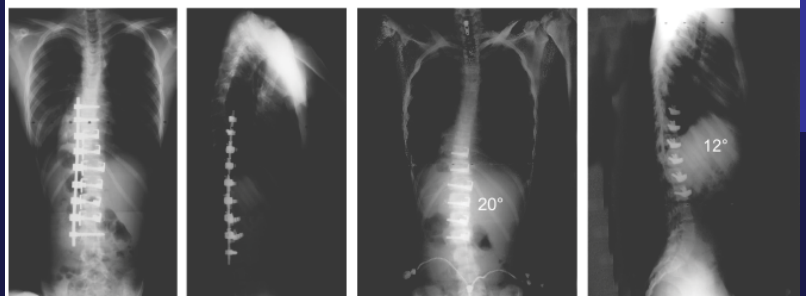
Fusionless Surgery for Scoliosis: 2–17 Year Radiographic and Clinical Follow-Up

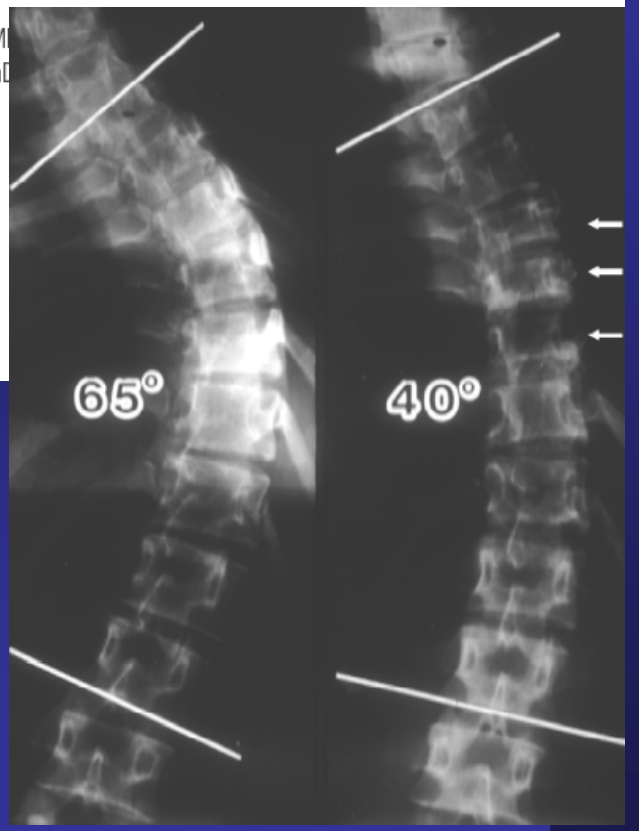
Toru Maruyama, MD, PhD,*† Tomoaki Kitagawa, MD
Atsushi Seichi, MD, PhD,* Tatsuya Kojima, MD, PhD
and Takahide Kurokawa, MD, PhD*

The Feasibility, Safety, and Utility of Vertebral Wedge Osteotomies for the Fusionless Treatment of Paralytic Scoliosis

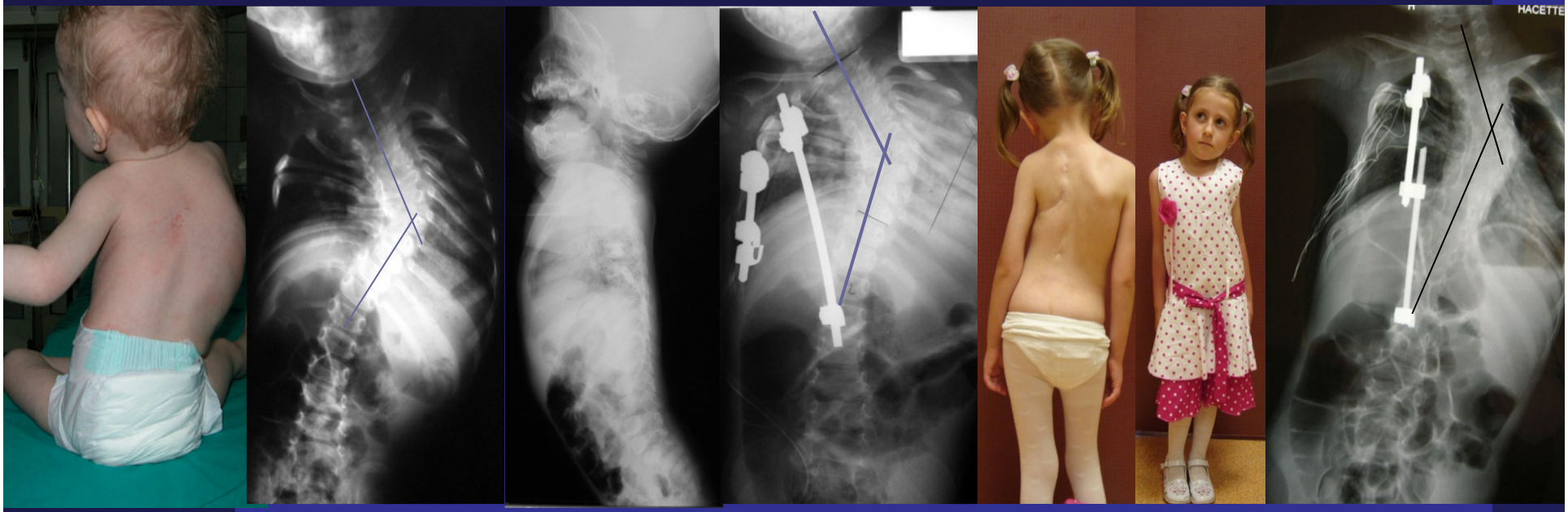
James T. Guille, MD,* Randal R. Betz, MD,† Rohinton K. Balsara, MD,‡
M. J. Mulcahey, MS,† Linda P. D'Andrea, MD,† and David H. Clements, MD§



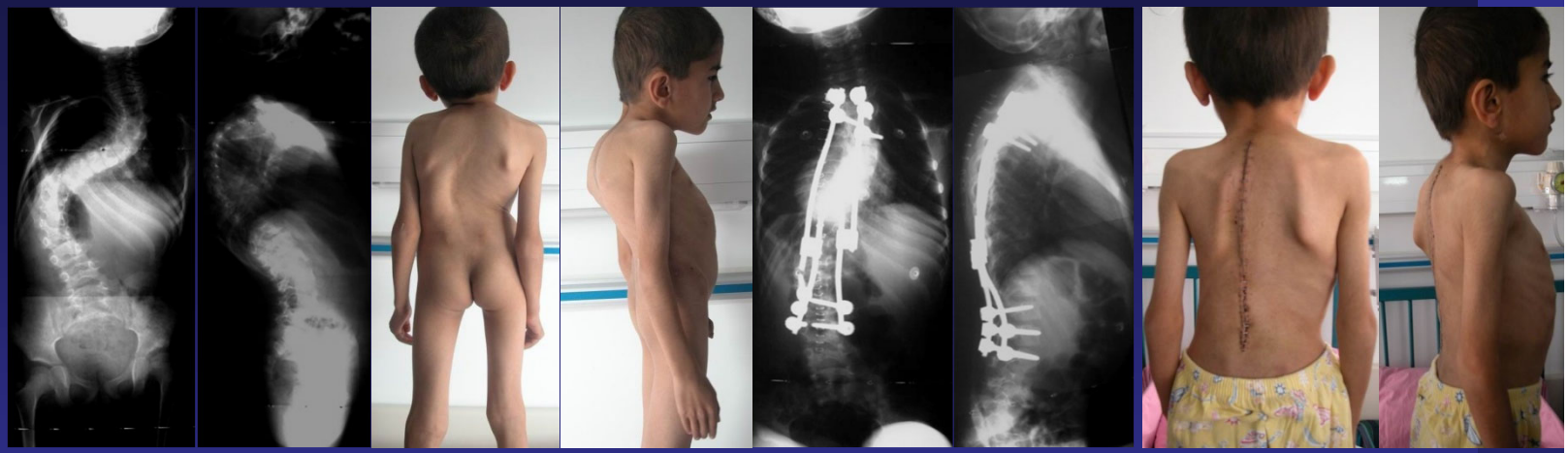




Thoracic expansion



Growing rod

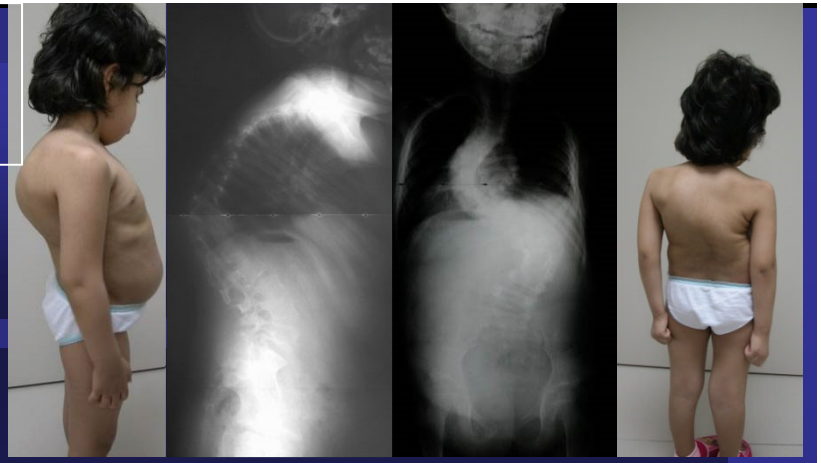


Growing rod technique

- Akbarnia BA. et.al, *Spine* 2005
  - 23 pts/189 total procedures
  - T1-S1 length
    - 1.21 cm/year
  - SAL
    - From 0.87(preop) to 1.00(latest FU)
  - Complications
    - 11 of 23 pts
      - 4 unplanned surgery

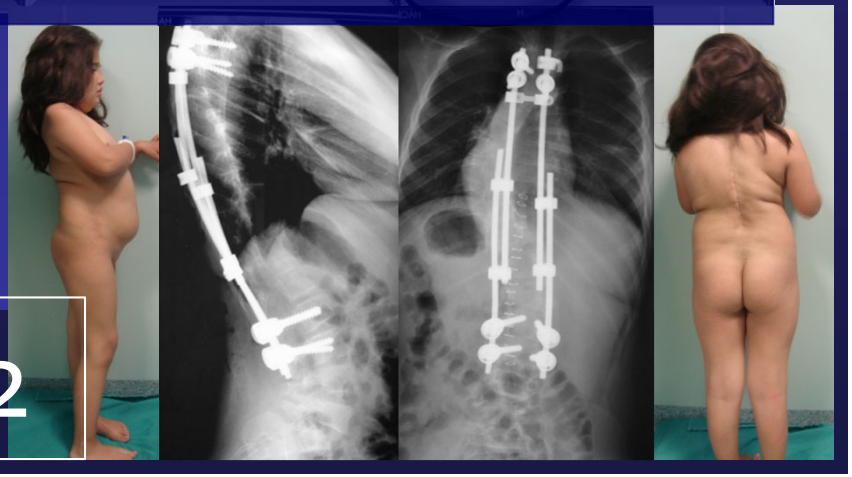
Results

6+2



Surgery	Date	Height	
		Preop	Postop
		Standing/Sitting	Standing/Sitting
Index	25.04.2005	103/52	104/53
1.	26.12.2005	105/54	106/54
2.	[illegible]	[illegible]	[illegible]
3.	16.10.2006	111/60	111.5/61
4.	[illegible]	112.5/62	114/63

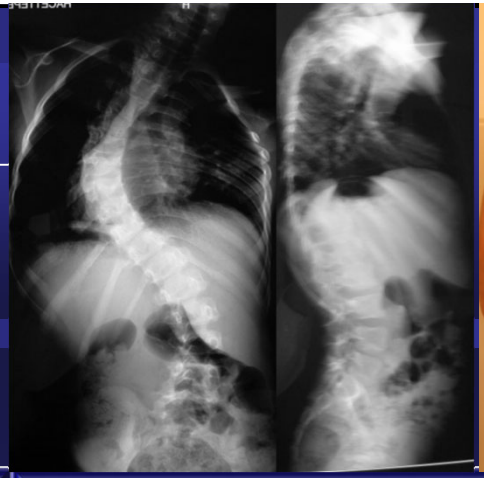
- No unplanned surgery
- 1 rod breakage at 1 week before the planned lengthening



8+2

Results

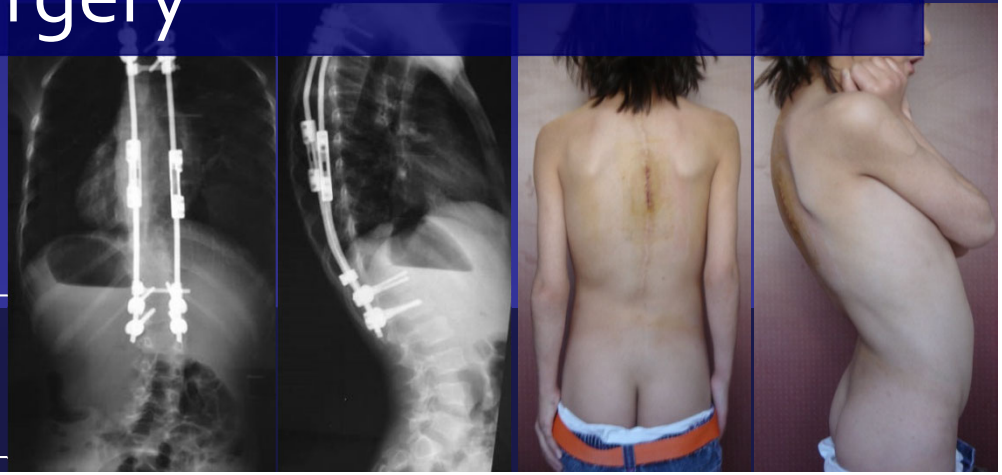
6+5



Surgery	Date	Height	
		Preop	Postop
		Standing/Sitting	Standing/Sitting
Index	27.03.2006	117.5/58	119/59
1.	16.10.2006	120.5/62	122/63
2.	13.04.2007	122.5/63	123/64
3.	20.10.2007	125/65.5	126/67

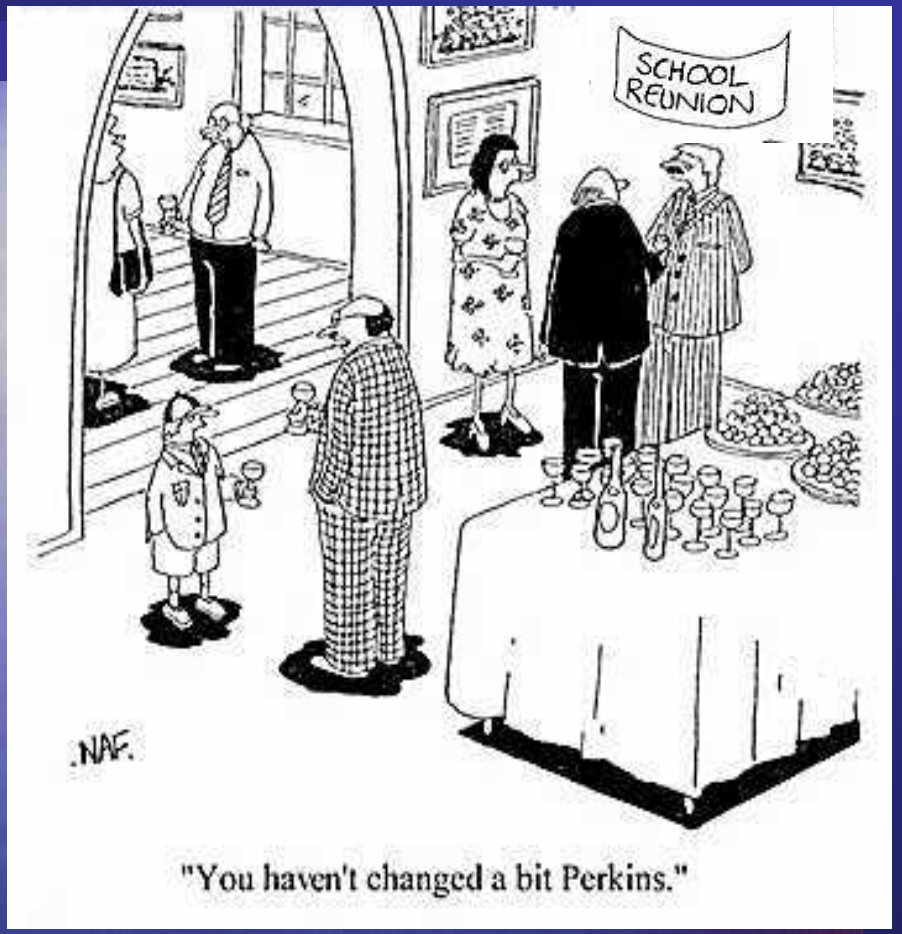
- No unplanned surgery

8+0



Conclusion

Courtesy Alain Dimeglio, MD



To be respectful the growth potential of the spine