AOSPINE EUROPE

AOSpine Advances Symposium
Spinal Deformity

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Shoulder imbalance—risk factors, how to analyze, how to avoid

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Session: Adolescent idiopathic scoliosis

Consequences of Scoliosis

- Medical consequence
- Aesthetic consequence
  - Truncal shift
  - Waist-line assymetry
  - Rib hump
  - **Shoulder imbalance**

Vesalius (1514-1564)

What about the normal population?

Shoulders are not always level in the normal population

±10mm is cut-off

This imbalance does not lead to an asymmetrical body perception

Akel I et al, Eur Spine J, 17:348-54, 2008

Shoulder Imbalance

Main reason is decompensation of proximal thoracic curve

Lenke Classification

TABLE I Description of Curve Types

Curve Type	Description	Characteristic Curve Patterns*			Structural Region of Each Curve Type
		Proximal Thoracic	Main Thoracic	Thoracolumbar/ Lumbar	
→ 1	Main thoracic	Nonstructural	Structural (major)	Nonstructural	Main thoracic
2	Double thoracic	Structural	Structural (major)	Nonstructural	Proximal thoracic, main thoracic
→ 3	Double major	Nonstructural	Structural (major)	Structural	Main thoracic, thoracolumbar/lumbar
4	Triple major	Structural	Structural (major†)	Structural (major†)	Proximal thoracic, main thoracic, thoraco-lumbar/lumbar
5	Thoracolumbar/ lumbar	Nonstructural	Nonstructural	Structural (major)	Thoracolumbar/lumbar
6	Thoracolumbar/ lumbar-main thoracic	Nonstructural	Structural	Structural (major)	Thoracolumbar/lumbar, main thoracic

Lenke L et al, JBJS ,83A:1169-82

Is Lenke Criteria Valid for Defining Prox. Struc. Curve?

- n=37 with Lenke 1,3,5,6 (non structural prox. thoracic curves)
- Divided into two groups
  - Group1: Instrumentation including prox. thoracic curve
  - Group2: Instrumentation stops at T4 or lower

- Results: Isolated correction of the main thoracic curve resulted in spontaneous correction of the nonstructural PTC with rate of 41%

- Conclusion: Lenke structurality criteria can effectively determine which proximal thoracic curves need fusion and which curves do not

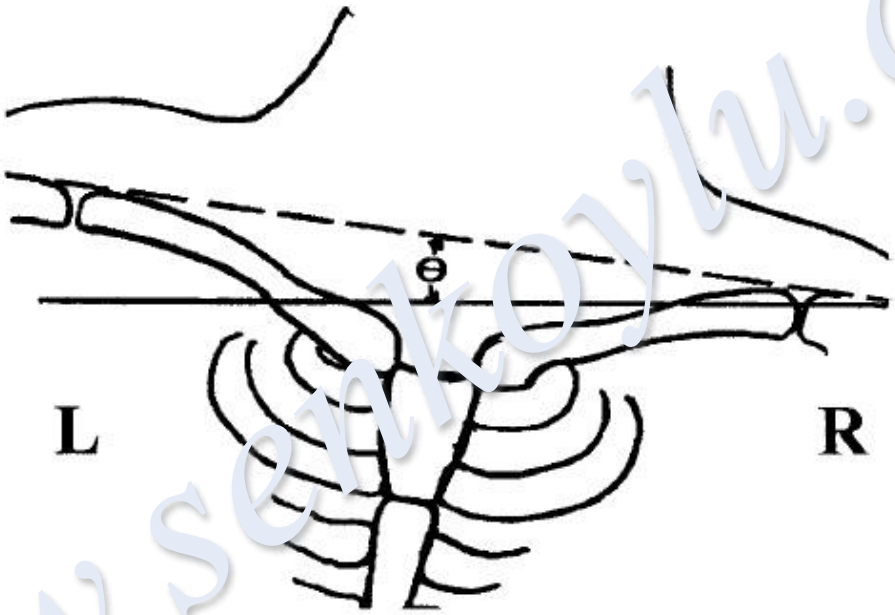
Cil A et al, Spine, 30:2550-5, 2005

Postoperative Left Shoulder Elevation in Lenke Type-1

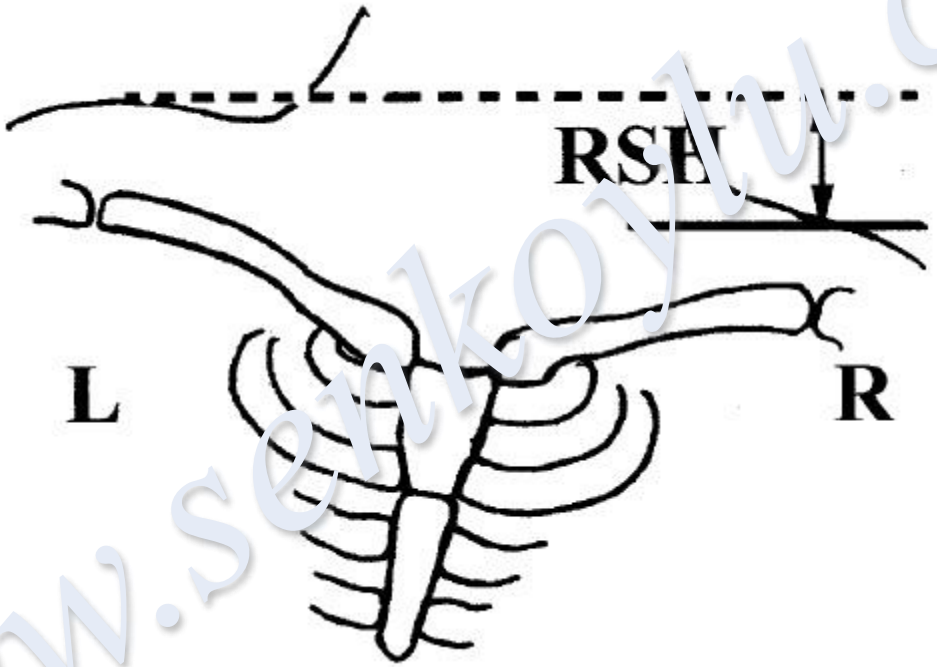
- <25 degrees is insufficient for the defining necessity of Prox Th. Curve fusion
- 39% rate of Lt shoulder elevation
- Risk factors:
  - Preop Lt shoulder elevation
  - PT Curve >25
  - Incomplete instrumentation of PT
  - Postop PT> 14
  - Correction of MT>67%

O'Brien M et al, SRS 43.Annual Meeting, Salt Lake City, 2008

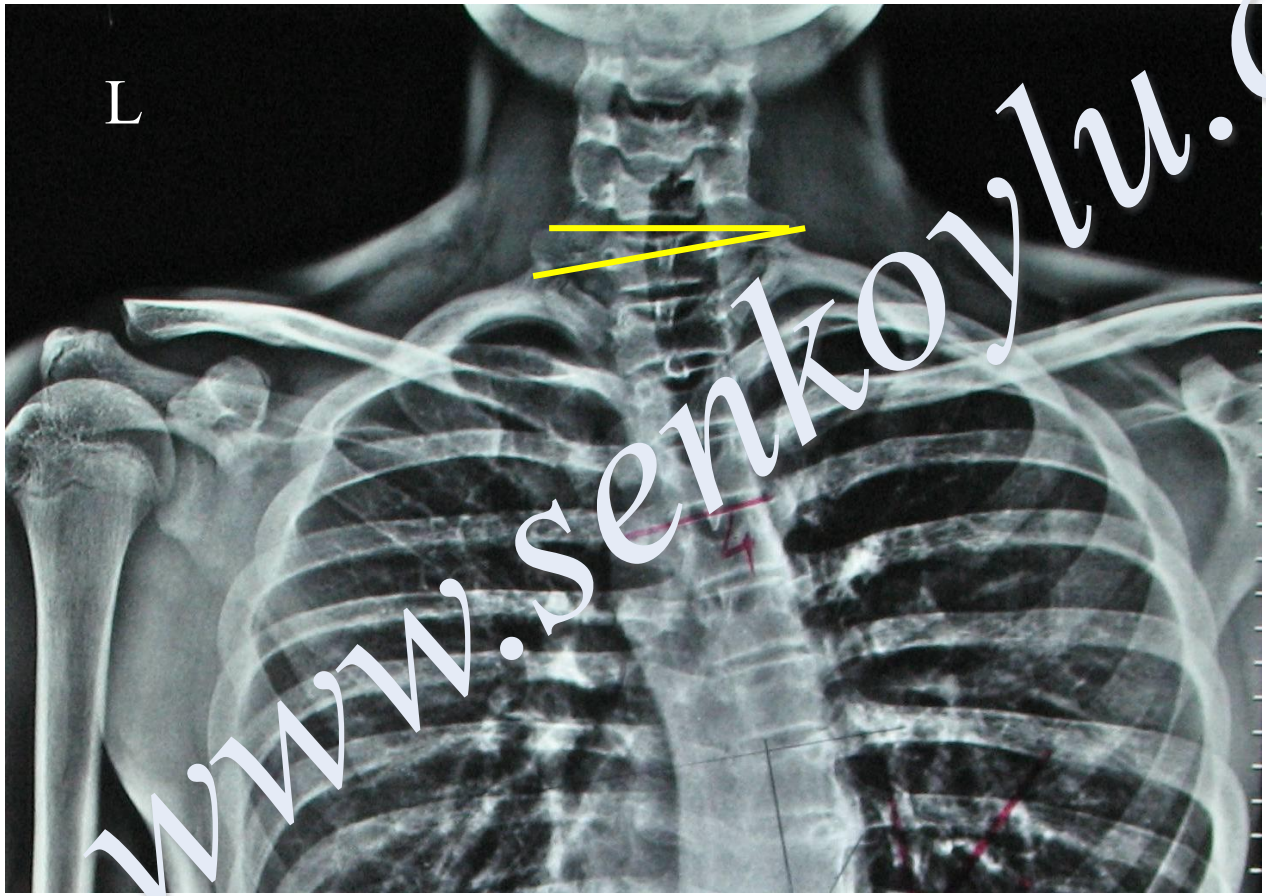
Clavicle Angle



Shoulder Height



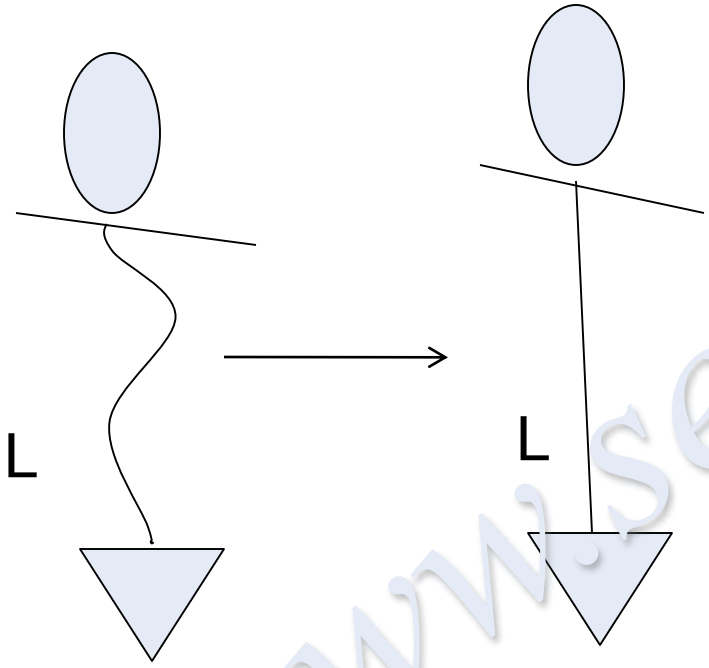
T1 Tilt

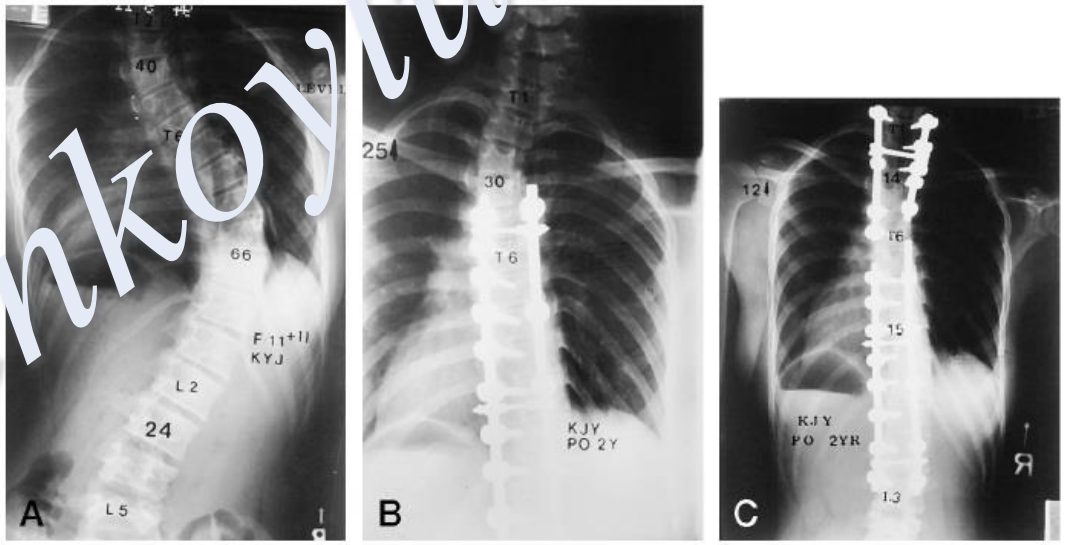


Lenke Type 1 and 3 curves (PTC is non-struc.)

Left shoulder level or elevated → Stop at T2

Otherwise:





Suk SI et al, Spine, 25: 2342-9, 2000

Lenke Type 1 and 3 curves (PTC is non-struc.)

- Right shoulder elevated

Traction xray under general anesthesia

If the (-) T1 tilt improves and position of first rib is are reversed

↓

Extend fusion up to T2

Disadvantage: 75% overestimating of Lt shoulder elevation causing unnecessary extension of fusion

Alanay A et al, Eurospine 2010, Vienna,

J Pediatr Orthop • Volume 28, Number 7, October/November 2008

How to Determine the Upper Level of Instrumentation in Lenke Types 1 and 2 Adolescent Idiopathic Scoliosis

A Prospective Study of 132 Patients

Brice Ilharreborde, MD, MS, Julien Even, MD, Yan Lefevre, MD, Franck Fitoussi, MD, Ana Presedo, MD, Philippe Souchet, MD, Georges-François Penneçot, MD, and Keyvan Mazda, MD

Level of evidence-3

PT is not necessary

Partial or total PT is necessary

PT is necessary

Conclusions

- Shoulders may not be level in the normal subjects

- Fuse all structural curves
  - Lenke 2
  - Lenke 4

- Lenke 1 and 3
  - If the Lt shoulder level or elevated → Fuse the Prox. Th. curve
  - If the Rt shoulder elevated → (consider T1 tilt)

Conclusion

- Risk factors of Lt shoulder elevation in Lenke 1
  - Preop Lt shoulder elevation
  - PT Curve >25
  - Incomplete instrumentation of PT
  - Postop PT> 14
  - Correction of MT>67%

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Thank You

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