Idiopathic Scoliosis: Screening, Diagnosis, and Treatment

Grant Hogue, MD

Division Chief Pediatric Orthopaedics and Spine Deformity

Dielmann Endowed Chair in Pediatric Orthopaedics

Conflicts/Bias

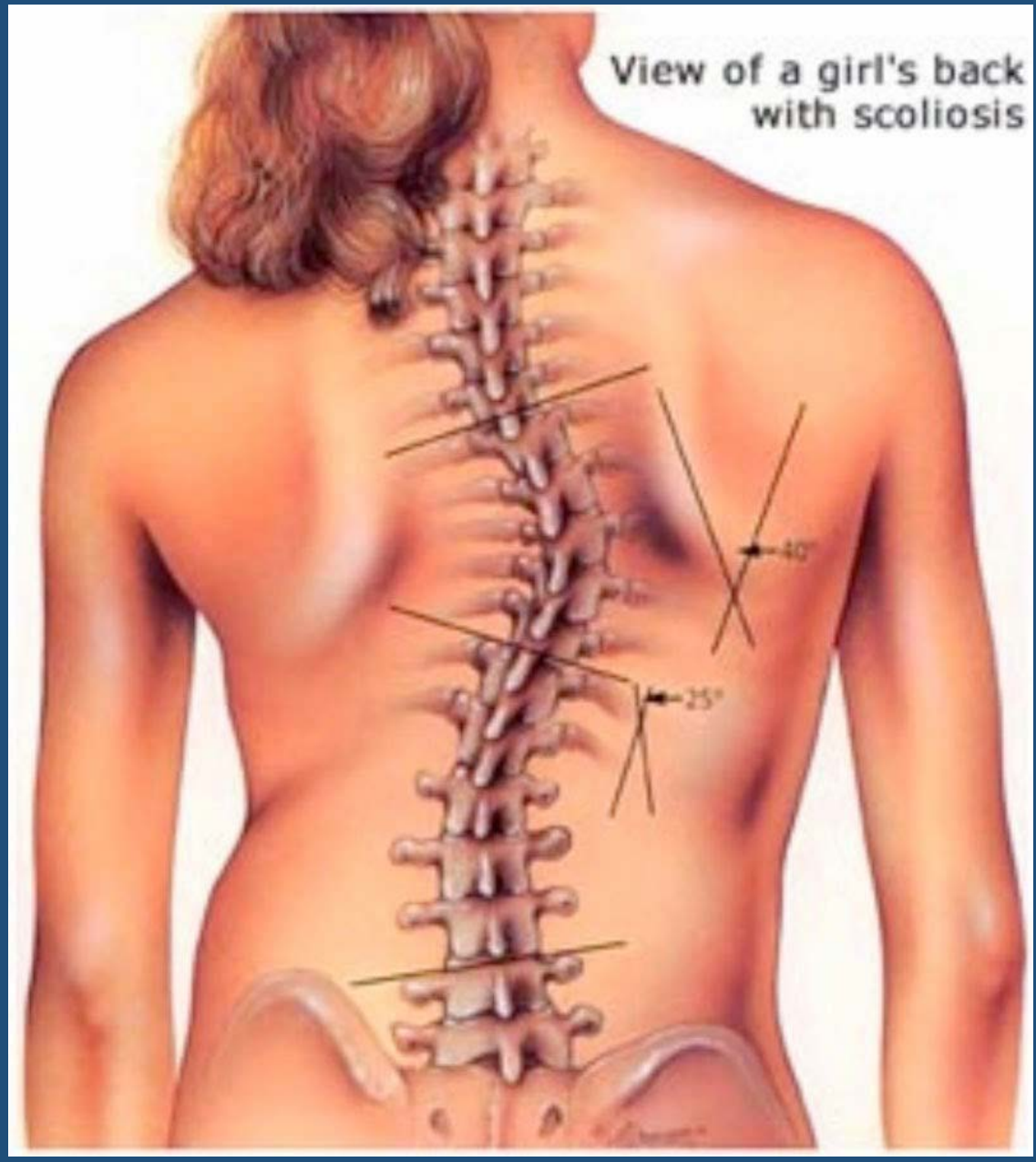
- Owner and founding board member of the *Tether Implant Corporation*
- Member of the Scoliosis Research Society
- Author: *Orthopaedic Surgery Essentials Spine: Adolescent Scoliosis and Kyphosis*

Goals

- Define Scoliosis
- Discuss Texas Spinal Screening Program
- Why should we screen? Does it matter?
- Diagnosis of scoliosis
- Treatment of scoliosis

Scoliosis

- Abnormal Curvature of the spine >10 deg as measured by the Cobb method



Scoliosis classification

- Adolescent idiopathic
  - No related medical issues
  - Curve onset after age 10
  - Most commonly:
    - Right thoracic curve
    - Female
- Don’t worry
  - Unless left thoracic

- Every other kind
  - Early-onset
    - <10 yo
    - Regardless of etiology
      - Idiopathic (infantile, juvenile)
      - Associated syndrome
  - Congenital
    - Malformed vertebral body/ribs
  - Neuromuscular
    - Associated neurologic or muscular disease
- Worry

Texas Screening Policy for 2018-19 School Year

- Girls will be screened two times, once at age 10 **(or fall semester of grade 5)** and again at age 12 **(or fall semester of grade 7).**
- Boys will be screened one time at age 13 or 14 **(or fall semester of grade 8).**

Who can conduct screening?

- Physicians
- PA
- NP
- RN
- PT
- Chiropractors
- Certified Screeners
  - Training and test required

SPINAL SCREENING PROGRAM PARENT NOTIFICATION AND REFERRAL

STUDENT: _____ BIRTH DATE: _____

ADDRESS: _____

SCHOOL: _____ SCHOOL TELEPHONE: _____

Dear Parent/Guardian:

Recently our school screened your child for spinal problems.

Your child's screening shows that he or she has signs of a possible spinal problem. It is important for you to have your child's spine checked by a doctor.

Catching a spinal problem early can make the treatment much easier. Not treating spinal problems can lead to serious health problems.

Please take your child to the doctor as soon as possible. Bring this form with you when you go and ask the doctor to fill it out. After your child sees a doctor, please return this form to school. Please let us know if you have questions or cannot pay for a doctor.

Thank you for your cooperation: _____

School Screening Findings:

L	R		L	R	
☐	☐	High shoulder	☐	☐	Rib hump
☐	☐	Shoulder blade stands out more than the other	☐	☐	Obvious curve of spine in lower back
☐	☐	Obvious curve of the spine in area of rib cage	☐	☐	Hip higher than the other side
				☐	Round back

Other: _____

School Screener's Name & Title: _____ Date: _____

Professional Examination Report:

Diagnosis: _____

Recommendations:

☐ No Treatment ☐ Treatment:

- ☐ Observation
- ☐ Brace
- ☐ Surgery
- ☐ Other (please describe): _____
- ☐ Referral (please describe): _____

Activity Limitation (if any, please describe): _____

Additional Comments: _____

Return Appointment: ☐ No ☐ Yes – Return Date: _____

_____ _____

Doctor's signature or hand stamp **Date**

Doctor's Mailing Address/Phone: _____

For school use:

This form completed and received by school (name/date): _____

This form not returned to school (reason): _____

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Other: _____

School Screener's Name & Title: _____ Date: _____

Professional Examination Report:

Diagnosis: _____

Recommendations:

☐ No Treatment ☐ Treatment:

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This form not returned to school (reason): _____

How to screen

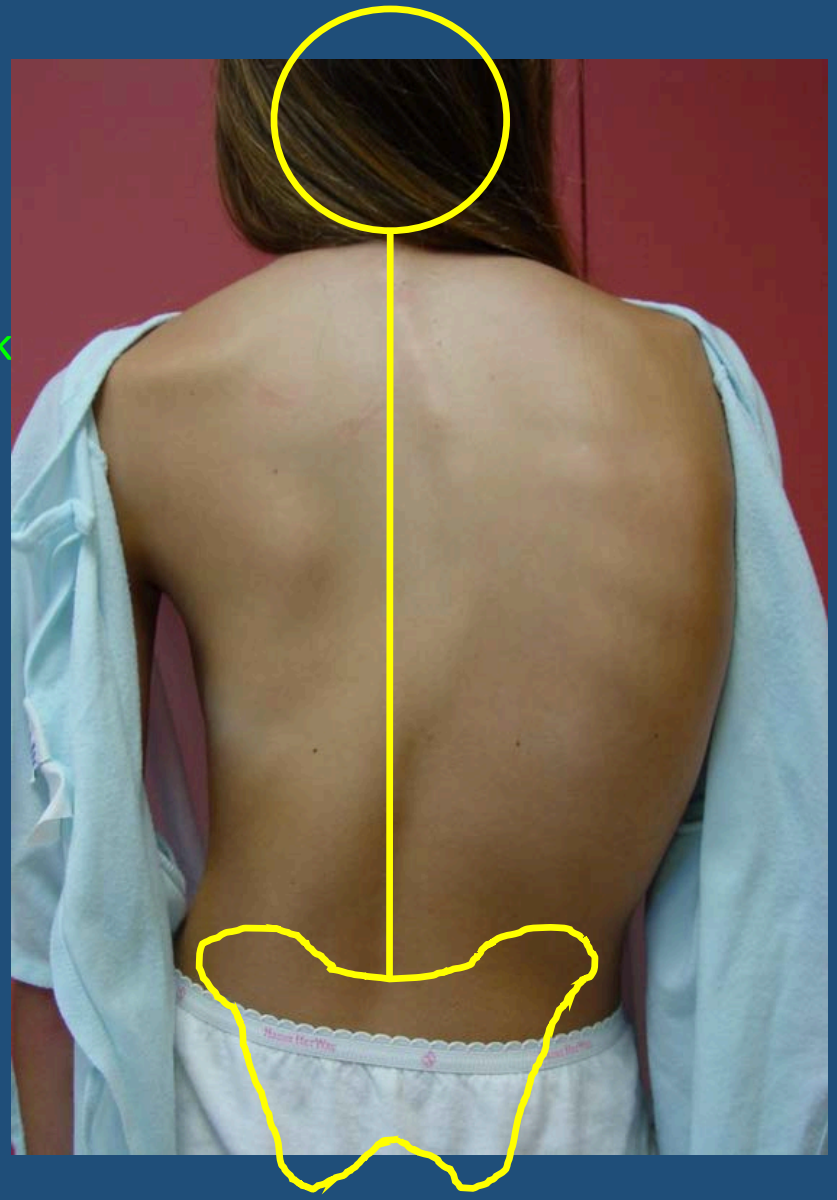
Scoliometer App

For iphone and Android

Monitor your child's scoliosis at home with your smart phone with this $1 Scolimeter phone app download

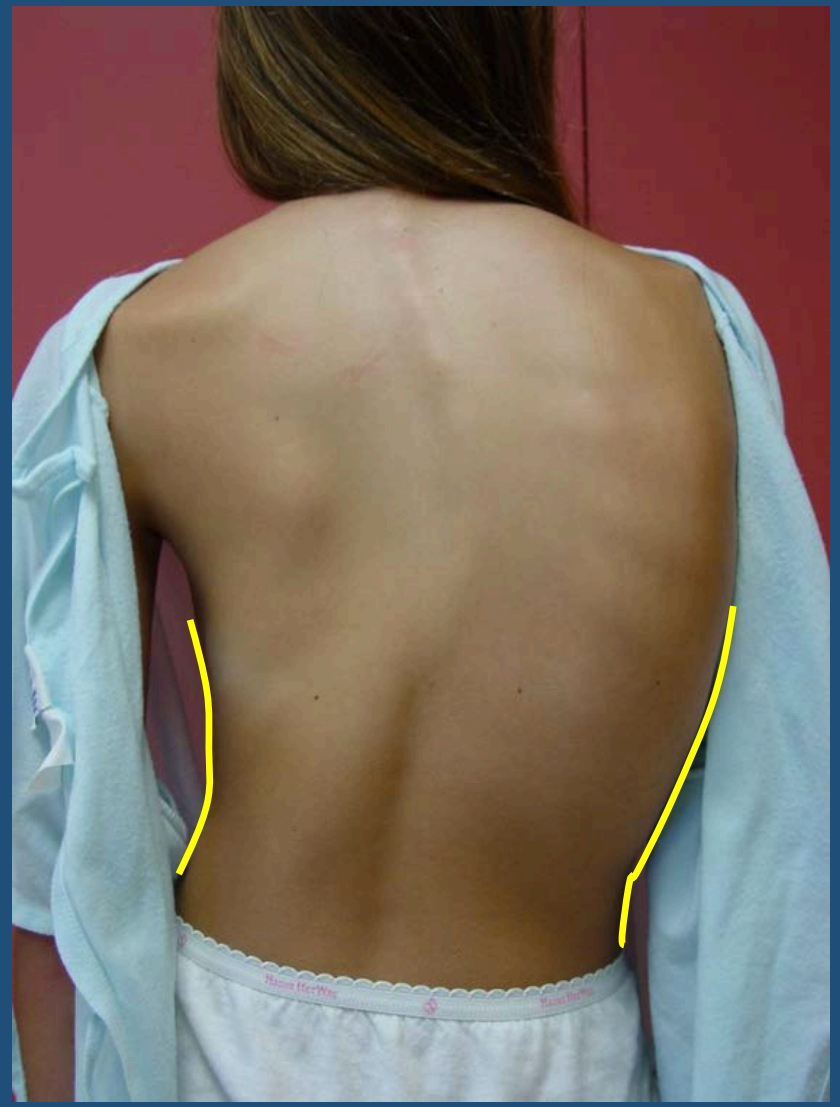
My exam

- Spine exam:
  - Global appearance
    - Head position over pelvis (trunk



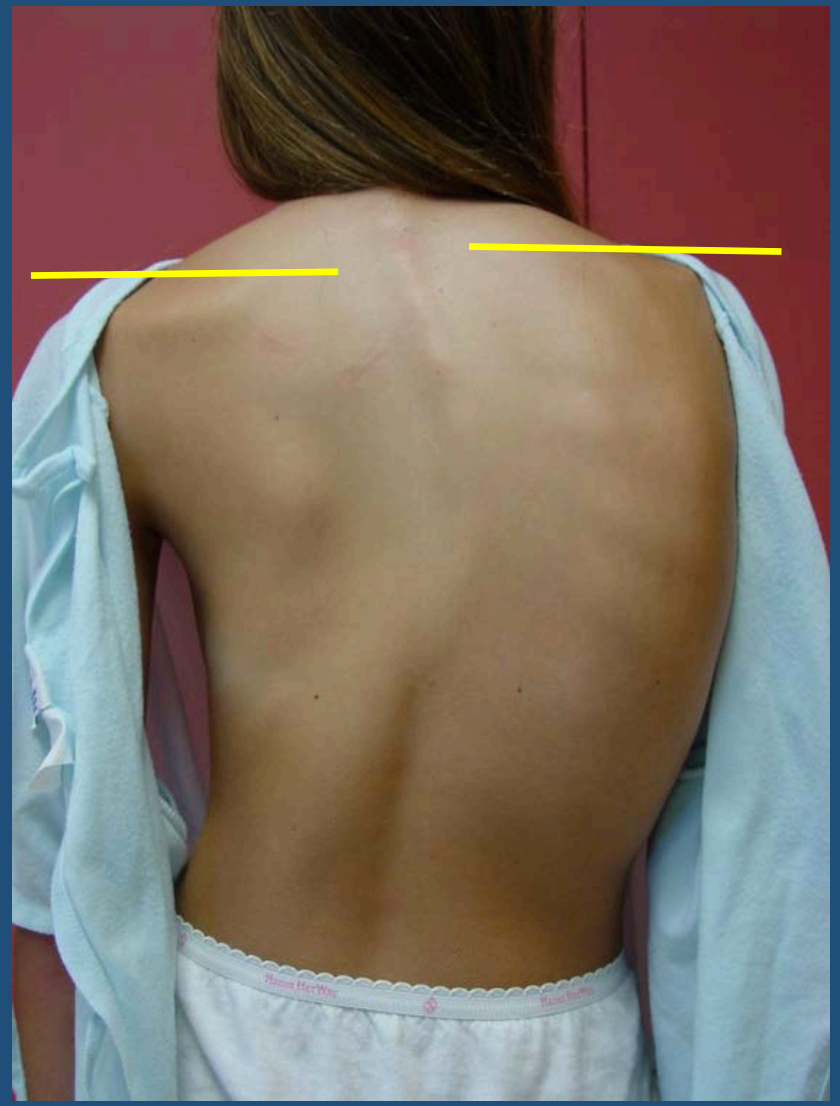
My exam

- Spine exam:
  - Global appearance
    - Head position over pelvis (trunk shift)
    - Waist symmetry



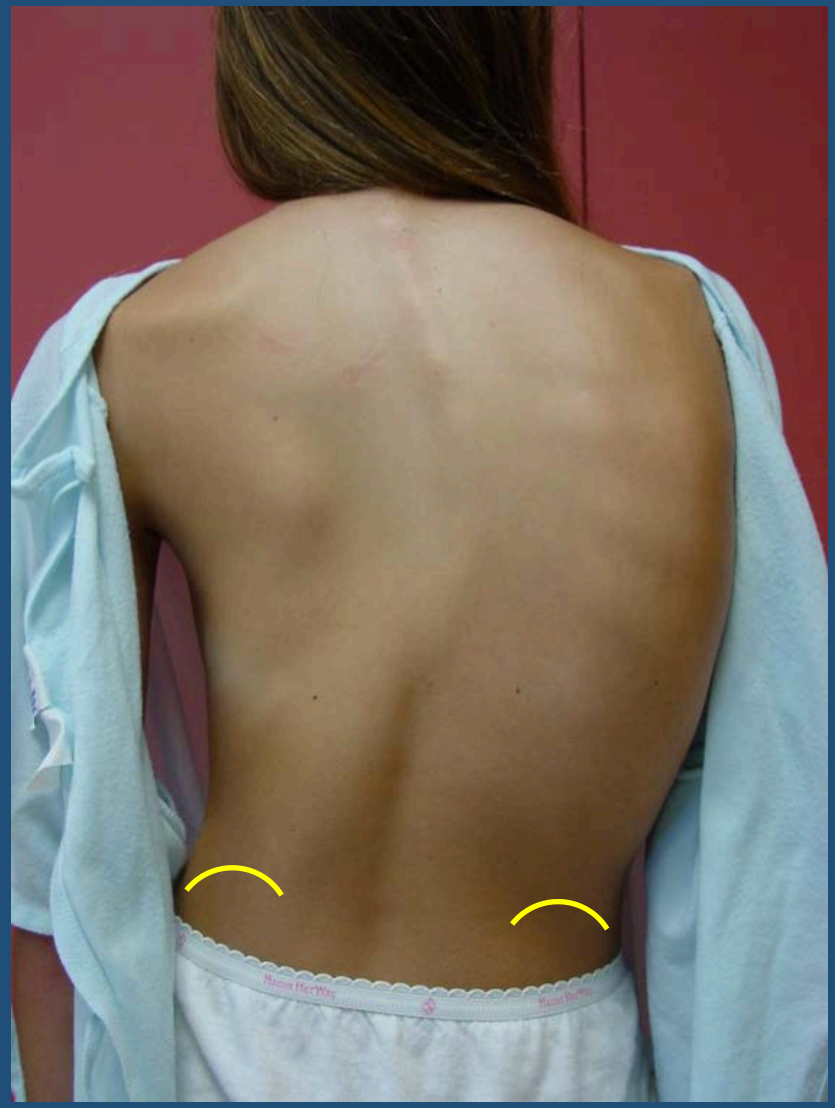
My exam

- Spine exam:
  - Global appearance
    - Head position over pelvis (trunk shift)
    - Waist symmetry
    - Shoulder height



My exam

- Spine exam:
  - Global appearance
    - Head position over pelvis (trunk shift)
    - Waist symmetry
    - Shoulder height
    - Iliac crest height



My exam

- Spine exam:
  - Global appearance
    - Head position over pelvis (trunk shift)
    - Waist symmetry
    - Shoulder height
    - Iliac crest height
    - Curve pattern
      - Apex of curve designates the side

My exam

- Spine exam:
  - Global appearance
    - Head position over pelvis (trunk shift)
    - Waist symmetry
    - Shoulder height
    - Iliac crest height
    - Curve pattern
  - Forward bend – rotational prominence of the ribs

Examination

- Adam’s Forward Bend
- Scoliometer is your best friend
- Scoliometer app on phone shown in studies to be equally effective

The Scoliometer – What does it mean?

- Measure axial rotation in the spine

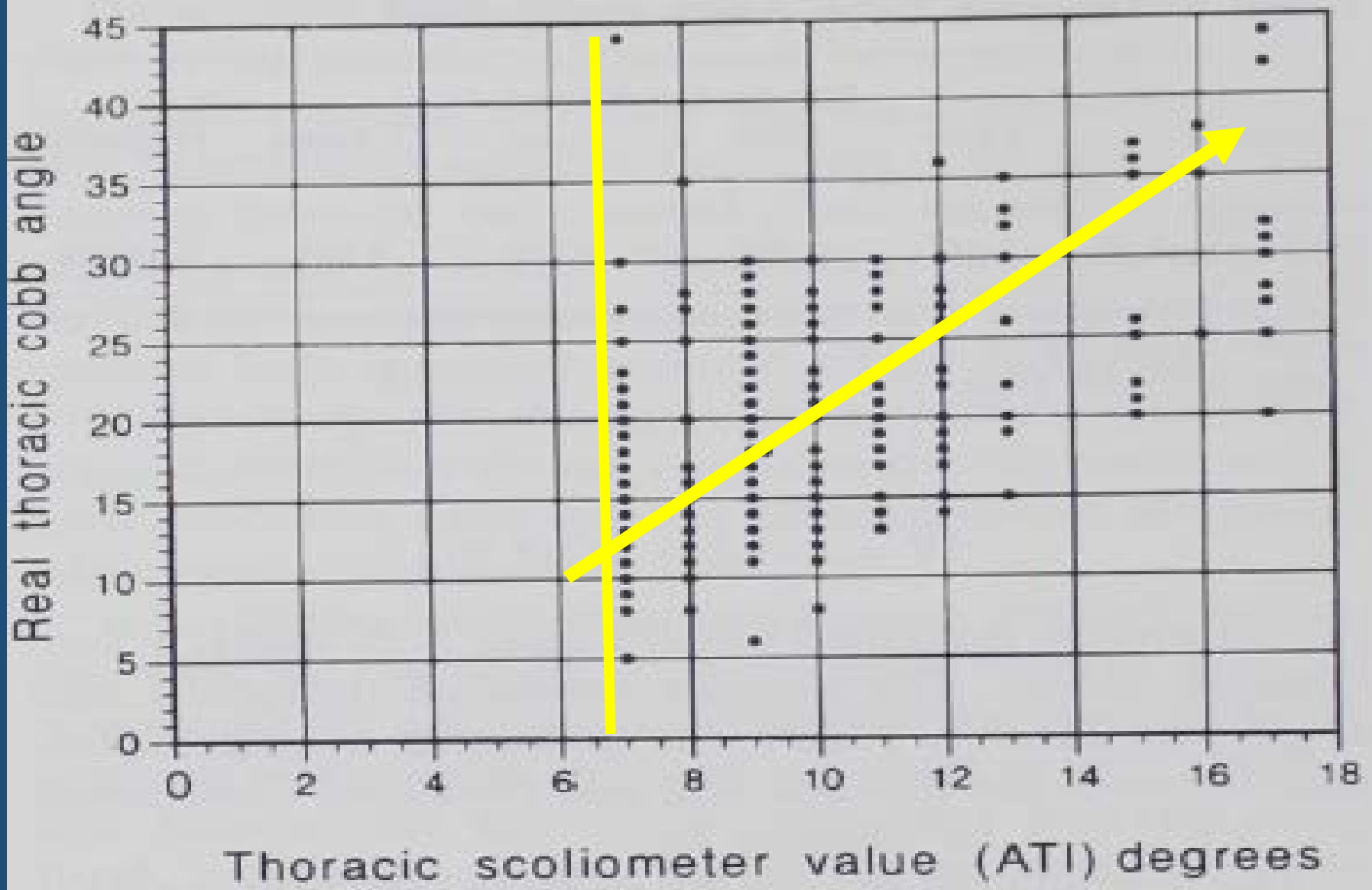


Figure 3. Plot of the thoracic scoliometer value against the real thoracic scoliotic Cobb angle. Note that there are only 17 real Cobb values under 10° corresponding to scoliometer values of at least 7°.

WHO gets scoliosis?

- Adolescent Idiopathic --- just don’t know. These tend to be **flexible females**
- There is a genetic/hereditary component
  - Make sure to get good family history
  - Siblings need to be observed closely

Why should we screen? Should we at all?

Does School Screening Affect Scoliosis Curve Magnitude at Presentation to a Pediatric Orthopedic Clinic?

Joshua J. Thomas, BS, Anthony A. Stans, MD, Todd A. Milbrandt, MD, MS, Vickie M. Treder, LPN, CCRP, Hilal Maradit Kremers, MD, William J. Shaughnessy, MD, A. Noelle Larson, MD*

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- Stopped screening
- Fewer xrays and evaluations
- VERY homogenous group/almost all commercially insured

Positive screening

- Kid is in your office
- You examine the patient and agree with the screening
- XR?

What type of Xray is best?

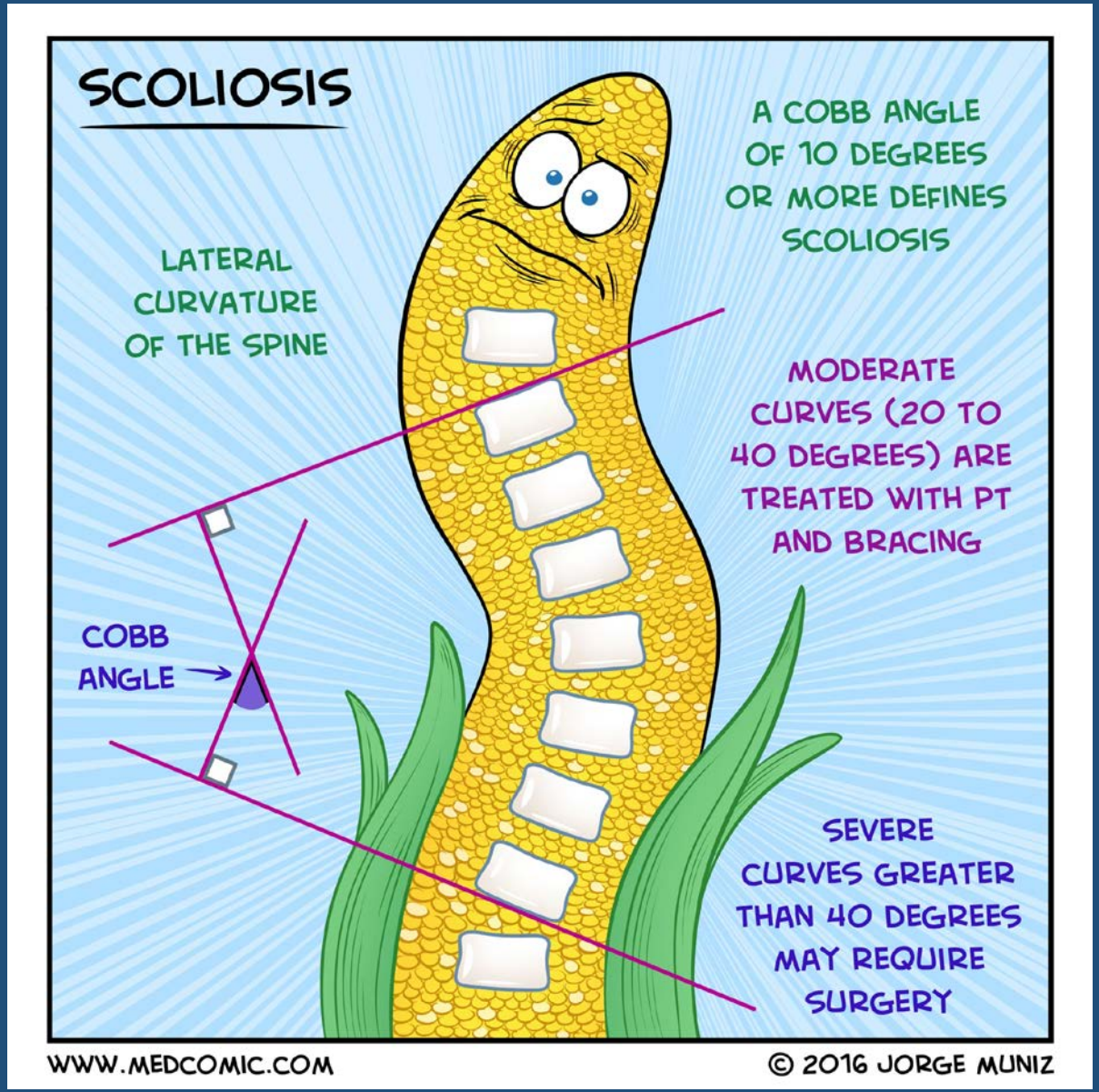
- What to order
  - T spine, L spine, Spine Series?
- Many imaging centers don’t have the ability to get the correct views, or stitch them together

What type of Xray is best?

- “long” 14x 36 inch films
- Visualize C,T,L spine as well as pelvis down to the triradiate cartilage

Cobb Angles: what's up?!?

- Measure out some angles!
- Cobb angle is from end vert to end vert
- >10 deg defined as scoliosis
- Intra-interobserver error of 3-5 deg



What else can we do to help with age on a spine xray?!?

Case Series

Two for One: A Change in Hand Positioning During Low-Dose Spinal Stereoradiography Allows for Concurrent, Reliable Sanders Skeletal Maturity Staging

Taylor J. Jackson, BA[a], Daniel Miller, MD[a], Susan Nelson, MD, MPH[a], Patrick J. Cahill, MD[a,b], John M. Flynn, MD[a,b,*]

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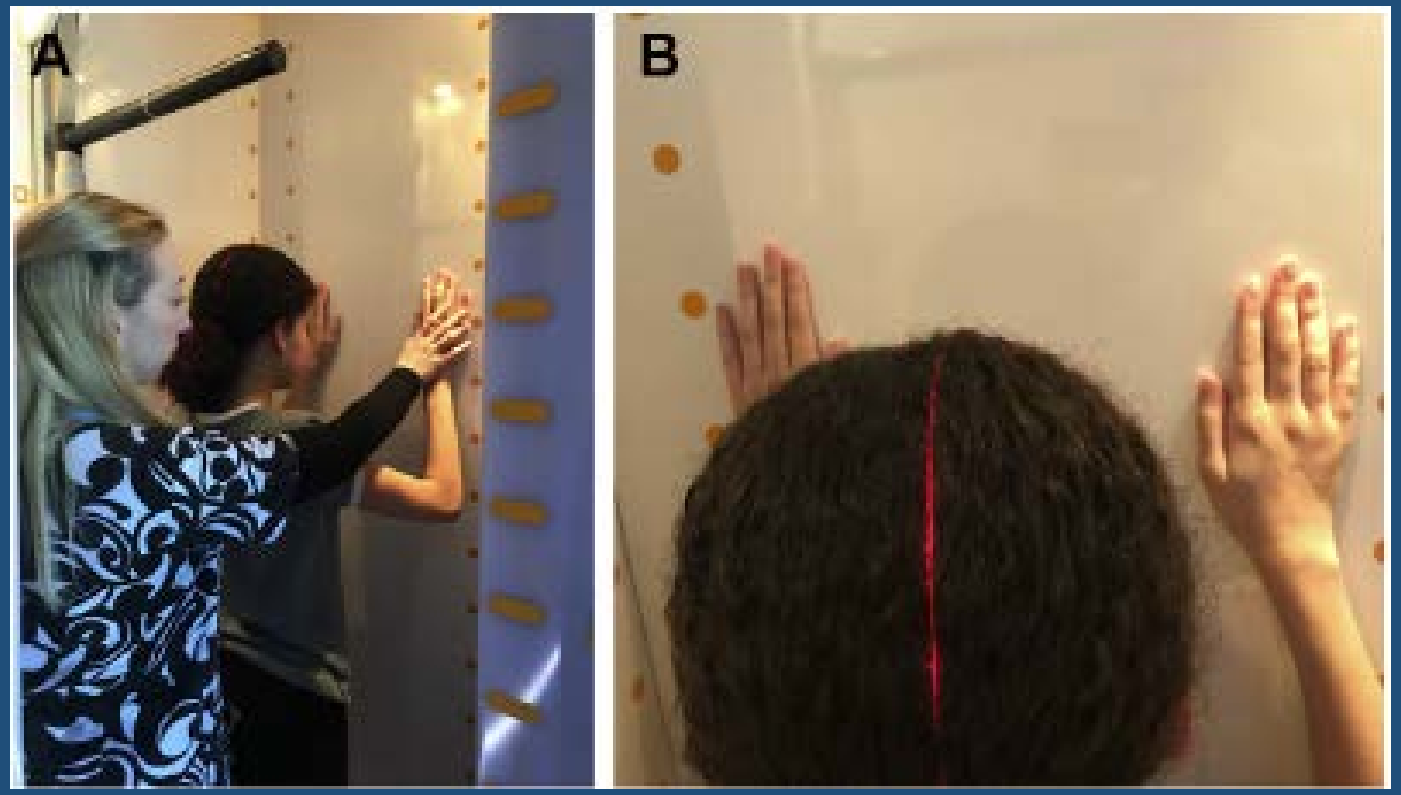
Something for nothing!

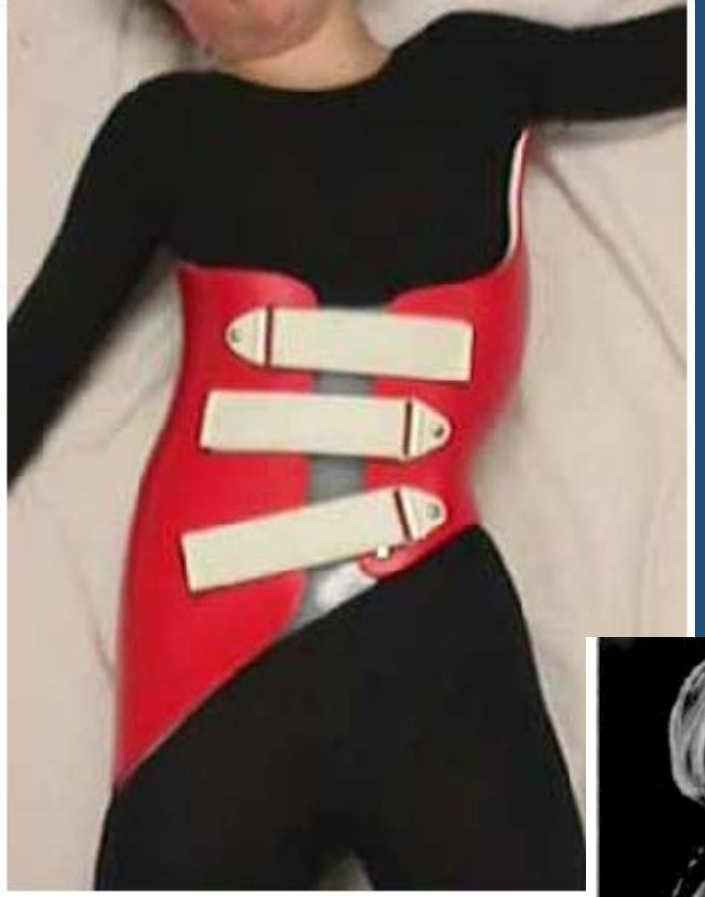
- By changing the hand position we can get a quick shot of the hands!
- Can do either bone age or Sanders classification to get better data on age and bone growth
- Cost to the patient?
  - $0

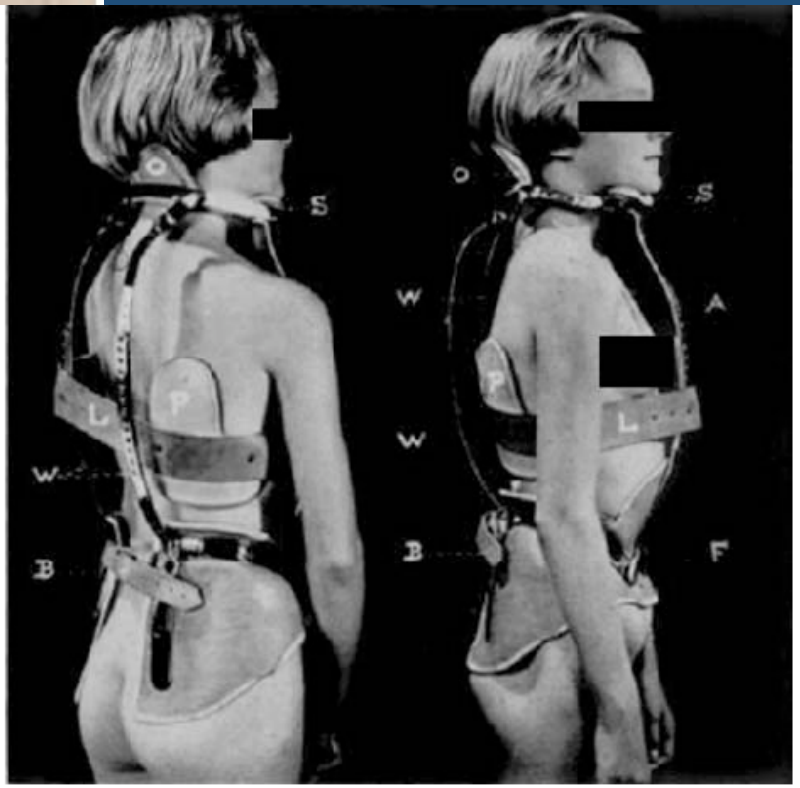


Scoliosis Treatment

- 0-25 deg → observation
- 25-45 → brace
- >45 → surgery

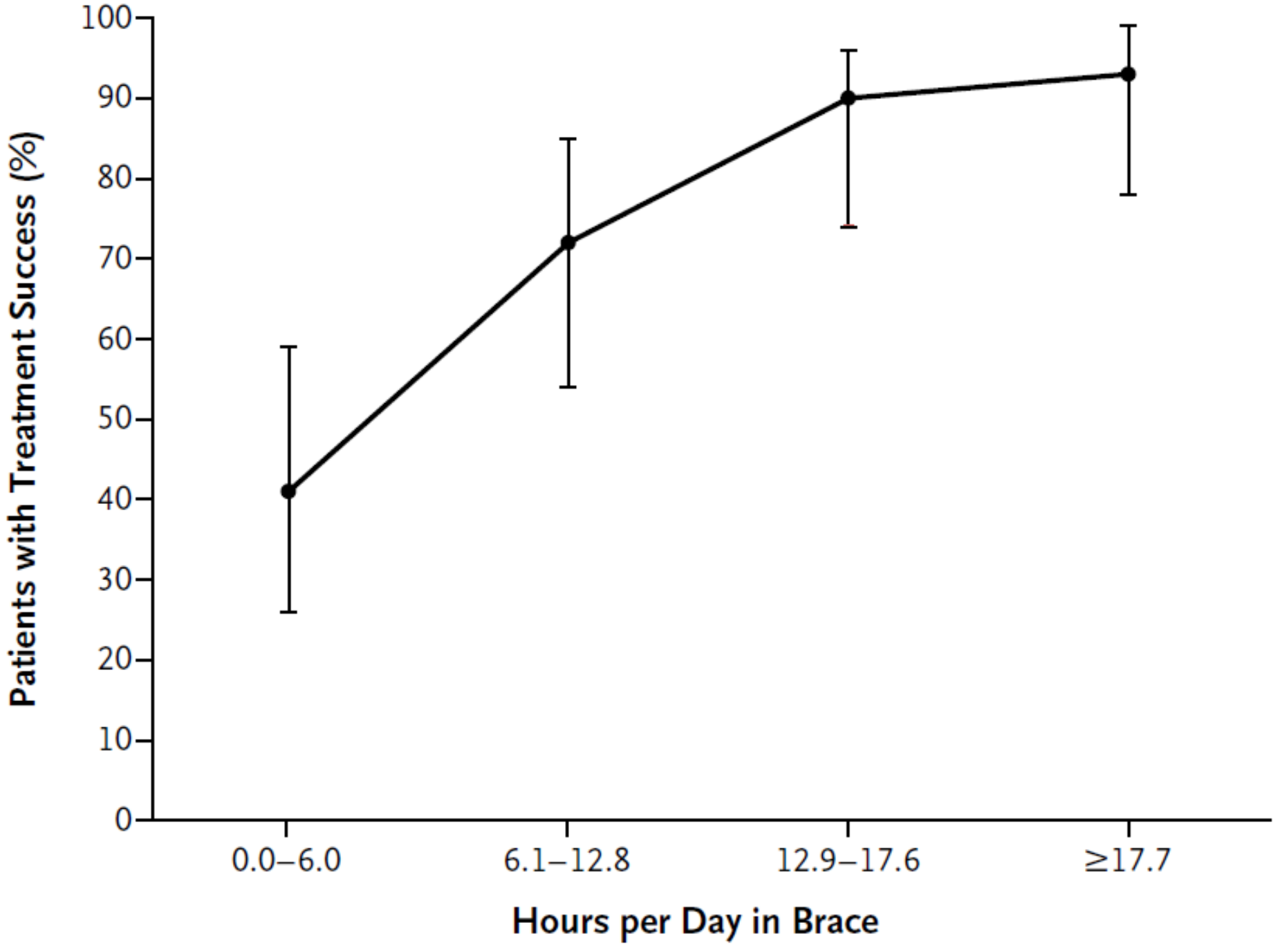
- MANY braces
  - Boston
  - Providence
  - Charleston
  - Milwaukee





Boston Brace

- TLSO style brace
- Full time brace. Day and night.


Patients with Treatment Success (%)
100
90
80
70
60
50
40
30
20
10
0
0.0–6.0
6.1–12.8
12.9–17.6
≥17.7
Hours per Day in Brace

Providence Brace

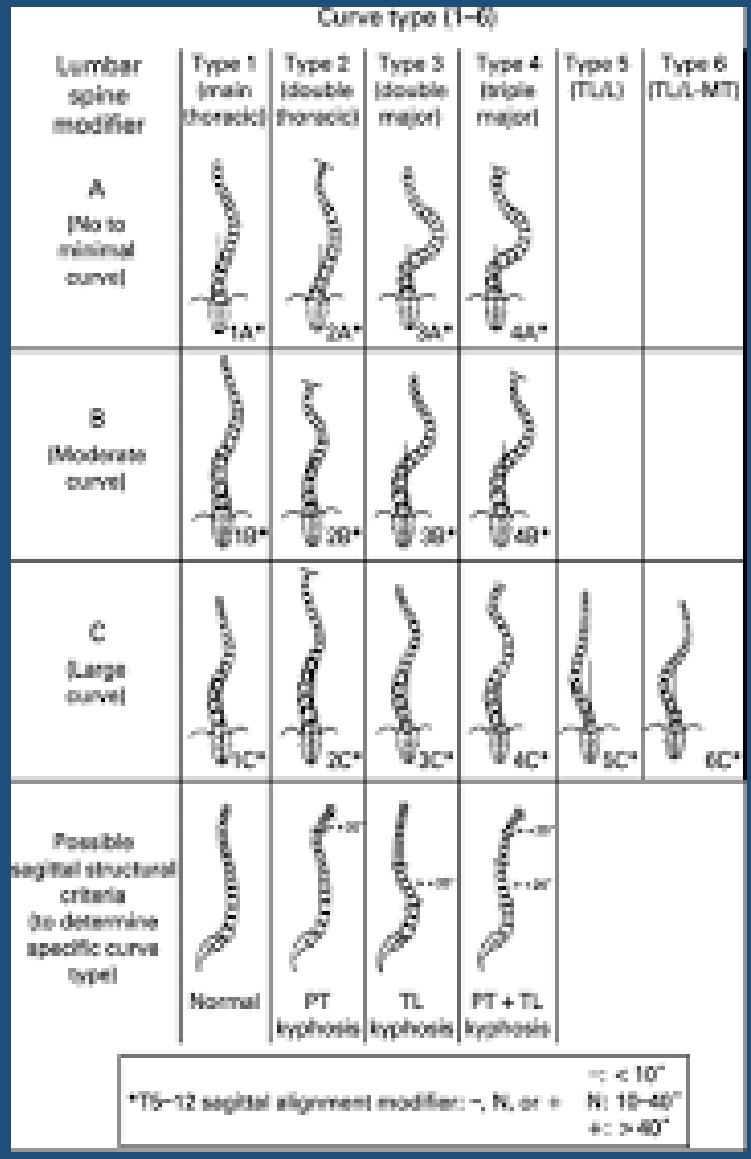
- Night brace
- Similar results to Boston Brace for curves with apex T7 and below

PA + Lateral + Benders = Ability to classify and plan

- Classification system for AIS?

Lenke Classification

- 3 step system that leads to classification and assists in presurgical planning
- Step 1
  - ID the primary curve and minor curves. Determine if structural.
- Step 2
  - Assignment of lumbar modifier
- Step 3
  - Assignment of sagittal thoracic modifier



CURVE TYPE

Type	Proximal Thoracic	Main Thoracic	Thoracolumbar/Lumbar	Description
1	Non-Structural	Structural (Major)*	Non-Structural	Main Thoracic (MT)
2	Structural	Structural (Major)*	Non-Structural	Double Thoracic (DT)
3	Non-Structural	Structural (Major)*	Structural	Double Major (DM)
4	Structural	Structural (Major)*	Structural (Major)*	Triple Major (TM)§
5	Non-Structural	Non-Structural	Structural (Major)*	Thoracolumbar/Lumbar (TL/L)
6	Non-Structural	Structural	Structural (Major)*	Thoracolumbar/Lumbar-Main Thoracic (TL/L-MT)

STRUCTURAL CRITERIA
(Minor Curves)

Proximal Thoracic
- Side Bending Cobb ≥ 25°
- T2-T5 Kyphosis ≥ +20°

Main Thoracic
- Side Bending Cobb ≥ 25°
- T10-L2 Kyphosis ≥ +20°

Thoracolumbar/Lumbar
- Side Bending Cobb ≥ 25°
- T10-L2 Kyphosis ≥ +20°

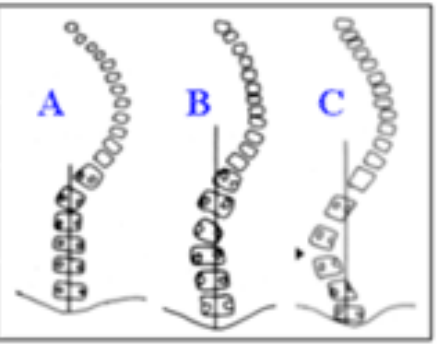
*Major = Largest Cobb measurement, always structural
Minor = All other curves with structural criteria applied
§Type 4 - MT or TL/L can be major curve

LOCATION OF APEX
(SRS Definition)

CURVE	APEX
Thoracic	T2-T11/12 Disc
Thoracolumbar	T12-L1
Thoracolumbar/Lumbar	L1/2 Disc-L4

Modifiers

Lumbar Spine Modifier	CSVL to Lumbar Apex
A	CSVL between pedicles
B	CSVL touches apical body(ies)
C	CSVL completely medial

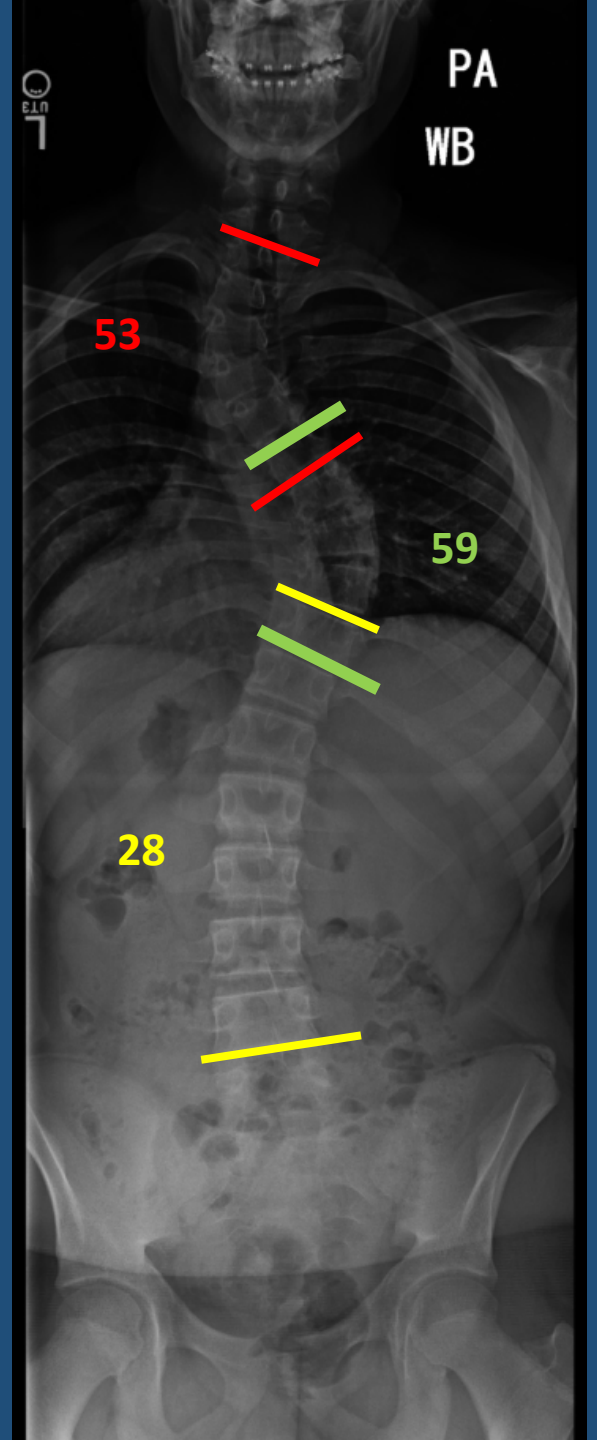


Thoracic Sagittal Profile T5-T12	
- (Hypo)	< 10°
N (Normal)	10° - 40°
+ (Hyper)	> 40°

Curve Type (1-6) + Lumbar Spine Modifier (A, B, C) + Thoracic Sagittal Modifier (-, N, +)
Classification (e.g. 1B+): _____

Step 1 ID Primary and Compensatory Curves

- Find End Verts and make Cobb Measurements
- Which curve is primary?
  - The biggest one



Step 1 ID Primary and Compensatory Curves

- Determination of a "structural curve"
  - What does that mean?
- Use bend films
  - What degree matters
  - **25 degrees**

STRUCTURAL CRITERIA
(Minor Curves)

Proximal Thoracic	- Side Bending Cobb ≥ 25° - T2-T5 Kyphosis ≥ +20°
Main Thoracic	- Side Bending Cobb ≥ 25° - T10-L2 Kyphosis ≥ +20°
Thoracolumbar/Lumbar	- Side Bending Cobb ≥ 25° - T10-L2 Kyphosis ≥ +20°

Step 1 ID Primary and Compensatory Curves

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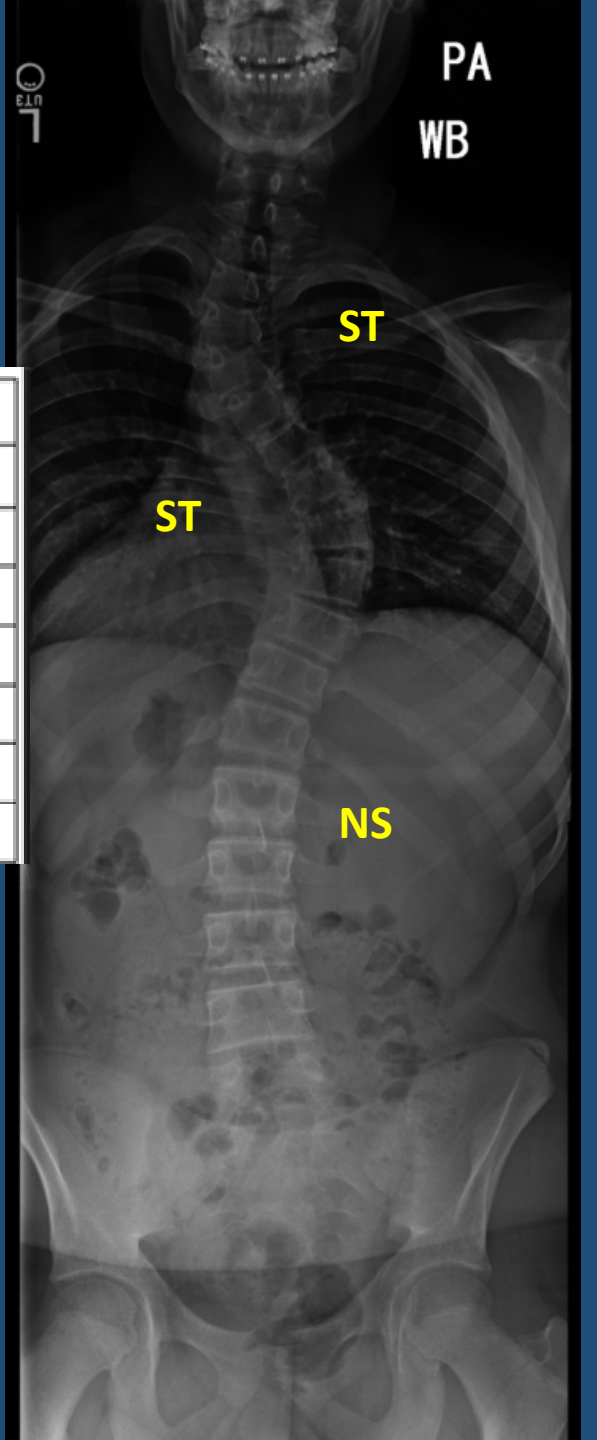
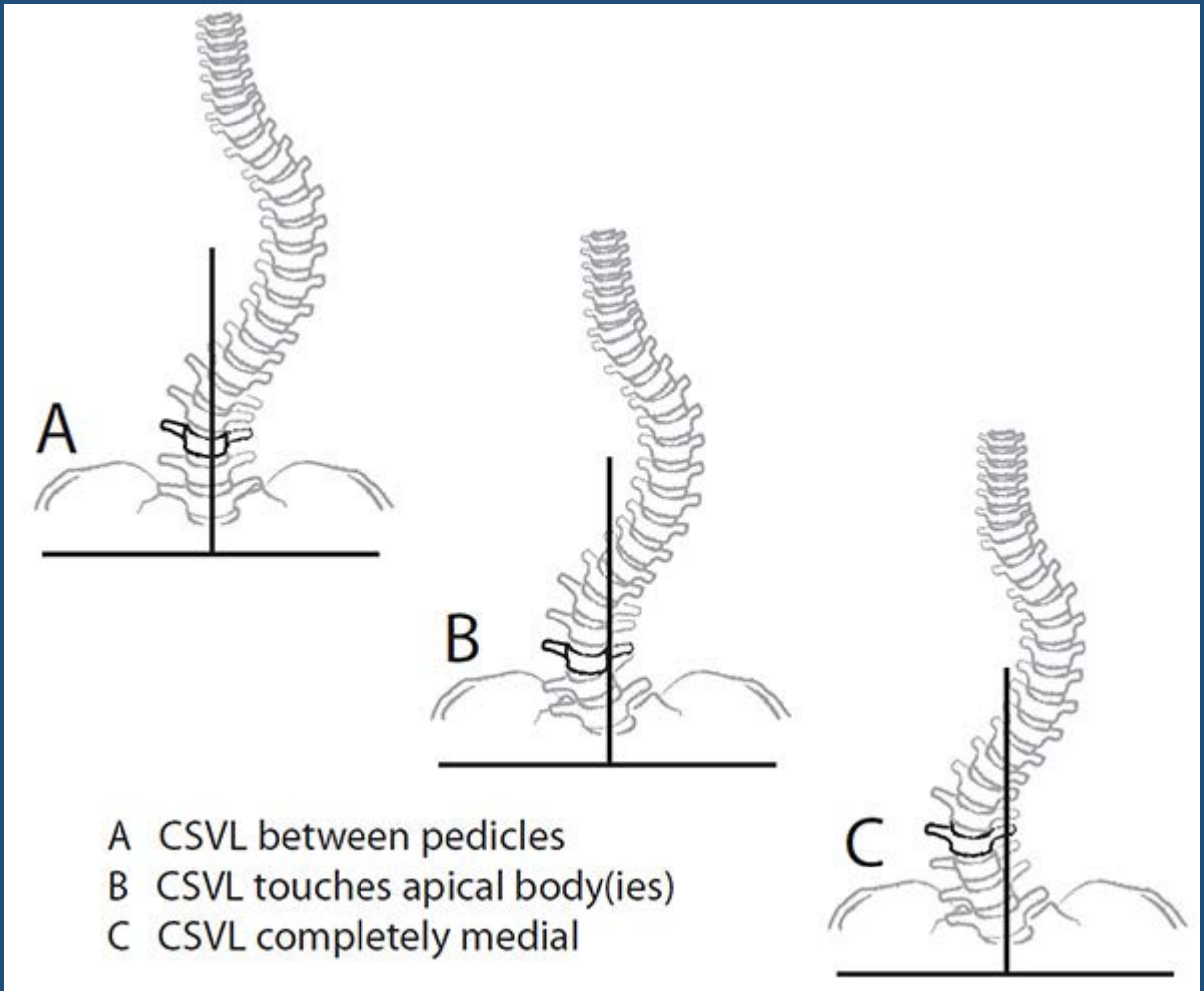
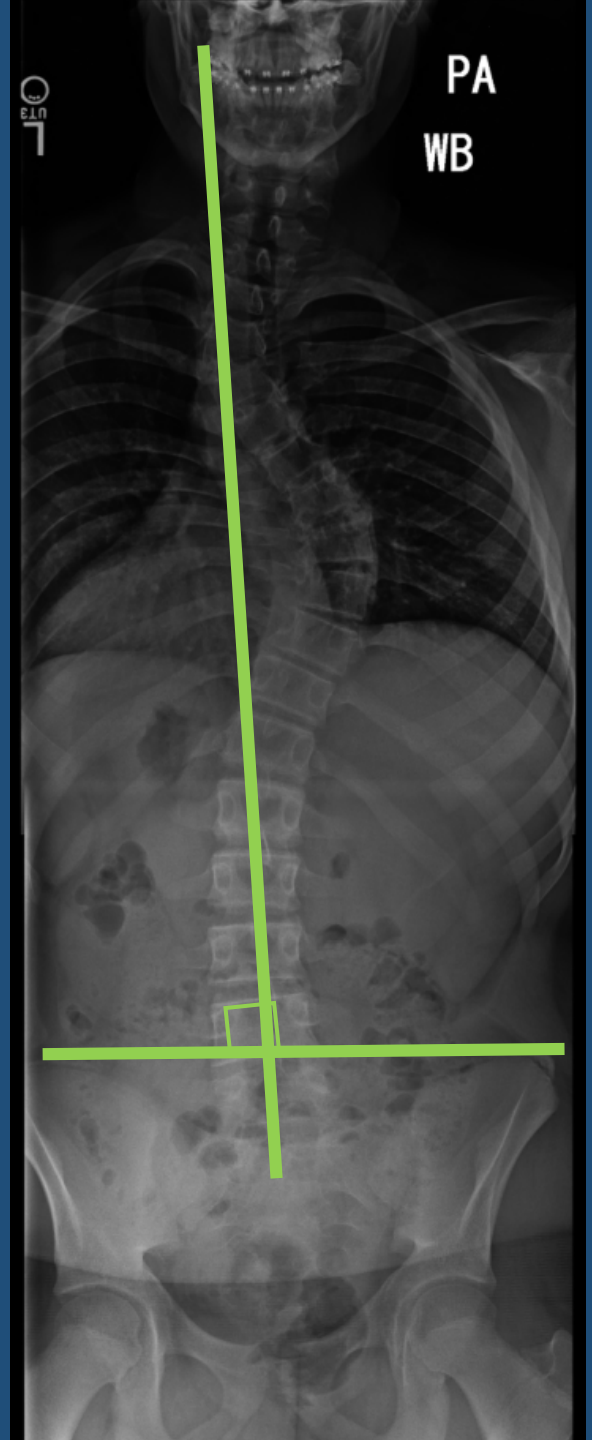
- What type of curve do we have?
- Step 1 now completed



Step 2: Lumbar Modifier

- Make a CSVL
- What's this kid?





Step 1 and 2 complete

- So far he's a Lenke 2A (double thoracic)

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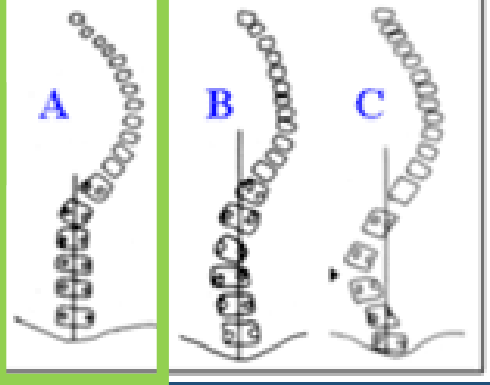

Step 3: Sagittal Thoracic Modifier

- Lenke 2A N

Thoracic Sagittal Profile T5-T12	
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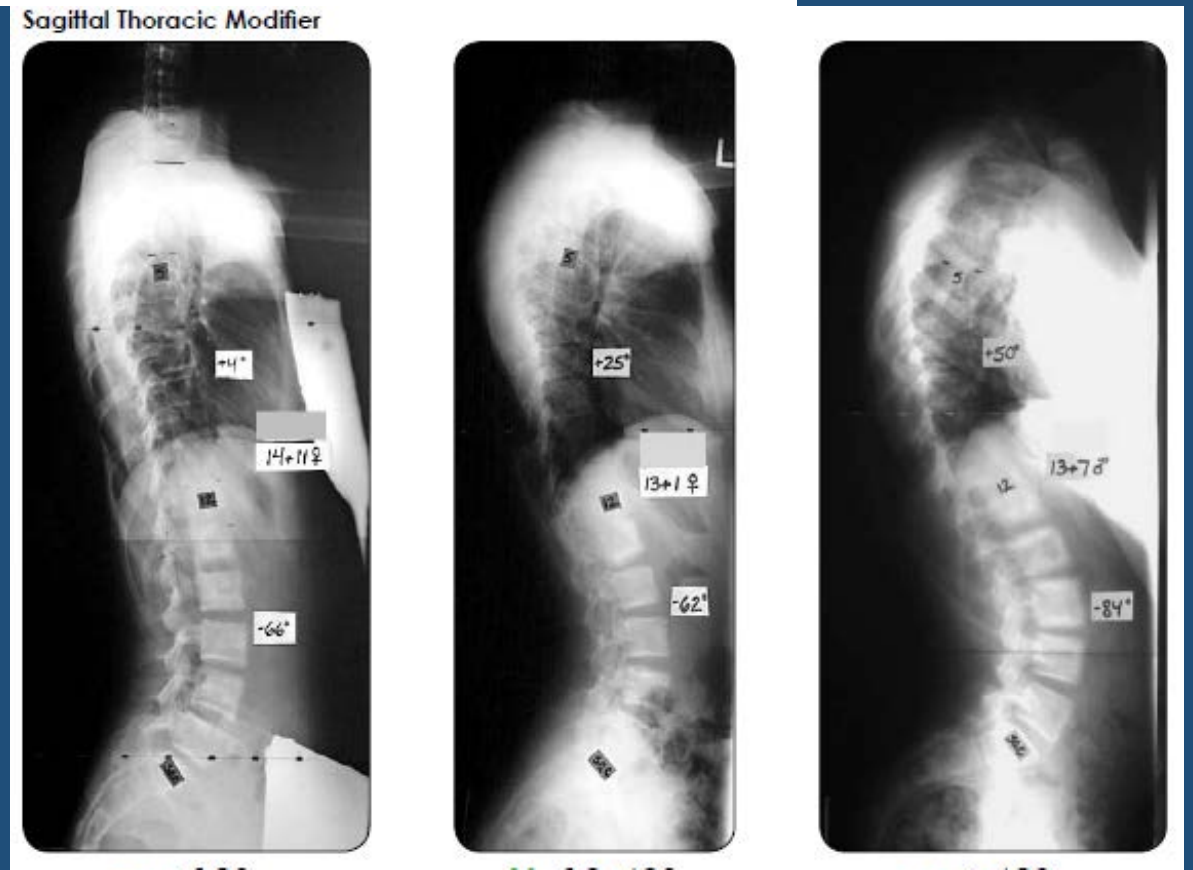
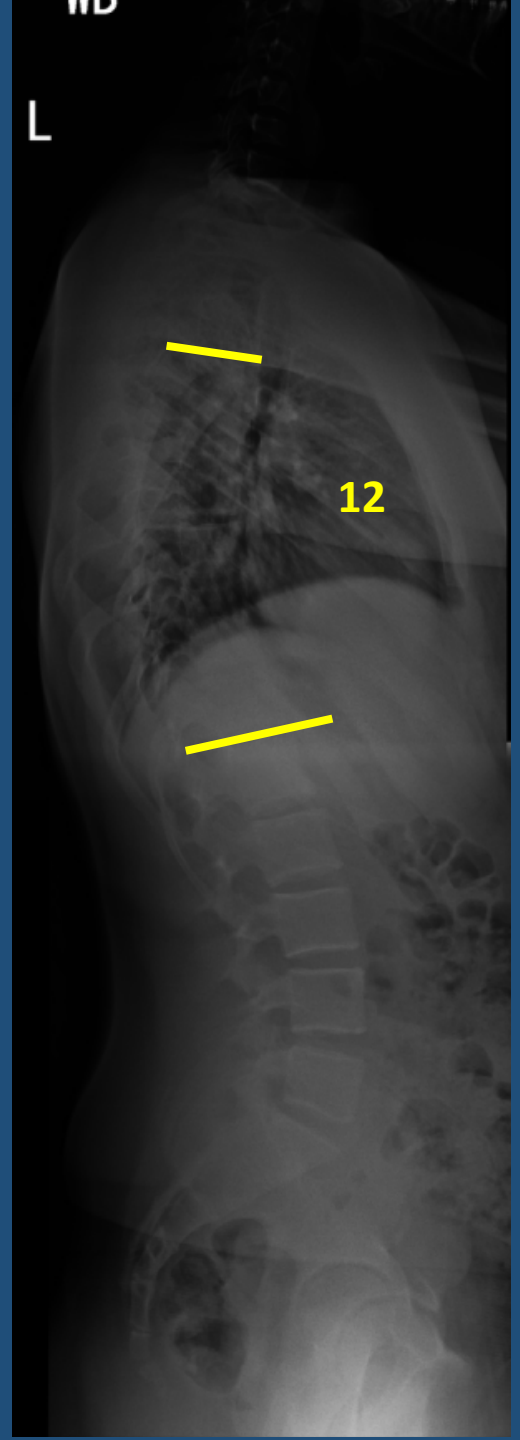
+ (Hyper)	>+40°





Step 3: Sagittal Thoracic Modifier

- Caveat
- We are now learning with different imaging techniques that most of these patients have even less thoracic kyphosis than what we see on the plane films.
- Keep this in mind

Presurgical Planning

- Lenke 2A N
  - Double thoracic curve
- Which curves to work on?
  - Upper thoracic curve?
  - Main thoracic curve?
  - Lumbar curve?
- Final answer?


PA
WT BEARING


PA
WT BEARING


L
WB


WT BEARING
L
UT3
PA


PA
R
UT2
STANDING


STANDING
R
UT2

Thank you!

- Clinic 210-450-9300
- Mobile 404-550-7811

UT Health San Antonio Pediatric Orthopaedics