# "Hybrid Growth Friend Constructs"

## Posterior Distraction + Anterior Vertebral Body Stapling


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# Disclosures

**I have the following financial relationships with the manufacturers and providers of commercial services**

- Royalties from a company or supplier
  - Biomet
- Paid consultant for a company or supplier
  - Biomet
  - Stryker
- Departmental research support from a company or supplier
  - AO Spine
  - Biomet
  - Medtronic
  - Synthes

**No conflict of interest with any device mentioned in this presentation**
**Nothing I am discussing is approved for indications described**

# Growth Friendly Implant Classification

**1. Distraction based**

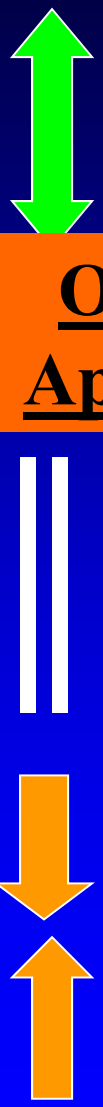
- **Growing Rods**
- **VEPTR**
- **Phenix**

**2. Guided Growth**

- **Luque-Trolley**
- **Shilla**

**3. Compression Based**

- **Tether**
- **Staple**



**< age 8 ?**

**< age 9 ?**
**All etiologies**

**Only VEPTR FDA Approved for Spine***

**< age 9 ?**
**All etiologies**

**>age 8**
**Non-congenital**

Courtesy of David Skaggs, MD

# Vertebral Body Stapling

**Vertebral Body Stapling Procedure for the Treatment of Scoliosis in the Growing Child**

*Randal R. Betz MD; Linda P. D'Andrea, MD; M. J. Mulcahey, MS; and Ross S. Chafetz, DPT*

Betz et al, *Clin Orthop* 2005

**An Innovative Technique of Vertebral Body Stapling for the Treatment of Patients With Adolescent Idiopathic Scoliosis: A Feasibility, Safety, and Utility Study**

Randal R. Betz, MD,* John Kim, MD,† Linda P. D'Andrea, MD,* M. J. Mulcahey, MS,* Rohinton K. Balsara, MD,‡ and David H. Clements, MD§

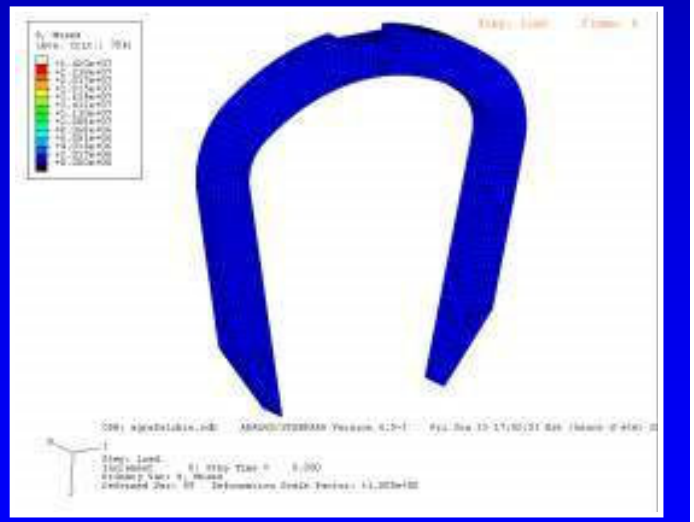
Betz et al, *Spine* 2003

# Temperature-Sensitive, Shape Memory Alloy Staple

NITINOL

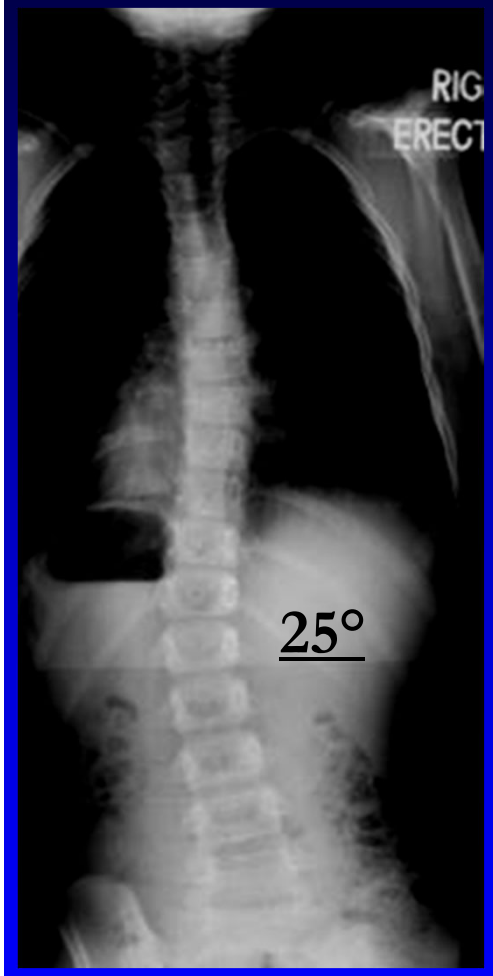
**NI**ckel-**TI**tanium-**N**aval-**O**rdnance-**L**aboratory

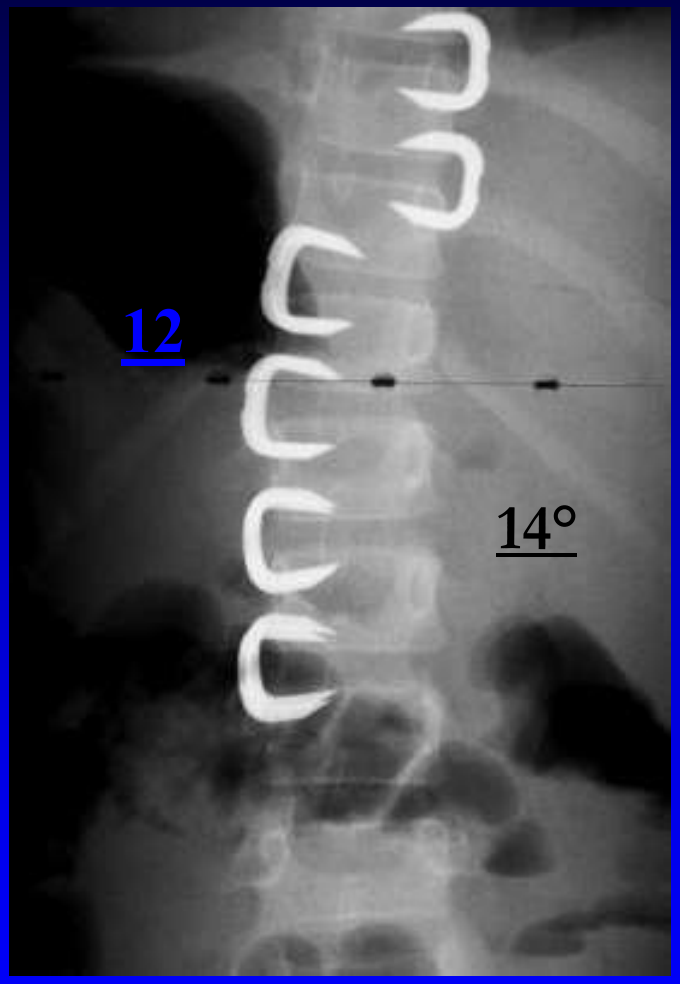
- 50% Nickel, 50% Titanium
- Improved pullout
- Constant force after implantation

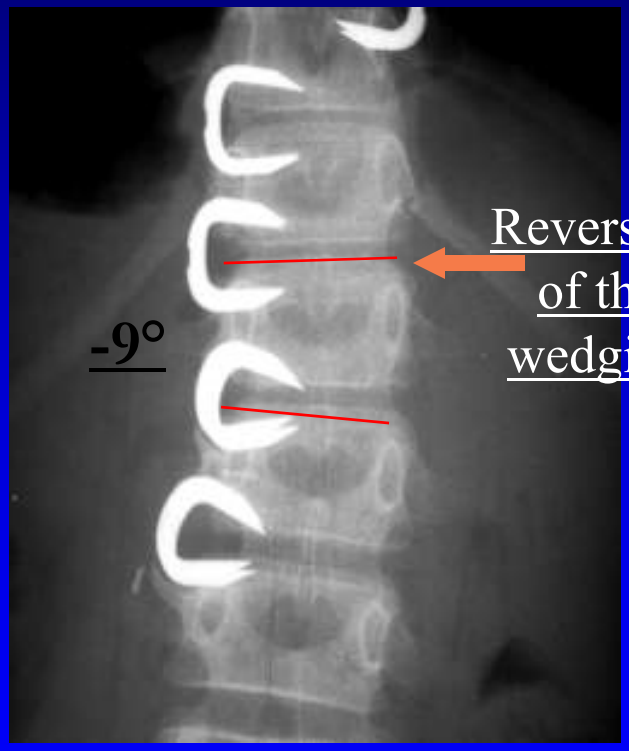


Courtesy Randy Betz

# Growth Modulation ≠ Natural History




10/ 2002

11/ 2002

2005

Courtesy Randy Betz

# Stapling: Early Results

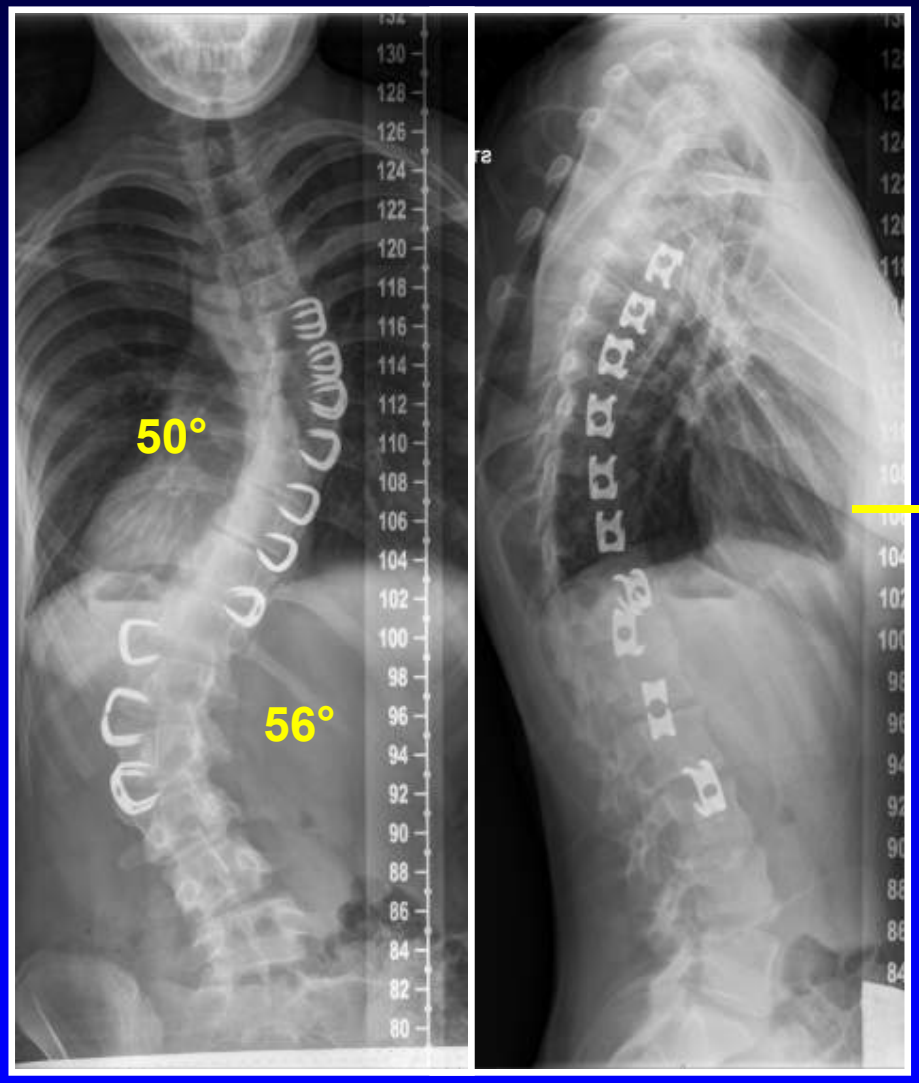
- Betz:
  - 80% skeletally immature patients with curves <35 showed diminution or maintainance of curve;
  - results worse in curves > 35 degrees

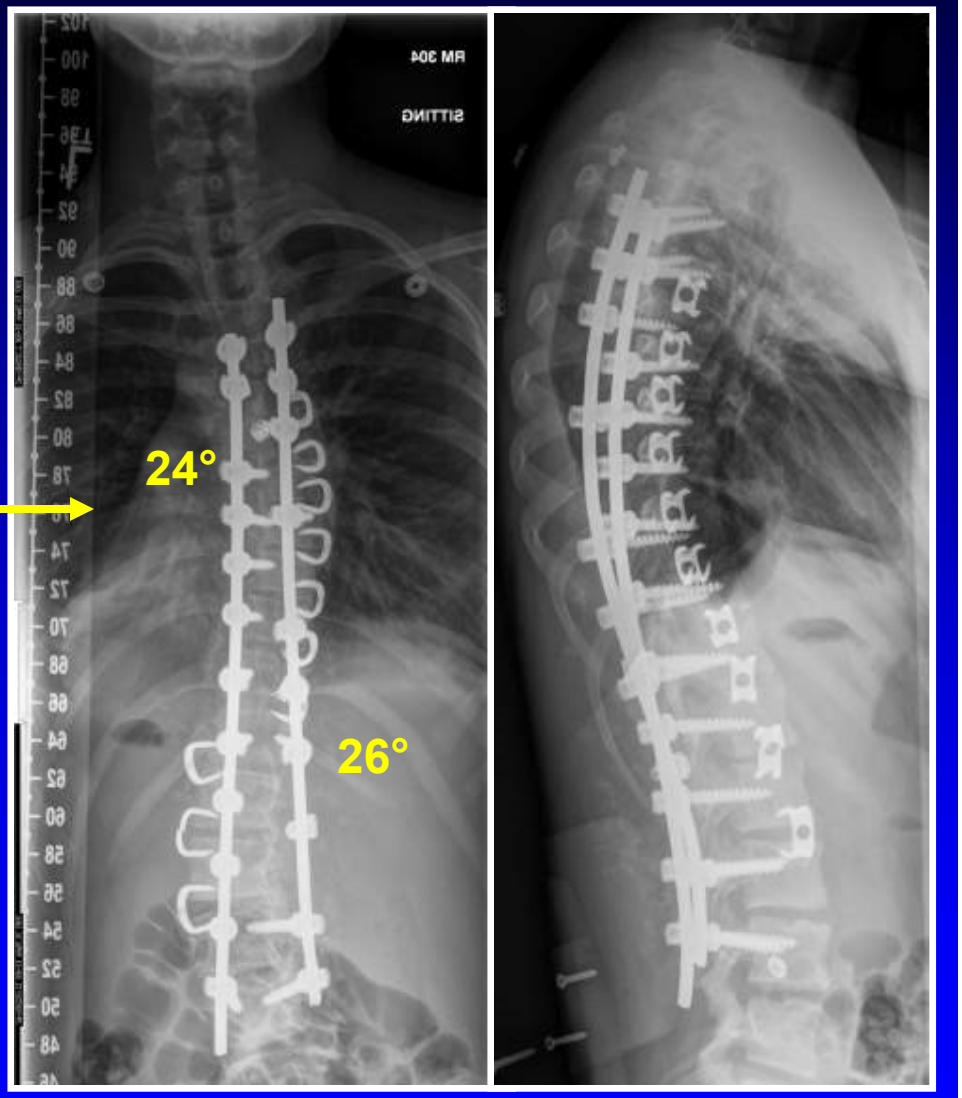
# Stapling: Early Results

- **Luhmann**
  - **13 Risser O patients with > 1 yr f/u (mean 20 mo)**
  - **2 fusion ; 1 overcorrection**
  - **Mean correction 4.5 degrees (34 to 31 deg)**

- **Oswald**
  - **25 pt w 3 yr Fu 25 pt.**
    - **30 percent with > 10 degree progression**
    - **25 percent with > 10 degree improvement**
    - **Curves greater than 35 do poorly and account for most progressive curves**

# Doesn't Always Work But Outcome Same



# Compression Base Implants;

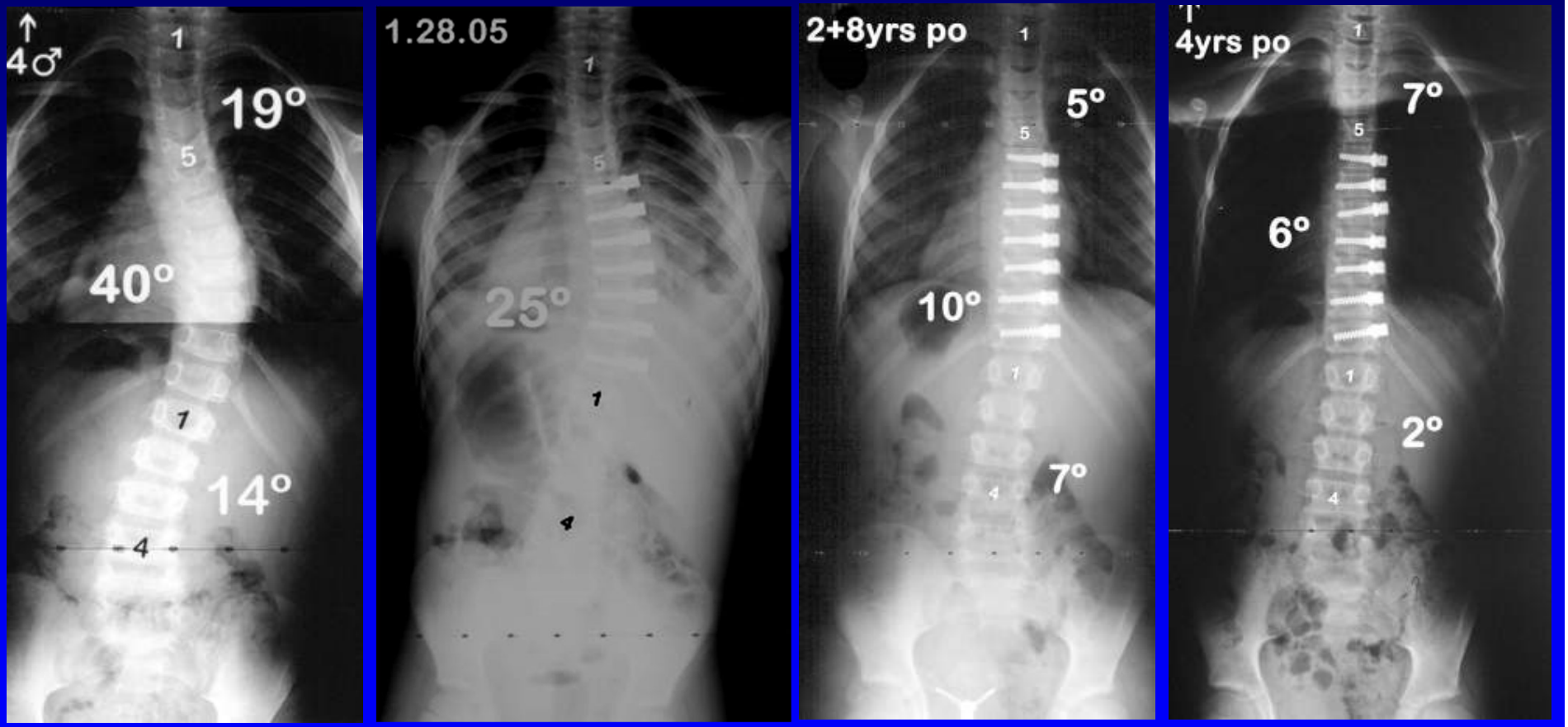
## Bone Anchor/Ligament Tether

- Bone anchors with flexible tethers
  - Immediate correction
  - Growth compression
- Braun et al., Spine 2006
  - Goat model
  - Mixed results

Courtesy John Braun

# Growth Modulation by Means of Anterior Tethering Resulting in Progressive Correction of Juvenile Idiopathic Scoliosis: A Case Report

*Crawford and. Lenke; JBJS 2010*




*…"1.4 deg per year per level"*

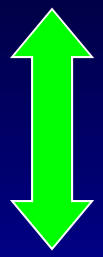
# Growth Friendly Implant Classification

**1.** Distraction based
- Growing Rods
- VEPTR
- Phenix

2. Guided Growth
- Luque-Trolley
- Shilla

3. Compression Based
- Tether
- Staple

4. Hybrid Approach
distraction on concavity
compression on convexity



**< age 9 ?**
**All etiologies**

**? Age**
**? Size of curve**

**< age 9 ?**
**All etiologies**

# “Hybrid Growth Friend Constructs”

Posterior Distraction + Anterior Vertebral Body Stapling

Morgan Stanley
Children’s Hospital of NewYork-Presbyterian
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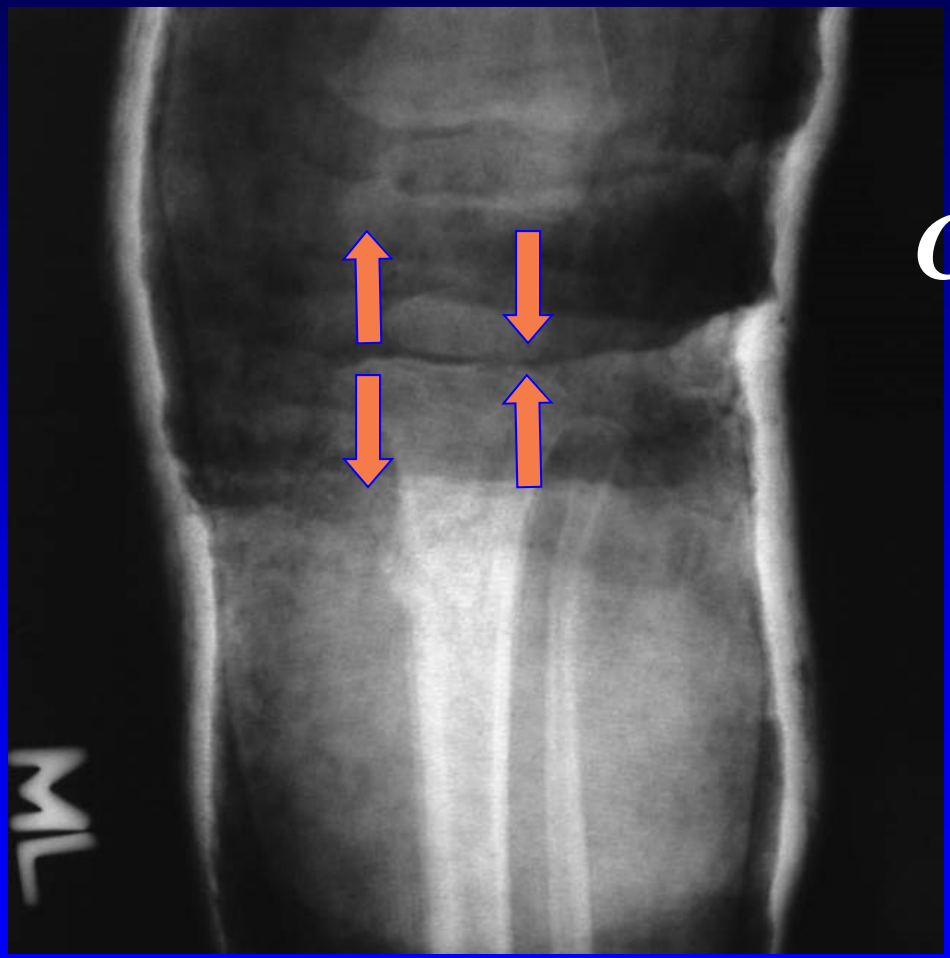
# Heuter-Volkmann

## Post Traumatic Tibia Valga

***Distraction***
***Medial***

**Facilitates growth**




***Compression***
***Lateral***

**Inhibits growth**

Can a Combination of Distraction and Compression
Of the Vertebral Physis Guide Growth ?

# Hybrid Growing Instrumentation Construct with Anterior Vertebral Body Stapling

## Case 1

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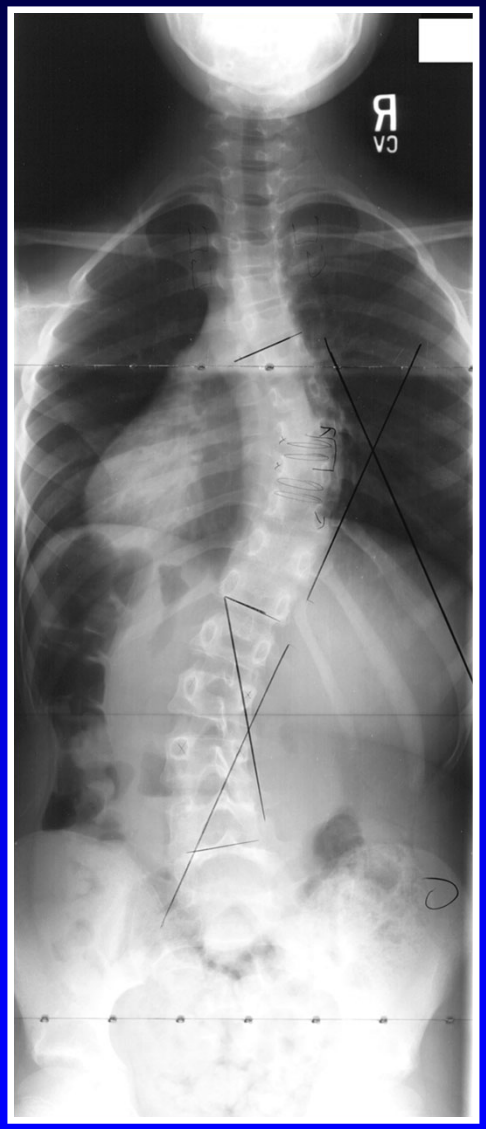
Pediatric Orthopaedic Surgery

# Patient GO



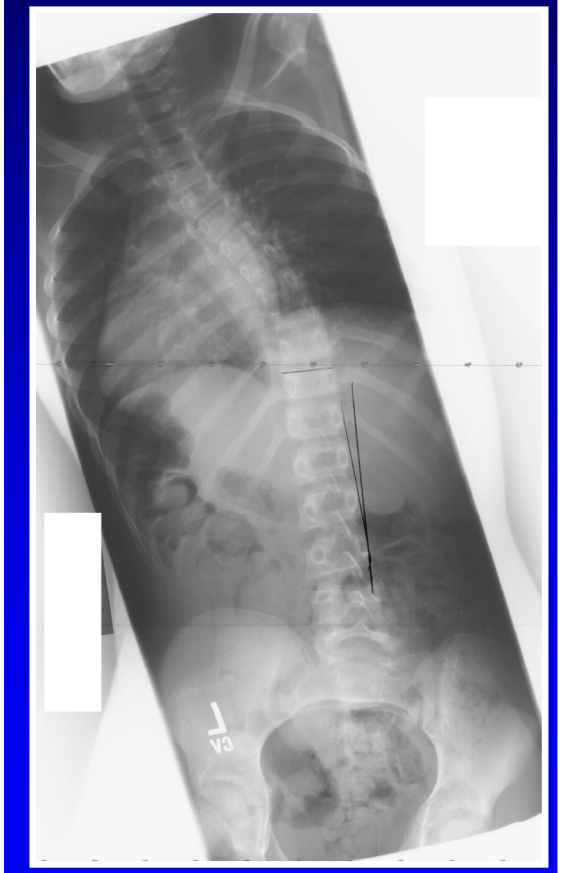
JIS

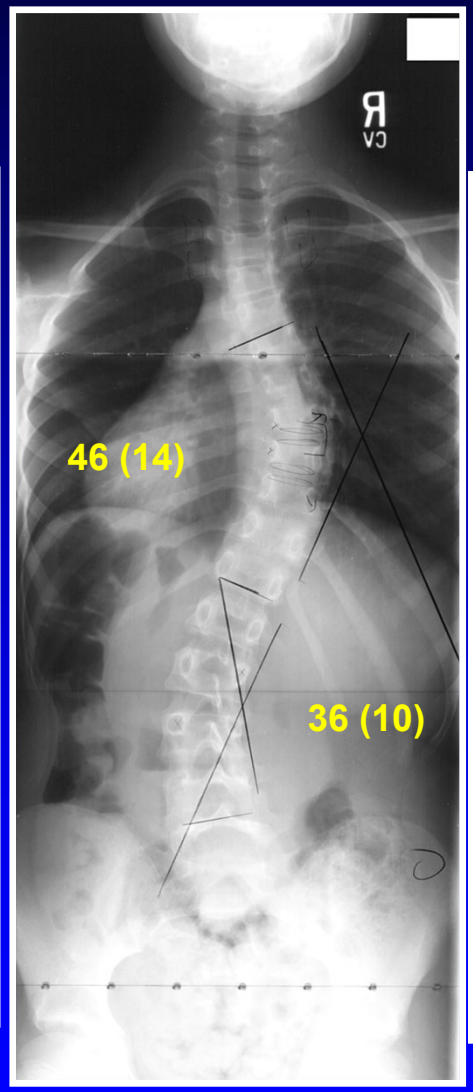
- **9 year old girl**
- **FMHx: Aunt s/p PSIF**
- **Progresion despite full time bracing**

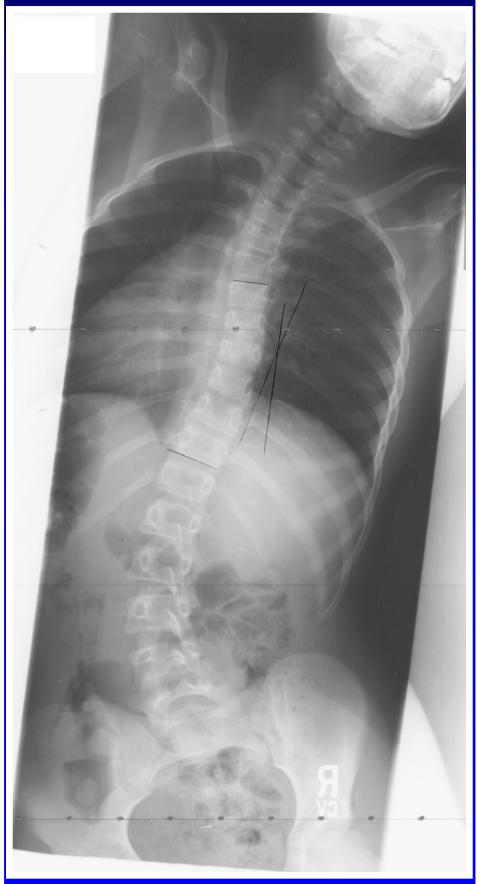
**Significant Growth Potential!**

- **Premenarchal**
- **Tanner 0**
- **Risser 0**

# Patient GO: Pre-Op

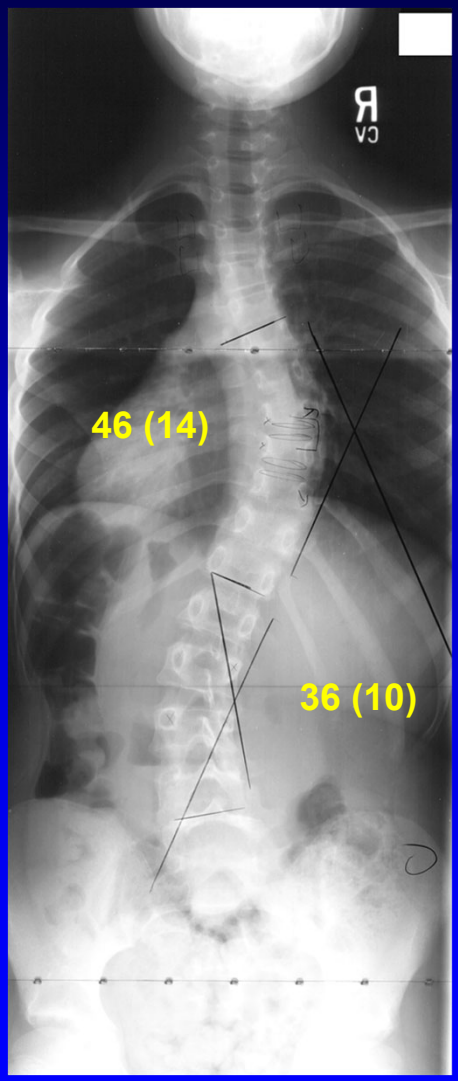




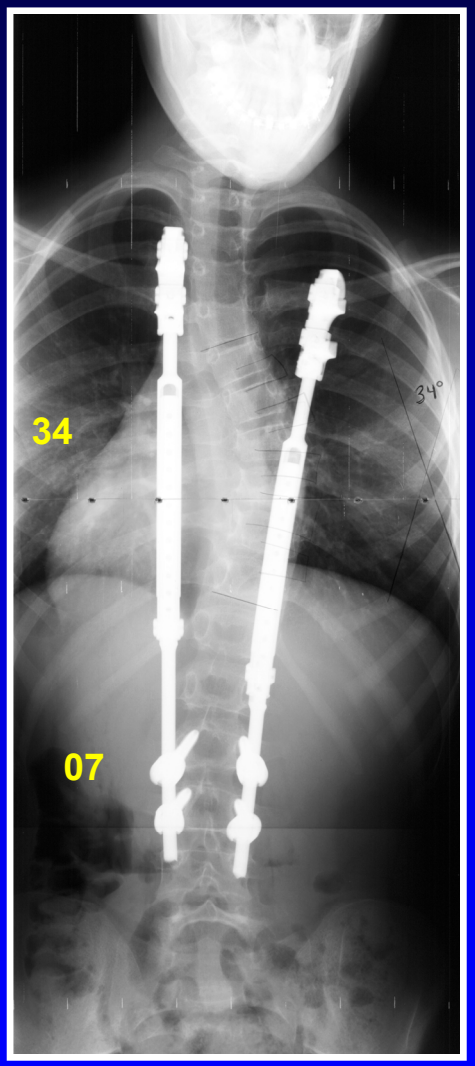



2/13/09 – Pre-op

# Patient GO: Step One
# B/L VEPTR T4-L3

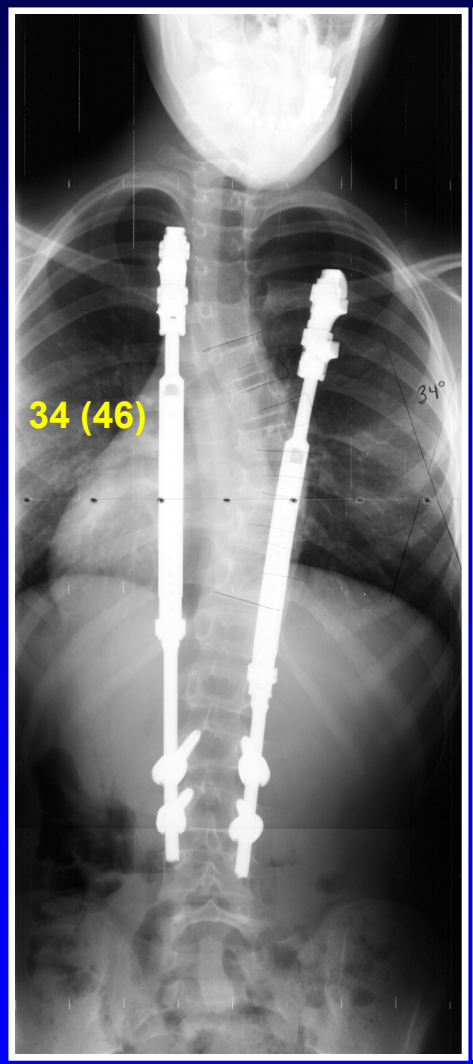


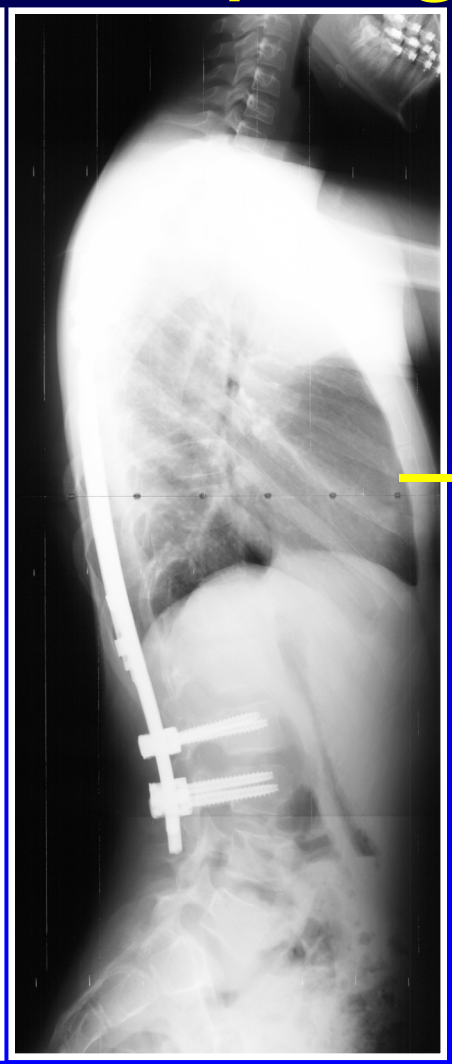

2/13/09 – Pre-op

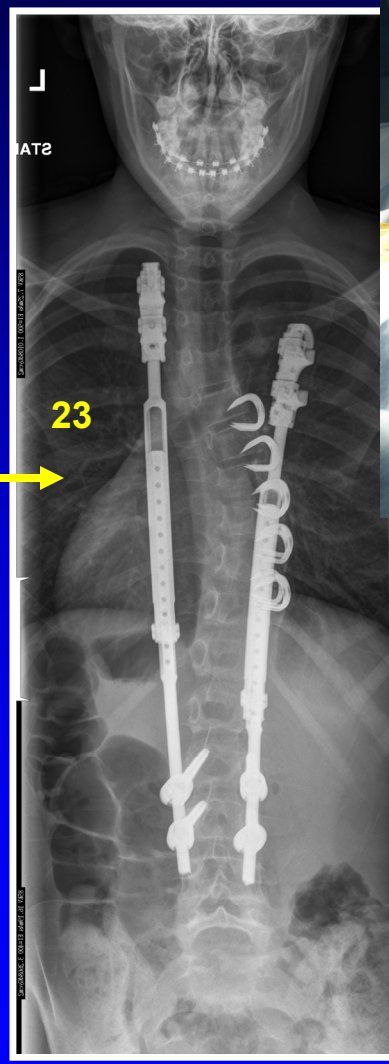


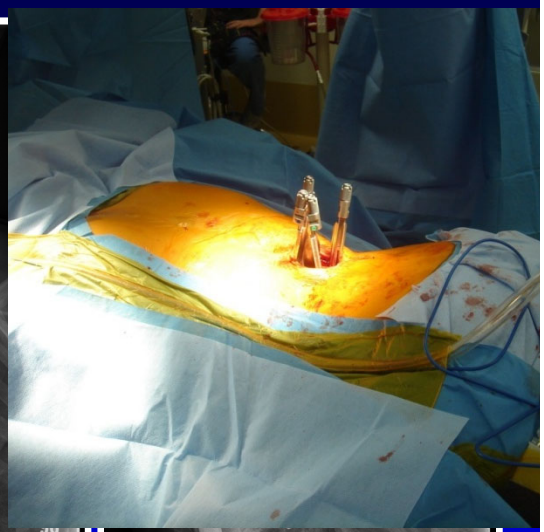

3/12/09 – Post-op

# Patient GO: Step Two
# Stapling T5-T10

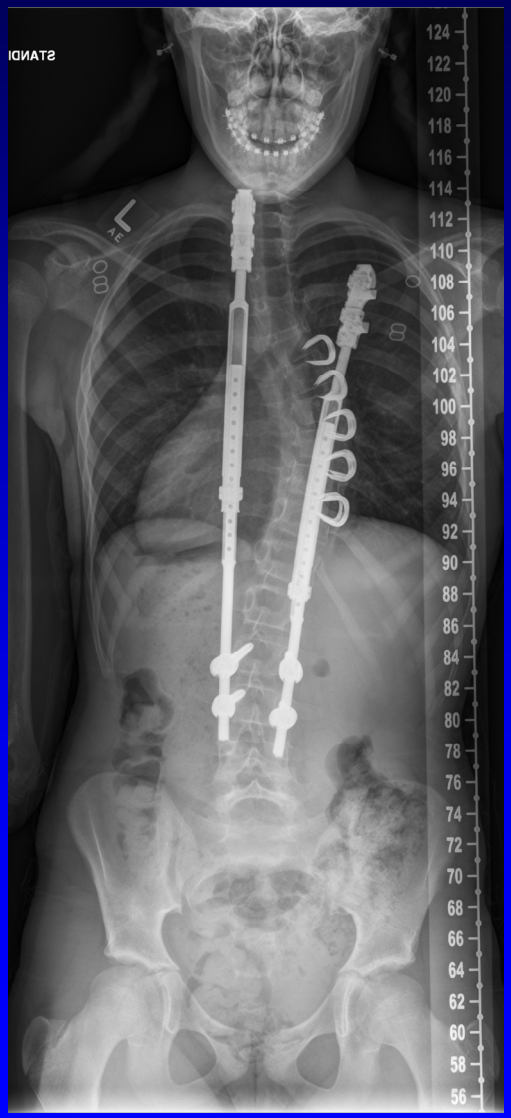


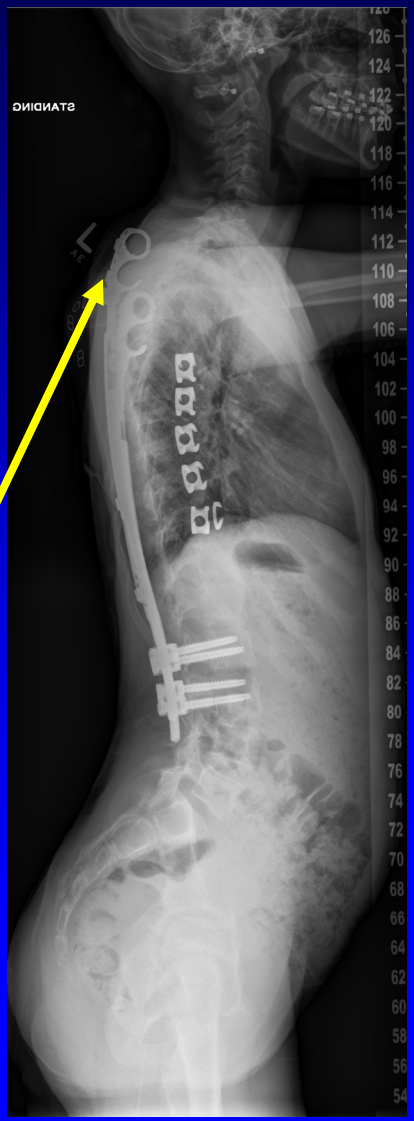


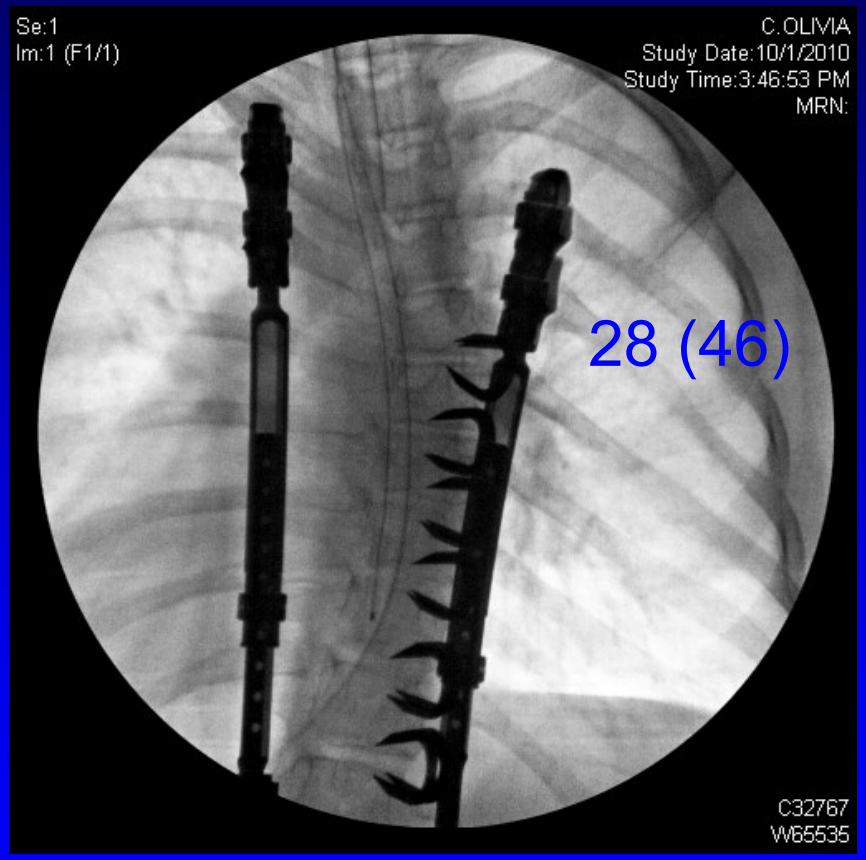
# Patient GO: Pre-op Second Lengthening



- No pain, no limits
- Complains of prominence of hardware
- X-rays show progression of curve (29- -> 36) and proximal migration of hook
- Plan for revision of Left proximal hook at upcoming lengthening



# Recent Revision Cradle




# Hybrid Growing Instrumentation Construct with Anterior Vertebral Body Stapling

## Case 2

Morgan Stanley
Children's Hospital of NewYork-Presbyterian
Columbia University Medical Center

Columbia Orthopaedics
Pediatric Orthopaedic Surgery

# Patient OC

## JIS

- 10 y/o girl;
- Diagnosed at age 7
- FMHx: Mother s/p Harrington rods for 60° curve at age 12
- Younger sister with significant curve as well (25°)
- Scoliscore 189 = 92%

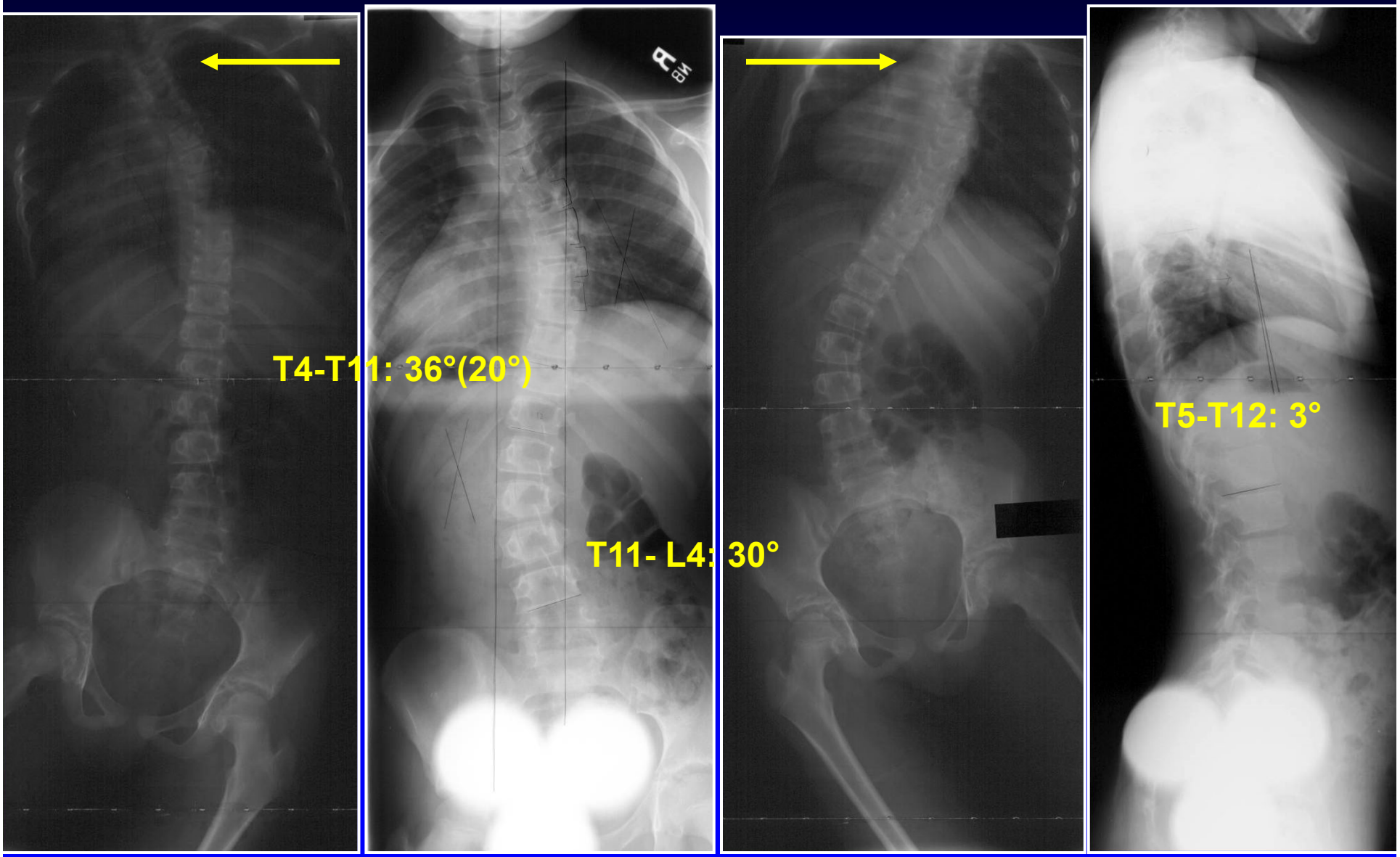
# Patient OC

- Rapidly progressive curve
- Resistant to bracing

**Significant Growth Remaining!**

- Open TRC, Risser 0
- Simplified TW-III Stage 2 (pre-capping)
- Pre-menarchal, Tanner 0

# Patient OC: Pre-op



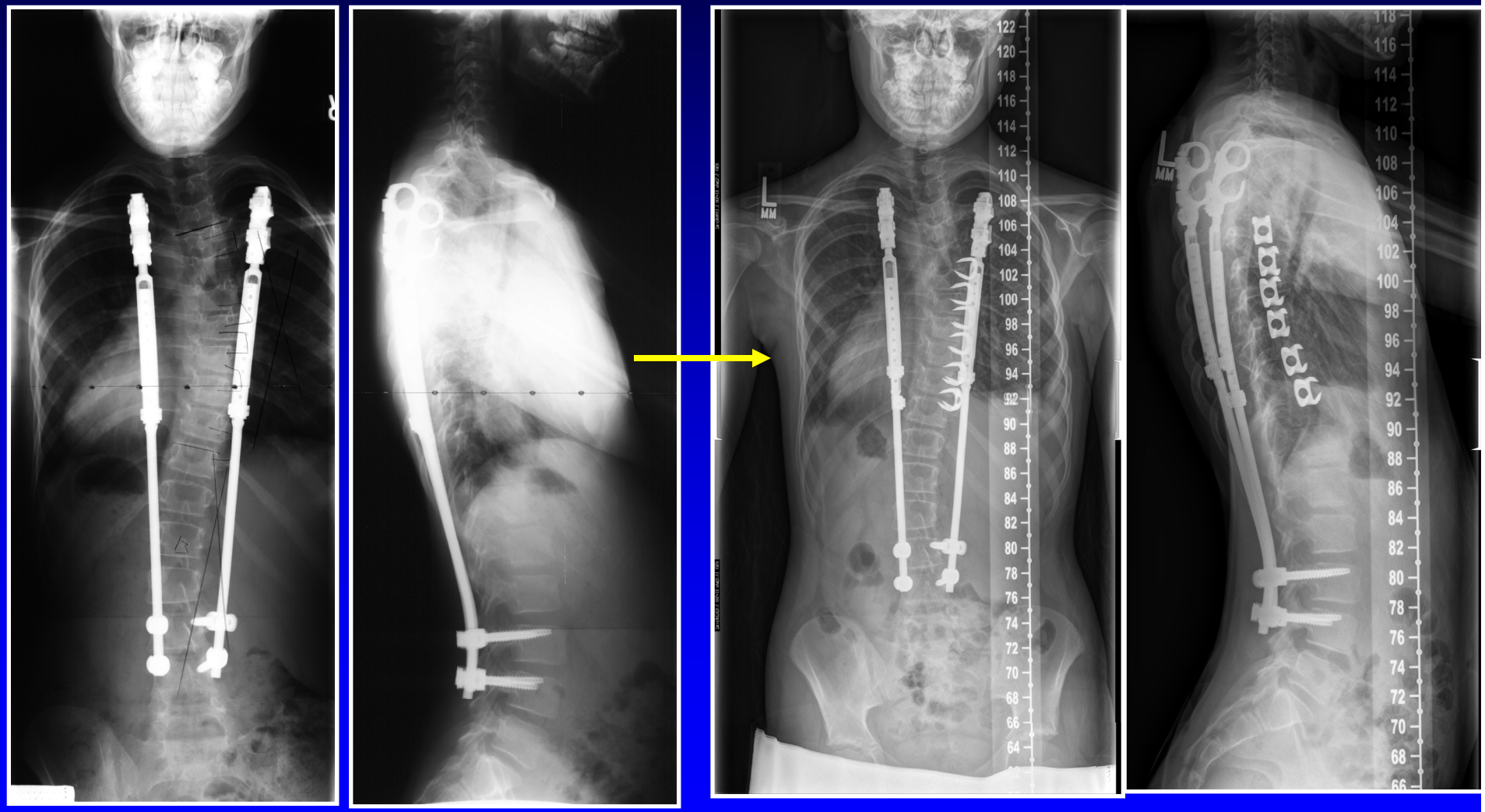

4/15/09 – Pre-op

# Patient OC: Step One
# B/L VEPTR


4/15/09 – Pre-op

6/17/09 – Post-op

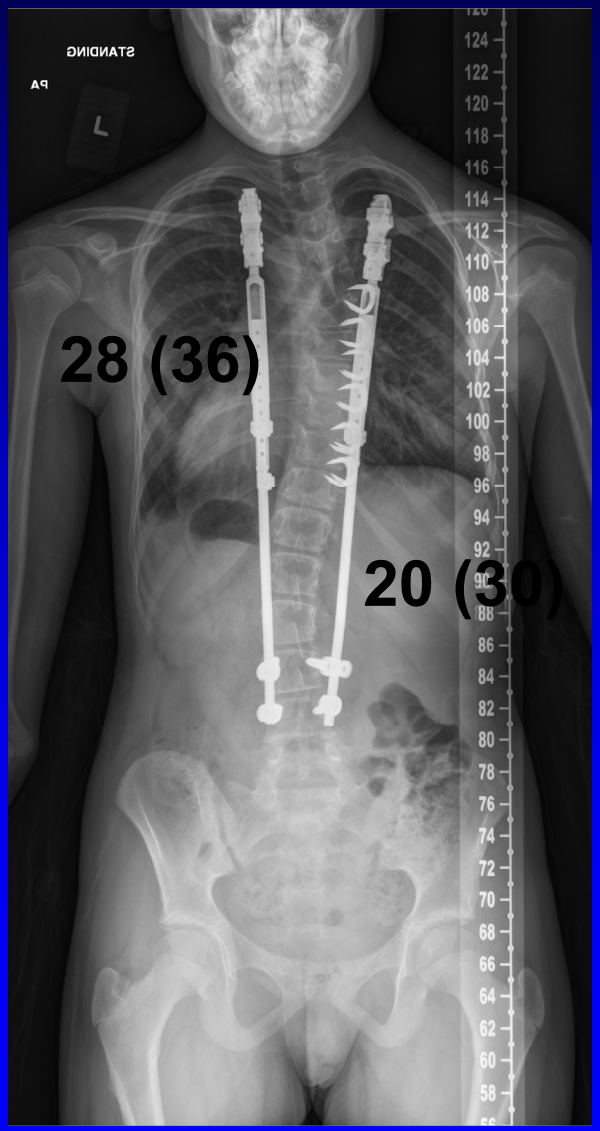
# Patient OC: Step Two
# Stapling T5-T10



8/13/09 – Pre-op

12/17/09 – Post-op

# Patient OC: Post-op Second VEPTR Lengthening




- No pain, very active
- Significant improvement in:
  - Alignment
  - Positioning
  - Balance
  - Posture
- Plan for next VEPTR lengthening in 12/2010

# Hybrid Growing Instrumentation Construct with Anterior Vertebral Body Stapling

## Case 3

Morgan Stanley
Children's Hospital of NewYork-Presbyterian
Columbia University Medical Center

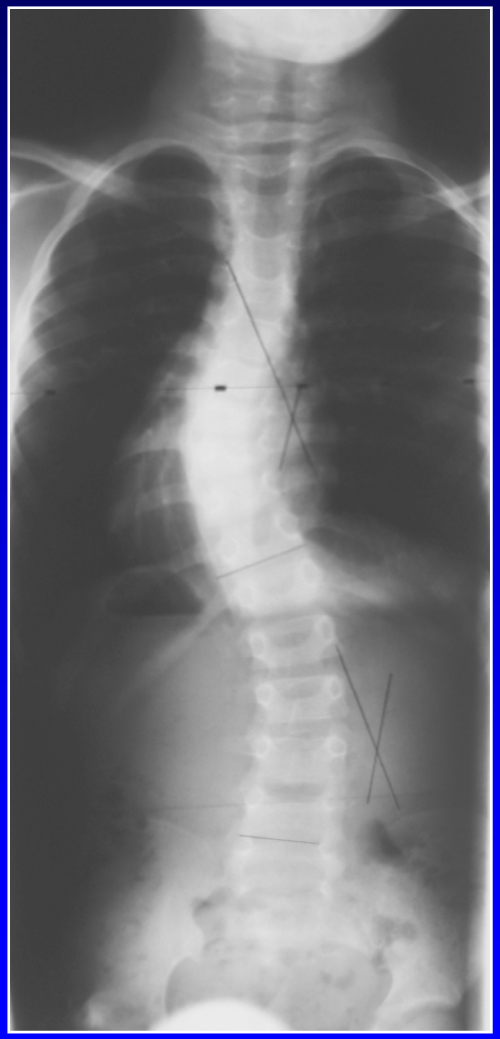
Columbia Orthopaedics
Pediatric Orthopaedic Surgery

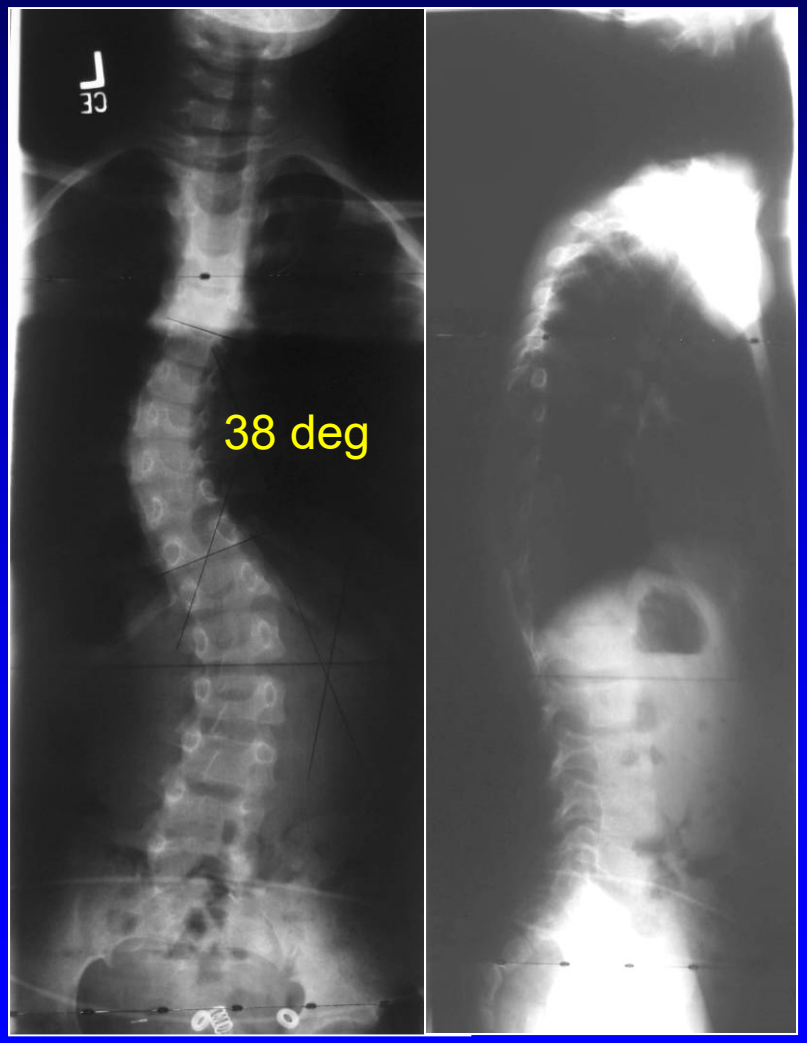
# Patient JR

- 7 y/o boy
- S/p trochanteric arthroplasty 2° neonatal sepis and osteo
- S/p L femoral lengthening
- Unable to tolerate bracing due to effect on gait

# Patient JR – Now 9yo

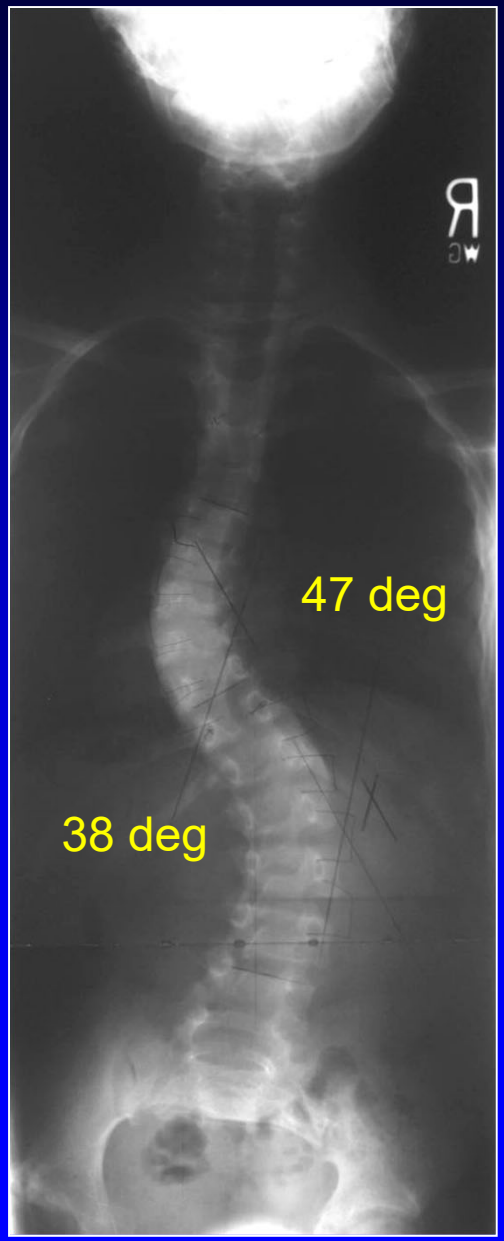
Little progression over 2 years

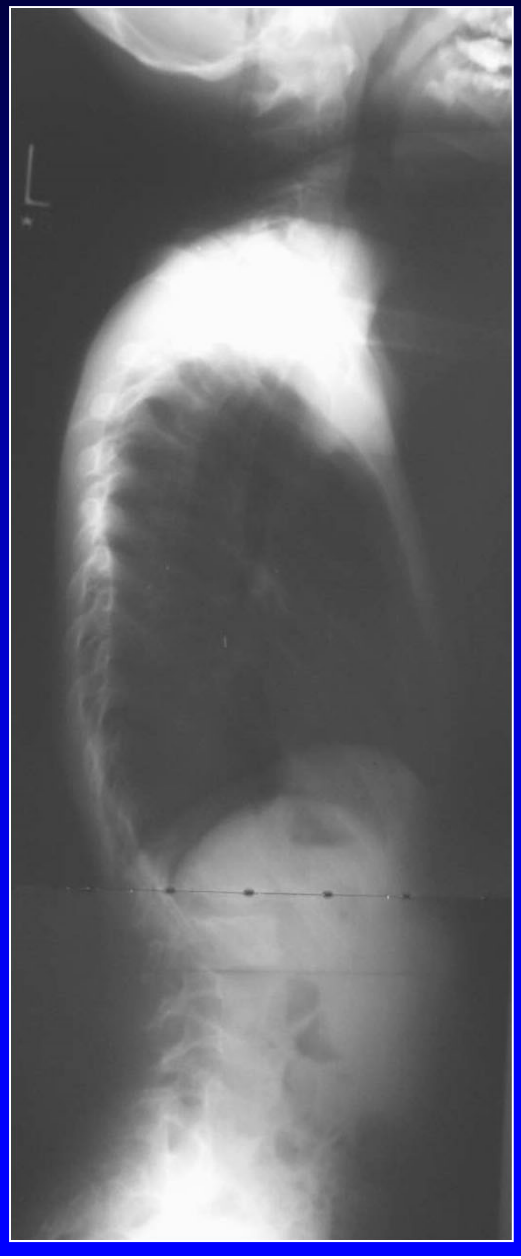




# Patient JR - Now 10yo

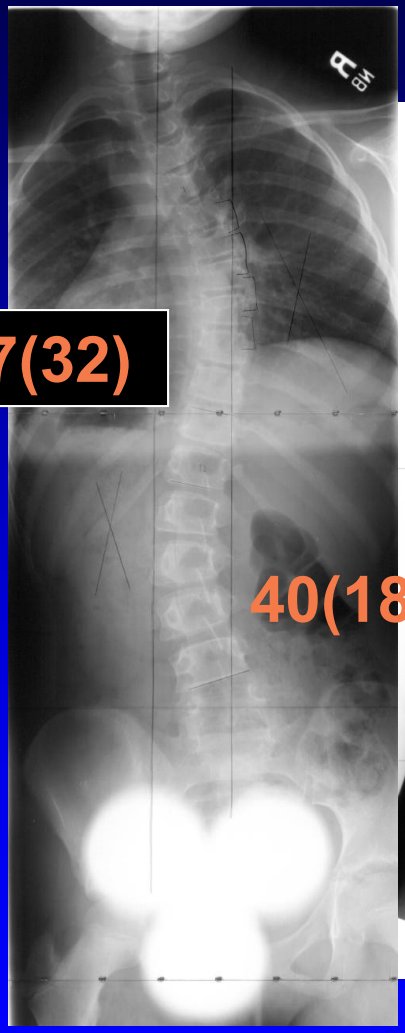
Significant progression from previous year



# Patient JR

47(32)



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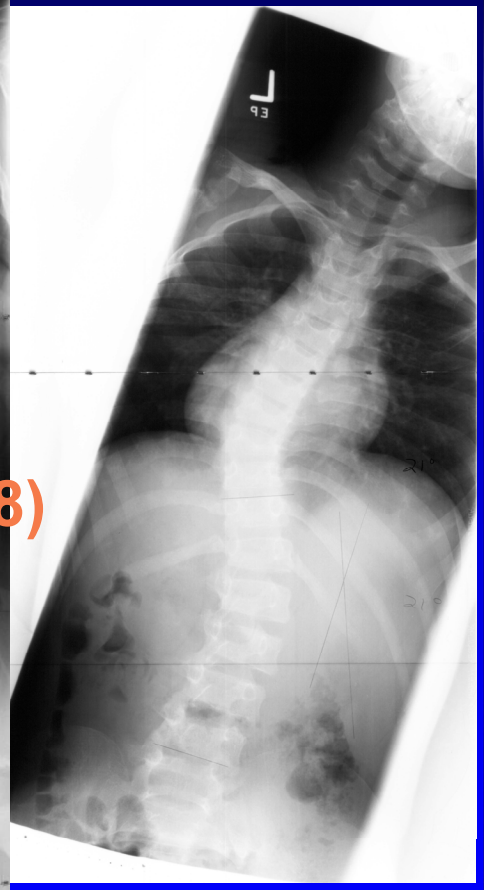
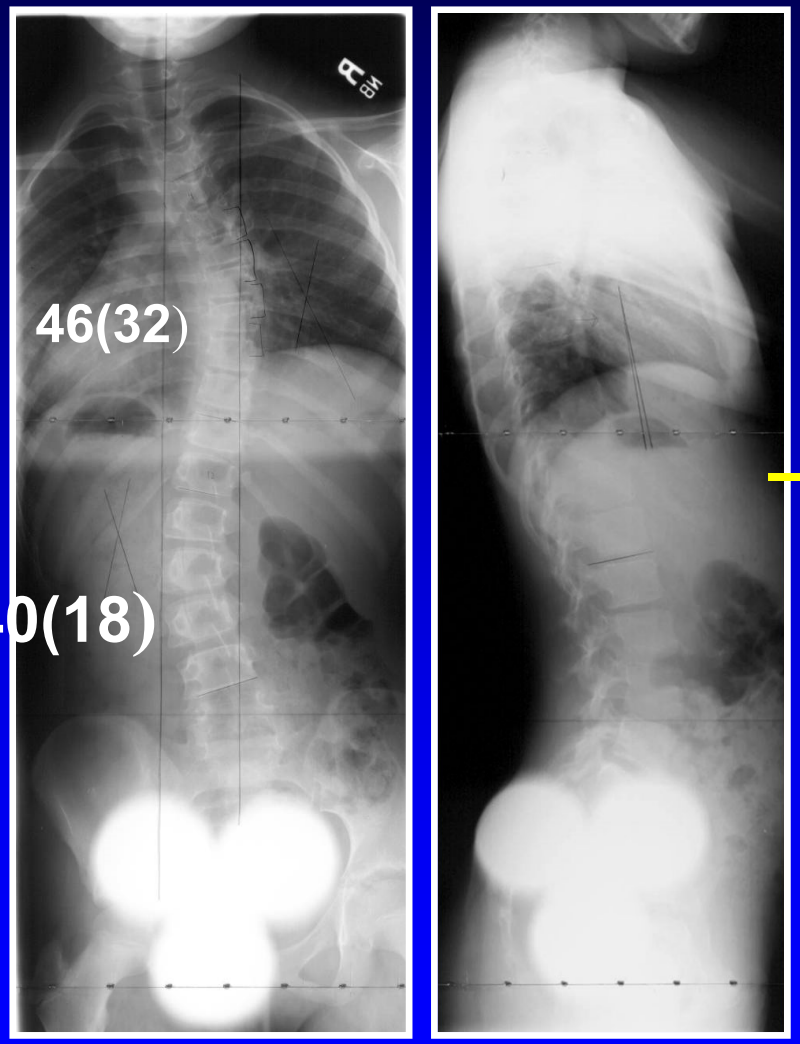
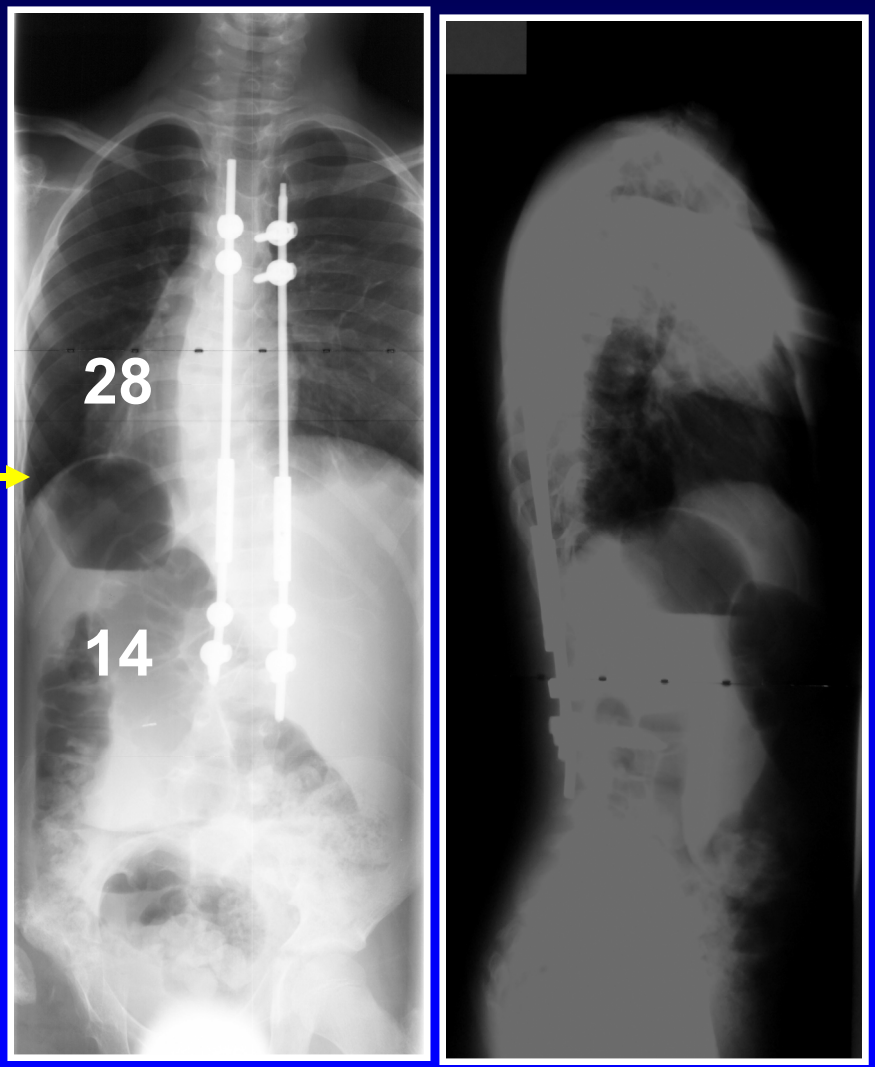


1/31/08 – Pre-op

# JR:Growing Rod T4-L3

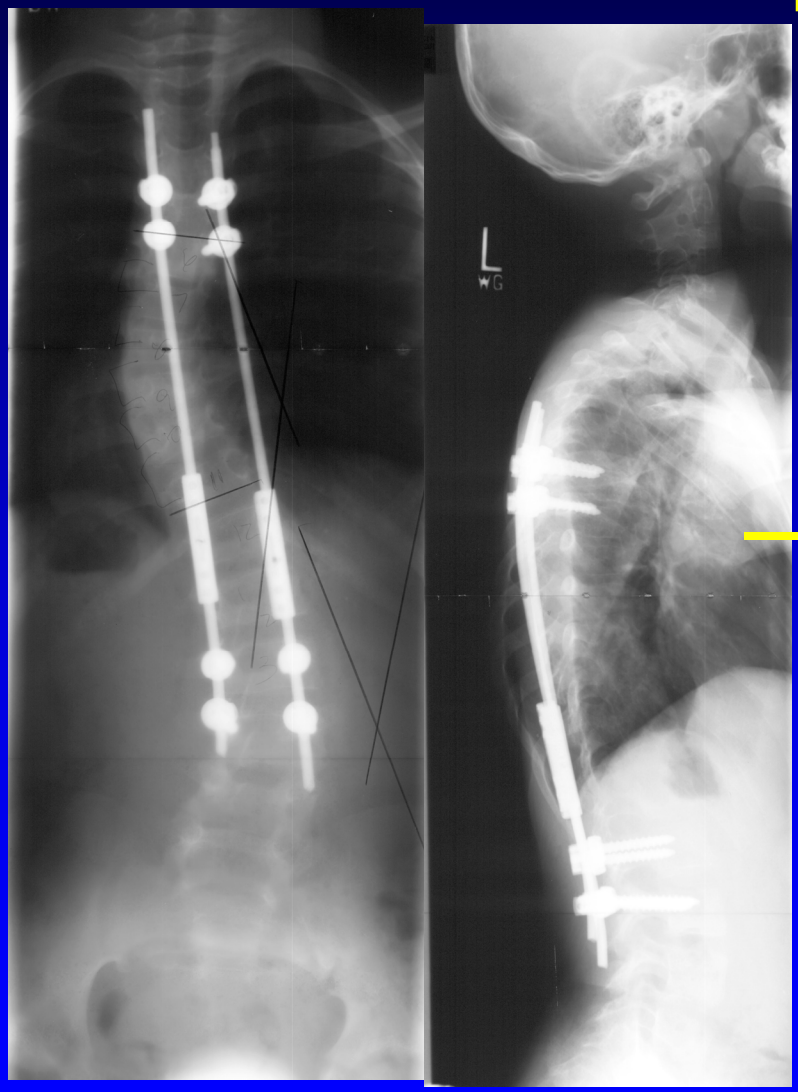



1/31/08 – Pre-op

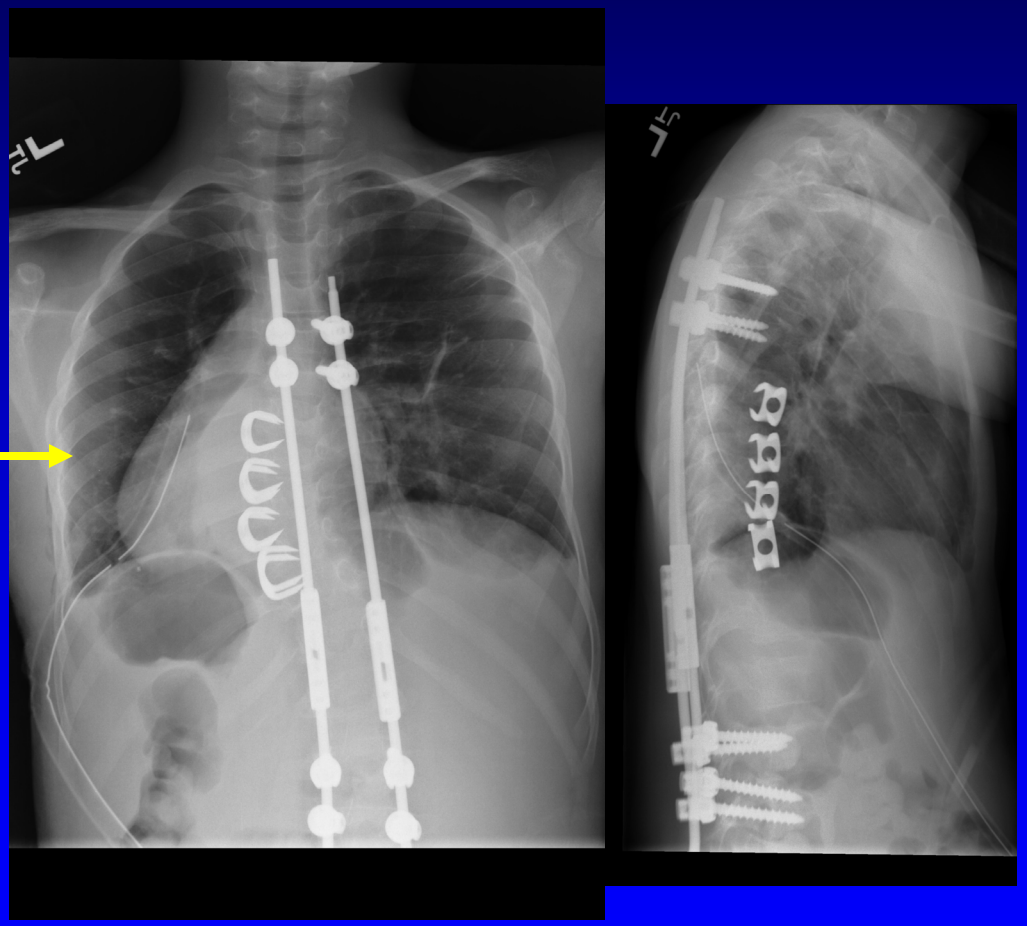



2/13/08 – Post-op

# JR:Stapling T7-T11

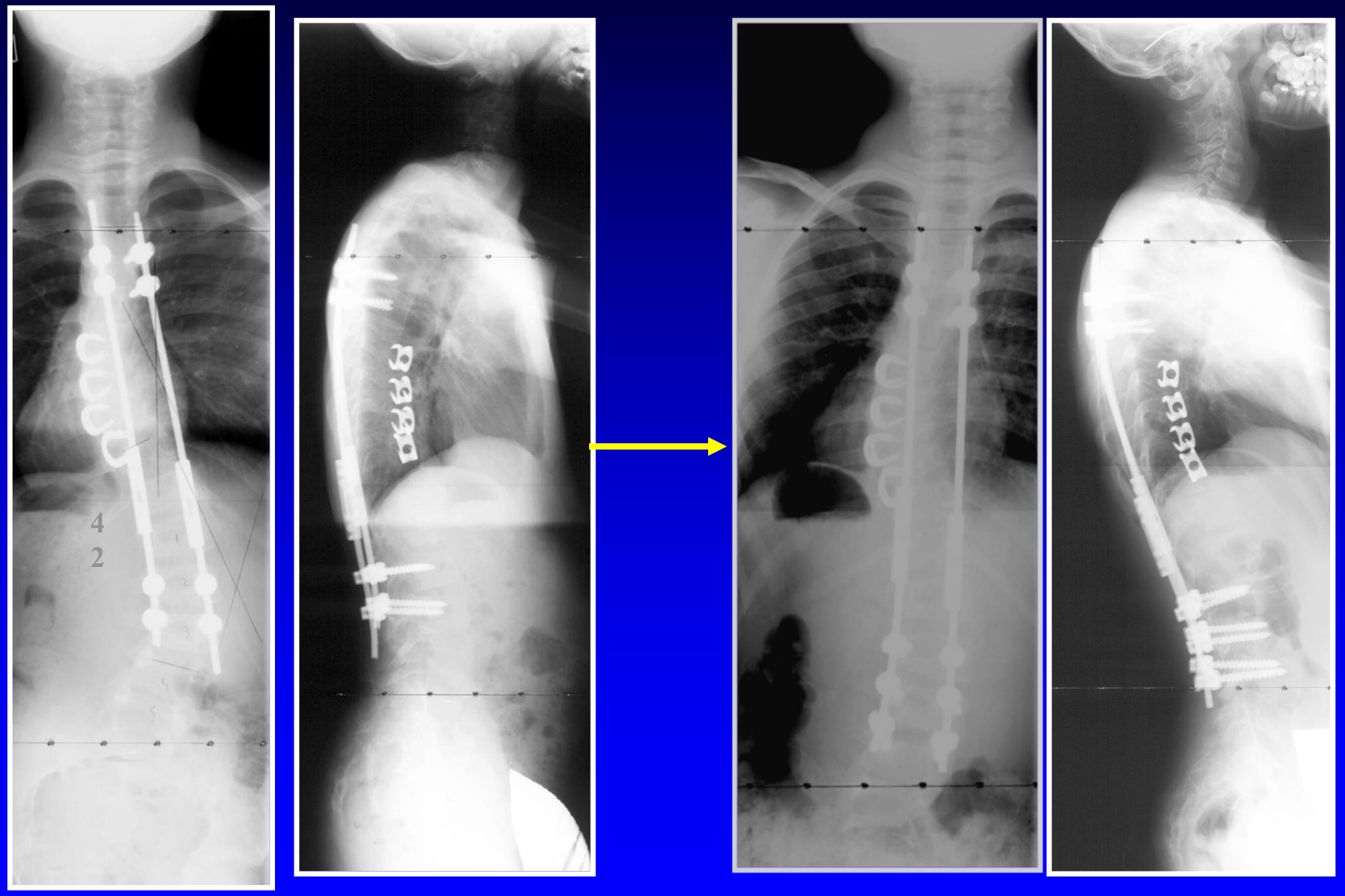


5/12/08 – Pre-op



6/27/08 – Post-op

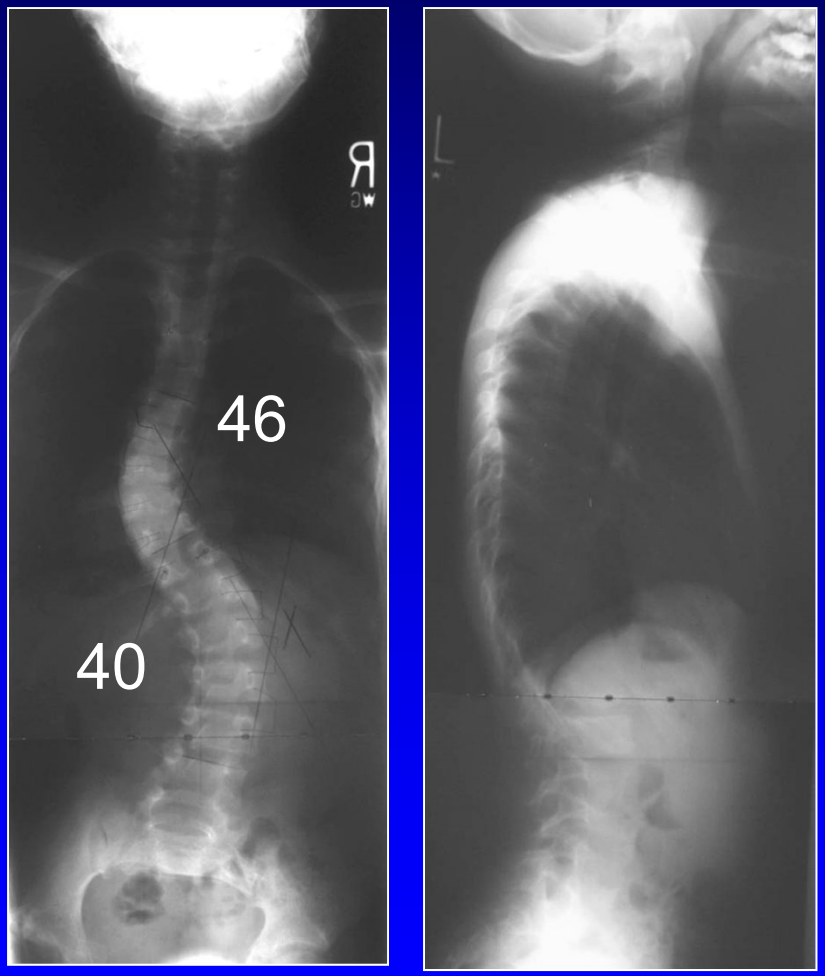
# Patient JR: Extension of Lumbar Fixation to L4

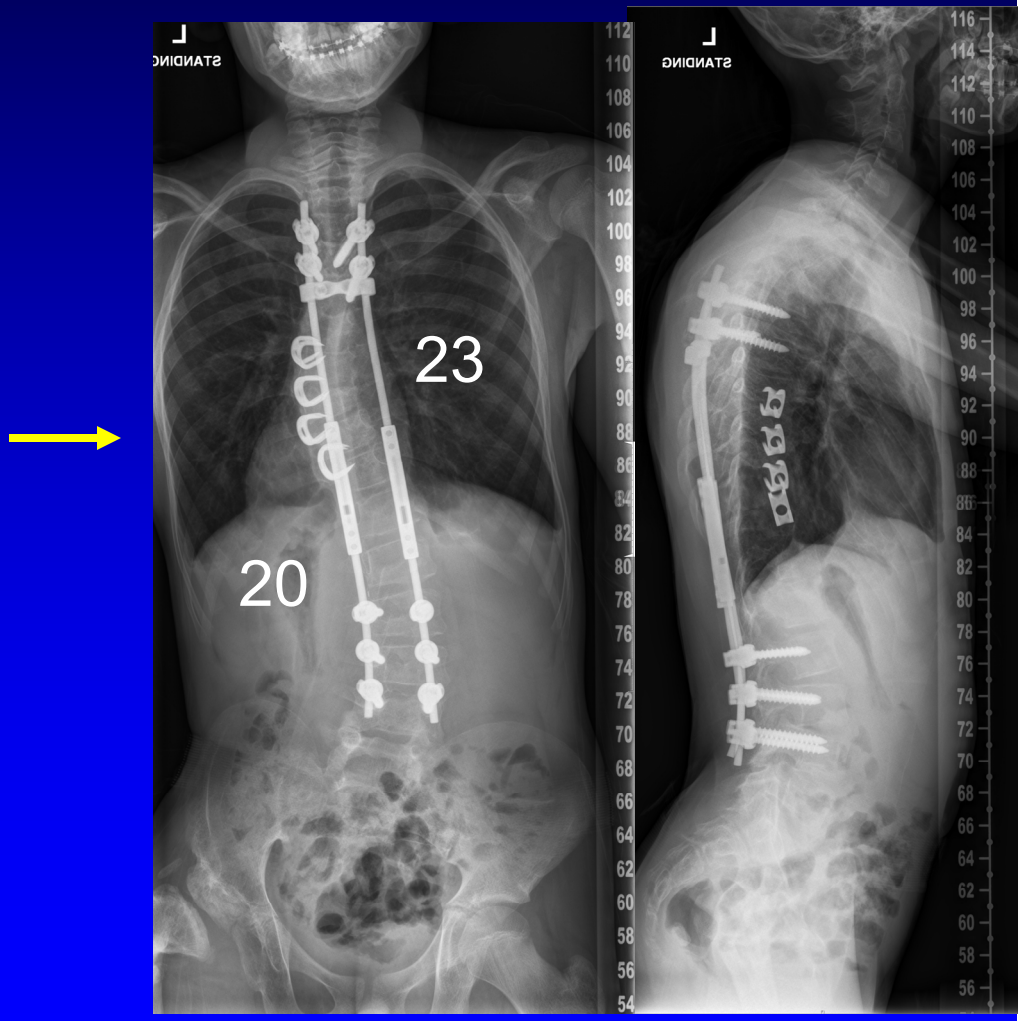


2/19/09 – Pre-op

4/23/09 – Post-op

# Patient JR: Most Recent Lengthening




10/14/2010 – Post-op

# Patient JR: These Days…

# “Hybrid Technique”

- Consider only at cases which would otherwise likely go to fusion
- Are results better than either distraction or anterior stapling alone ?

- What do we do with patient and construct at skeletal maturity? – “growth rod graduate”

# Thank You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