

The Chêneau Brace Concept

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Disclosure:

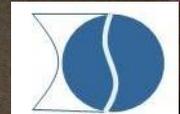
- Medical director of 'Institut Elena Salvá'. Private rehabilitation clinic
- Medical advisor of 'Ortholutions'

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Dr. Jacques Chêneau

In Bad Sobernheim
(Photo by Sanomed)



‘Trunk deformity reflects the spinal deformity’

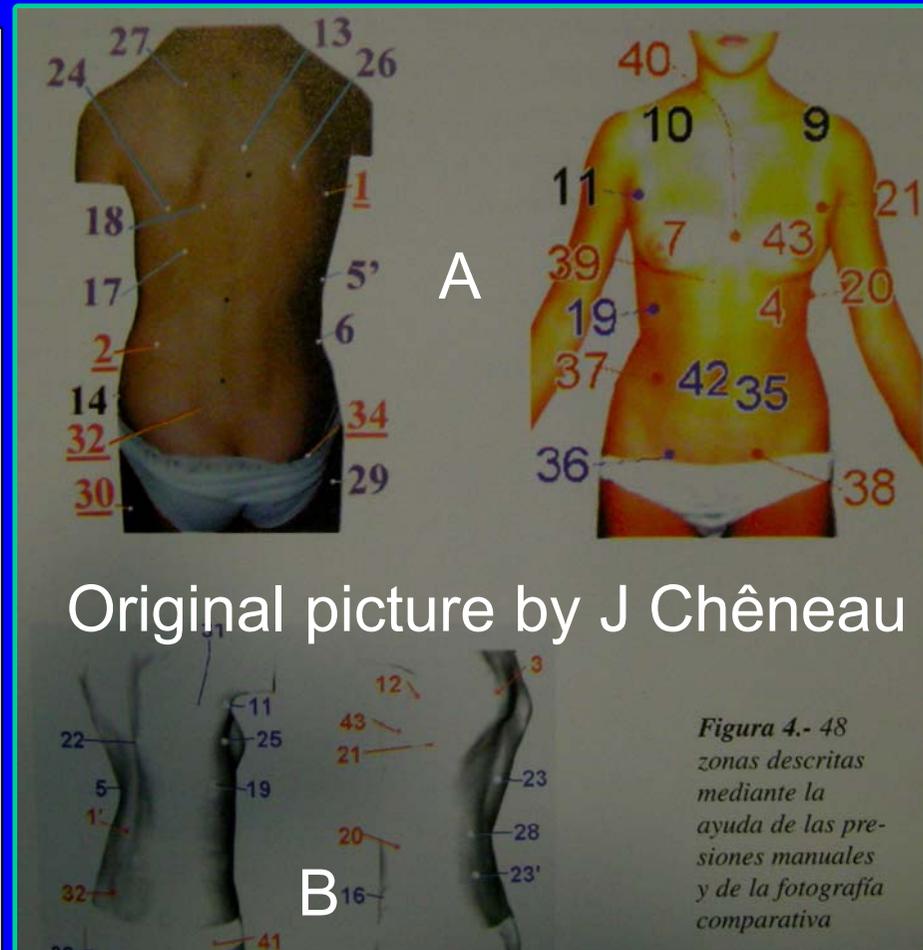
-PROMINENT and FLAT regions

- No NEUTRAL Regions: PELVIS included

- All regions numbered:
SCOLIOTIC ANATOMICAL MAP
(A)

- Hemi-bodies show an INVERTED
SAGITTAL PROFILE (B)

- LORDOTIZATION of the thoracic
spine / KYPHOTIZATION of the
lumbar spine



A corrected positive mould is created in order to provide highly selective PADS and EXPANSION ROOMS

Negative → Positive → 3D Modification



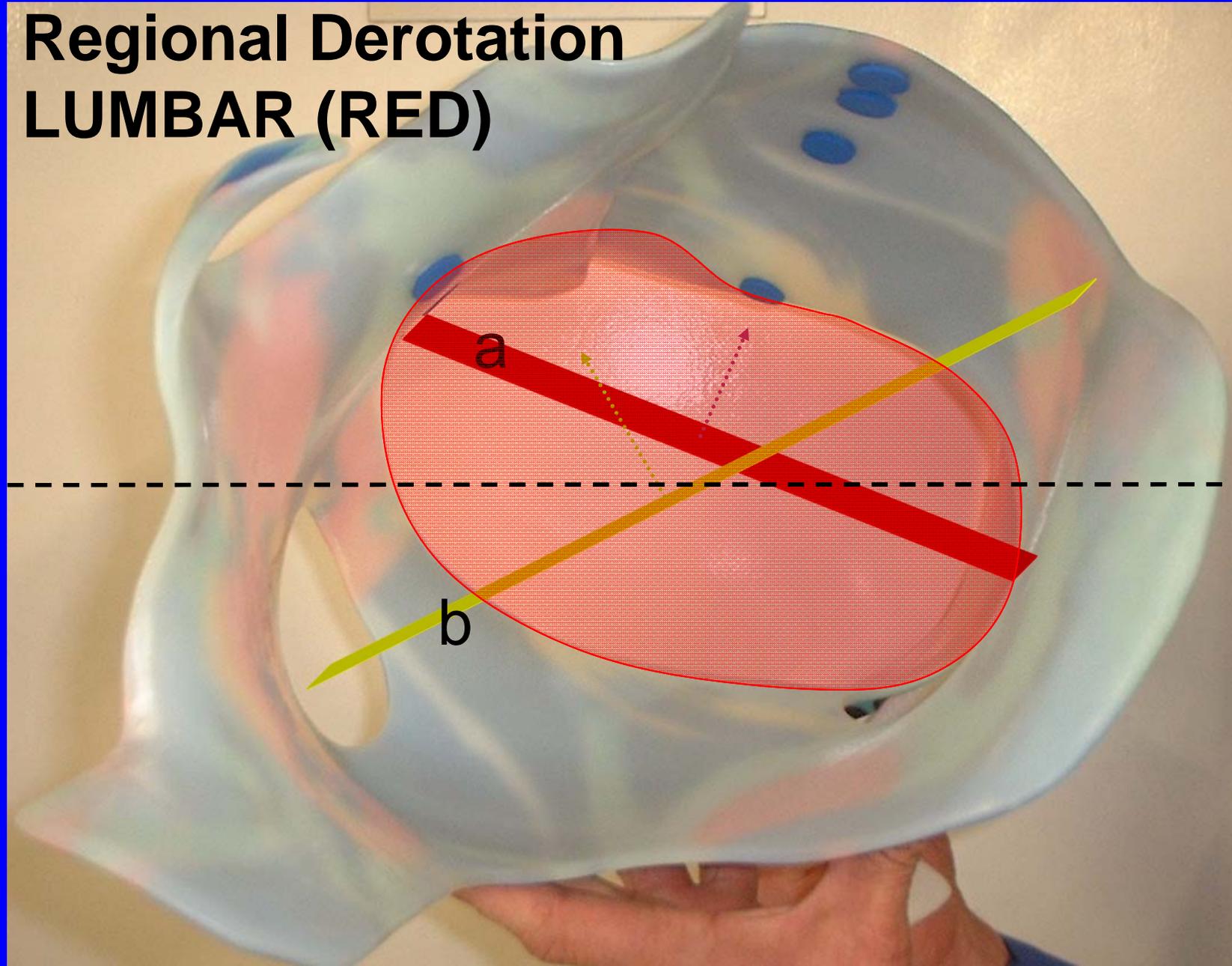
- 1) PADS (Located in the space, oriented and shaped to provide 3D correction)
- 2) EXPANSION ROOMS (For tissue's migration, growth and breathing movements, converting a rigid brace into a dynamic rigid brace)
- 3) No NEUTRAL parts



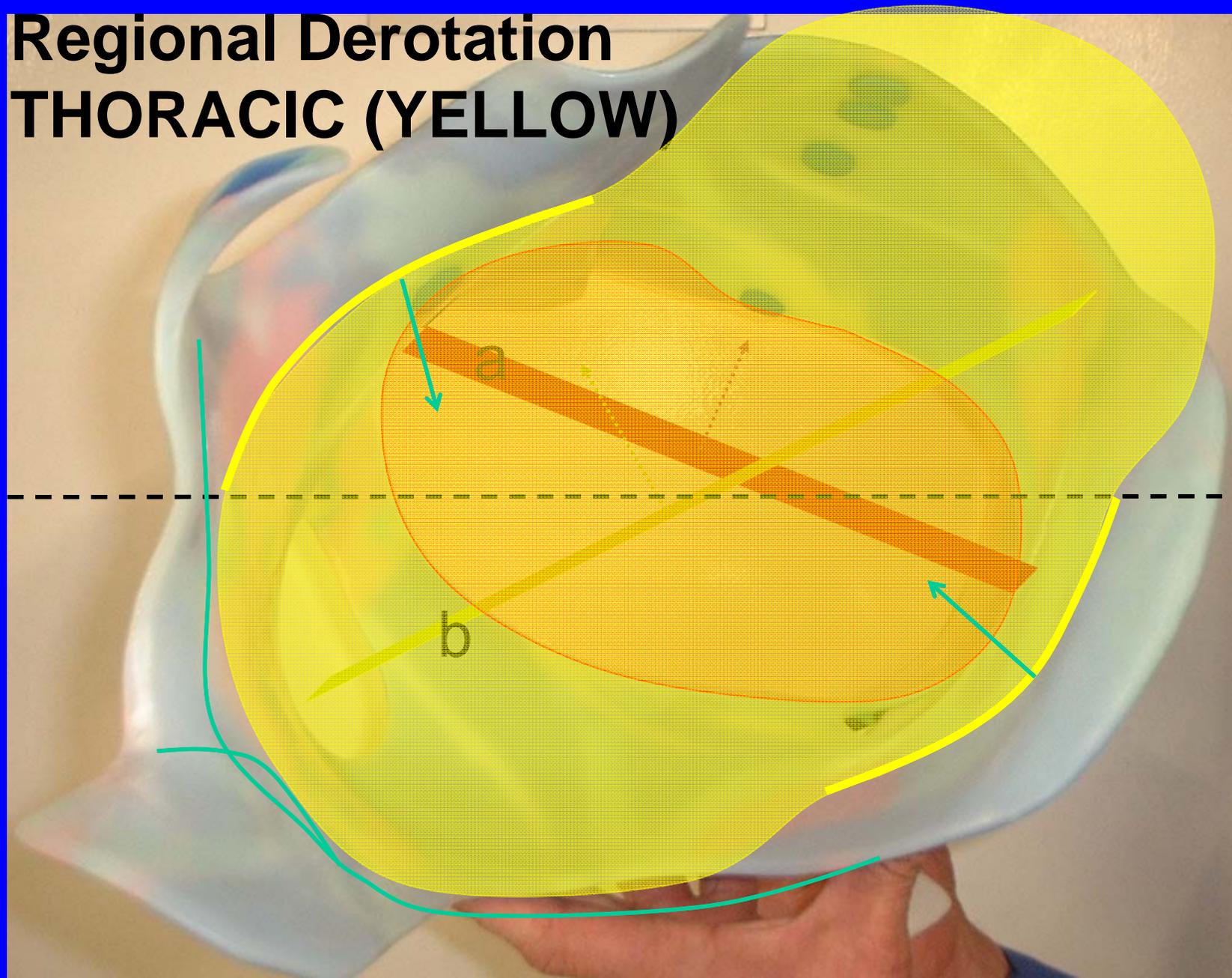
3D Correction

- Three-points systems in the frontal plane. Alignment in the frontal plane
- Regional derotation and pair of forces in the transversal plane for local derotation
- Sagittal balance and physiological alignment
- Breathing mechanics against the morphological lordotization of the main thoracic spine

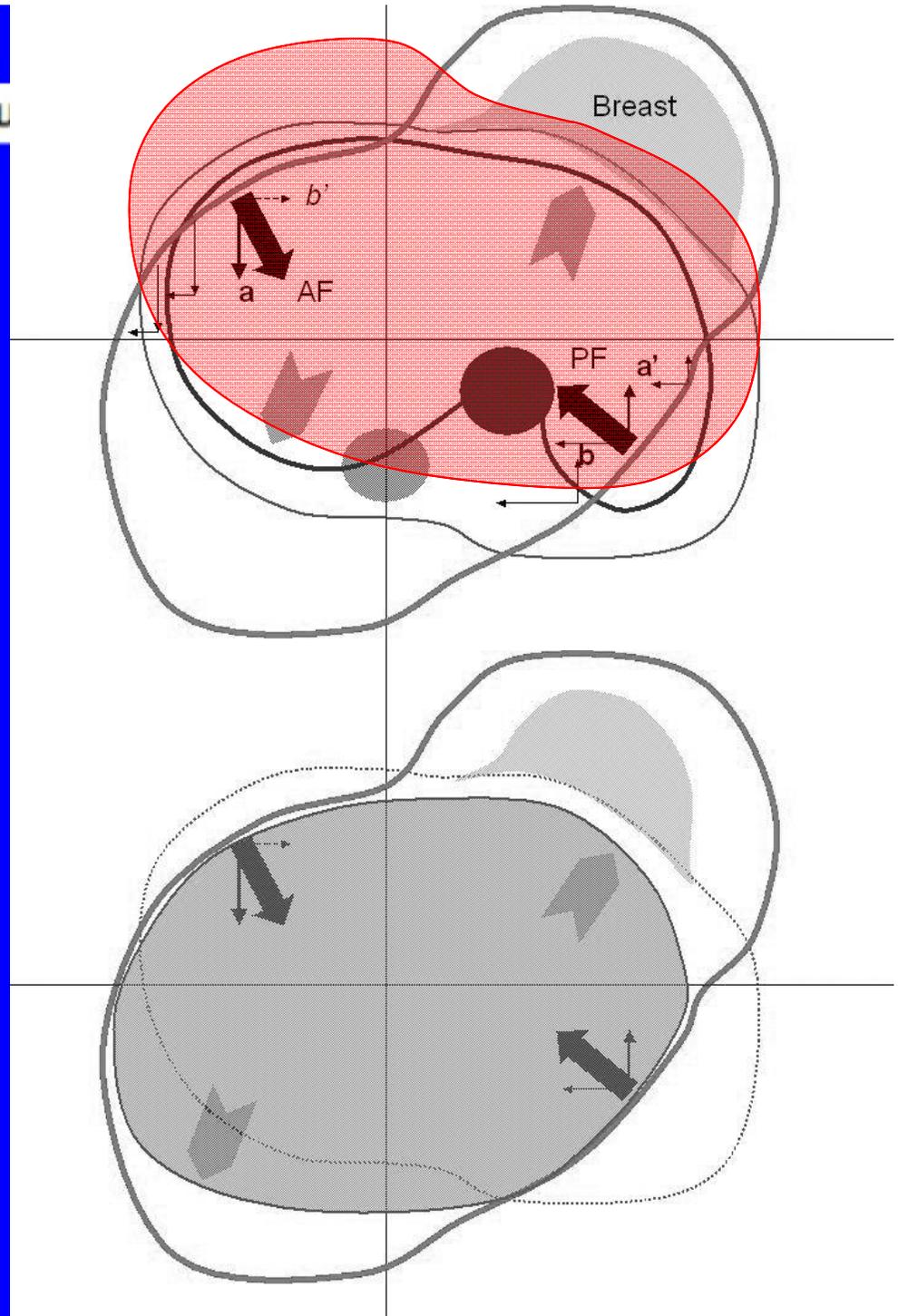
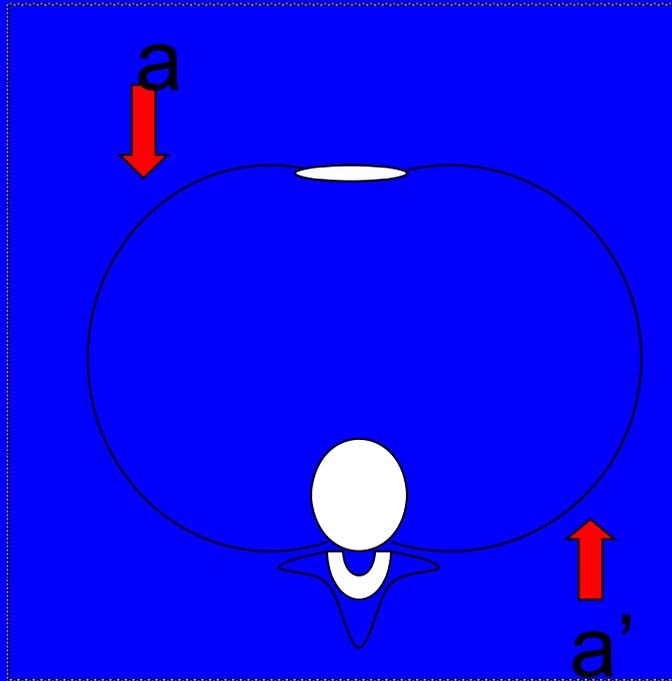
Regional Derotation LUMBAR (RED)



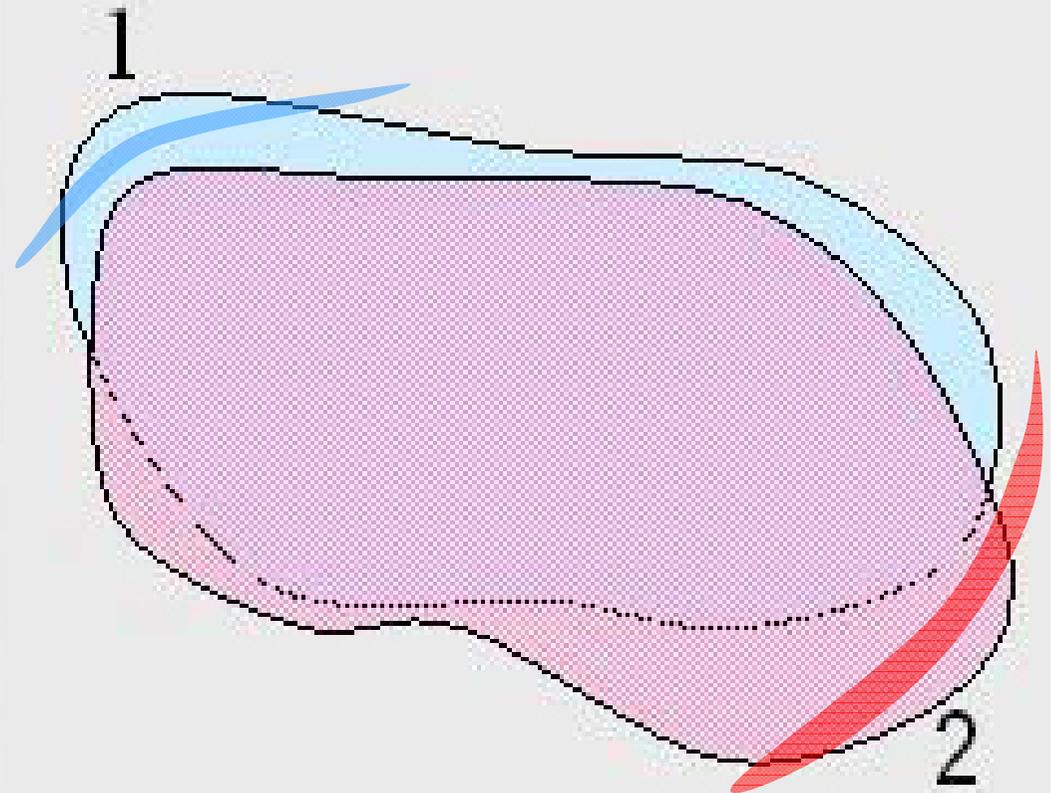
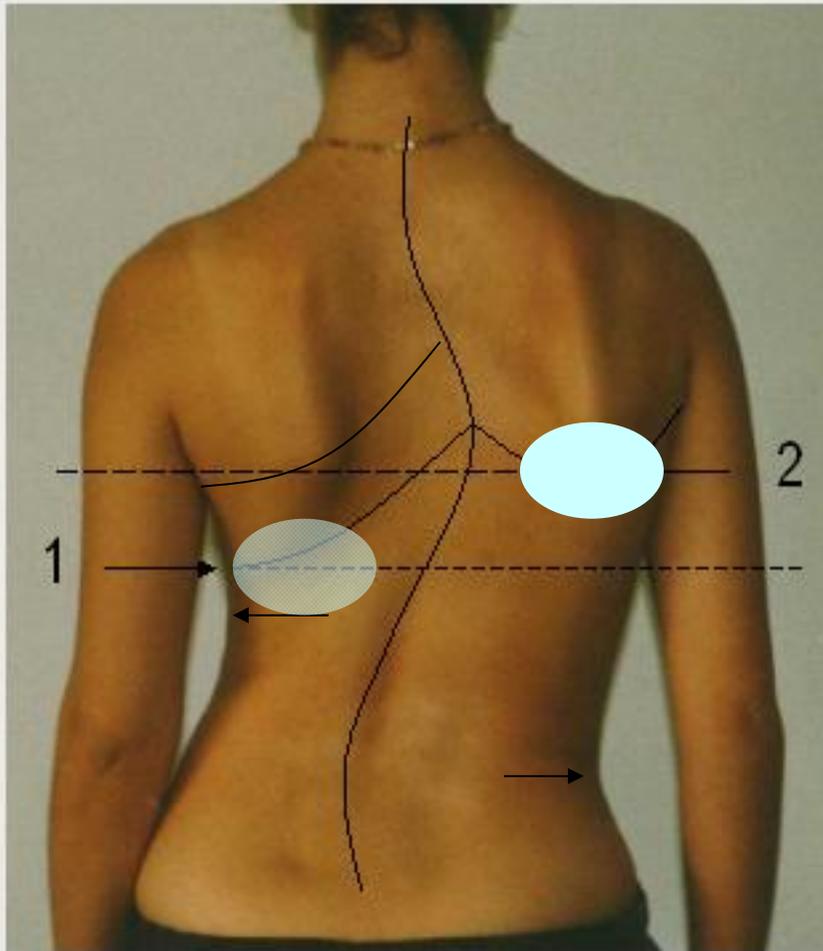
Regional Derotation THORACIC (YELLOW)



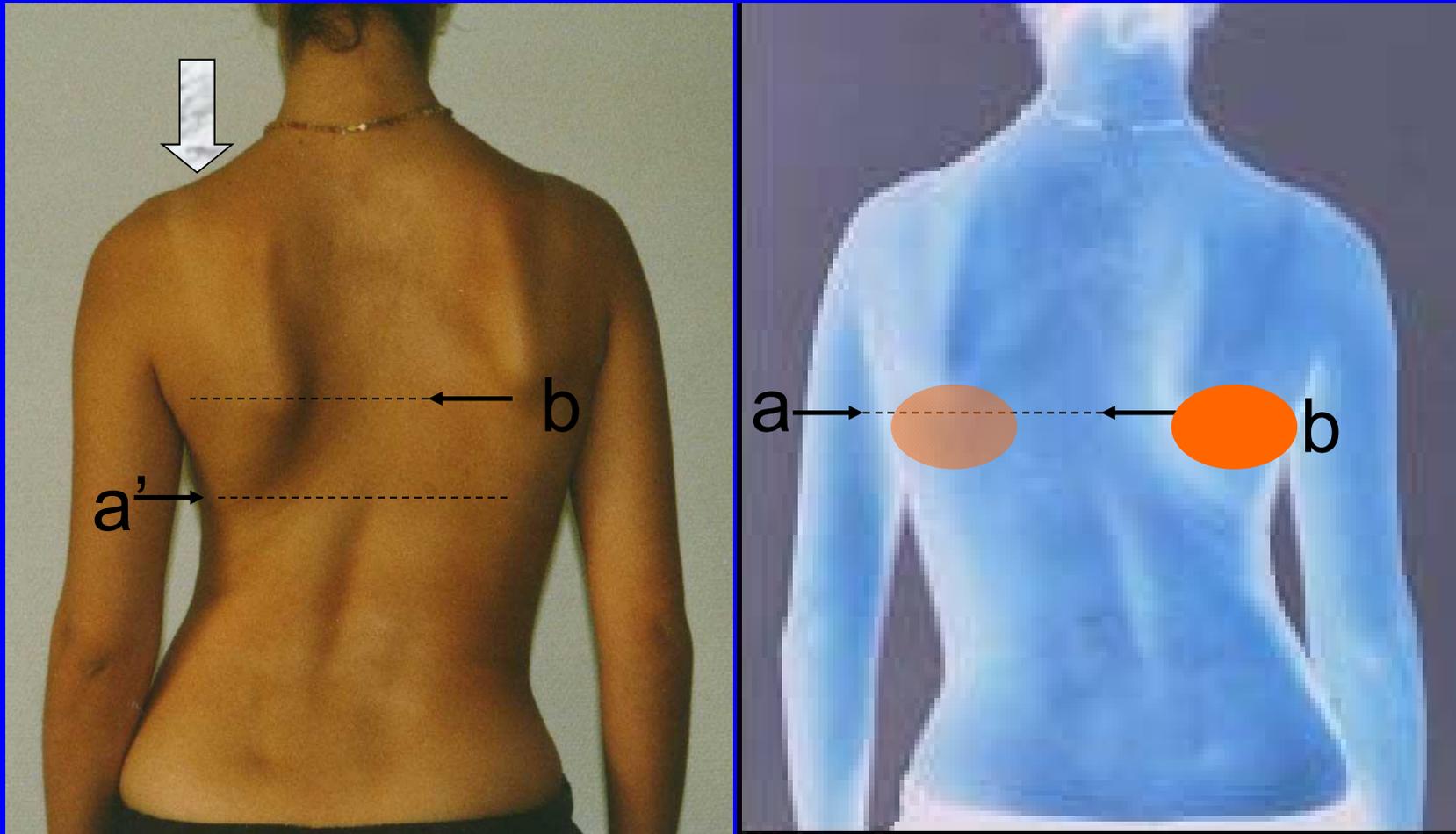
Local Derotation

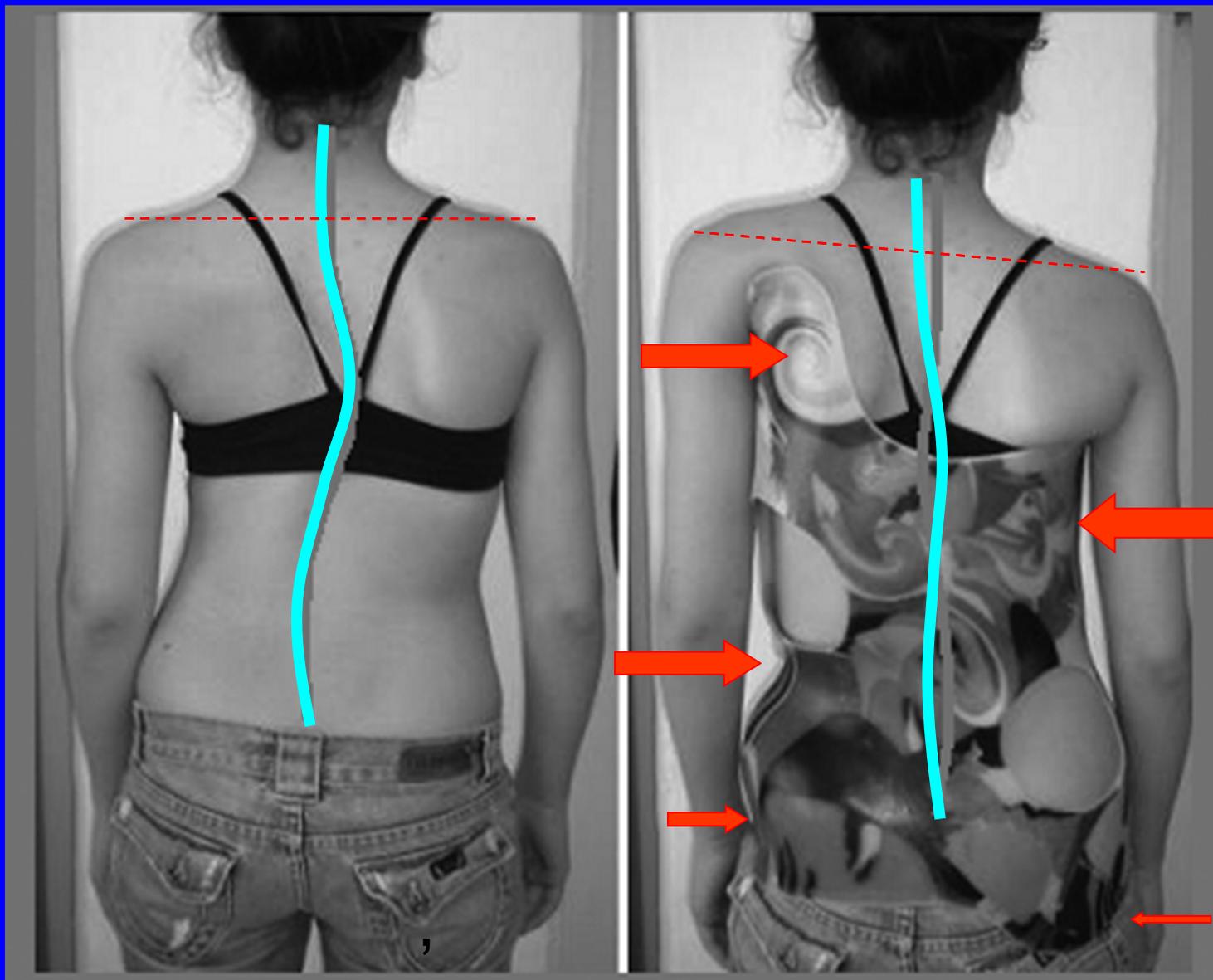


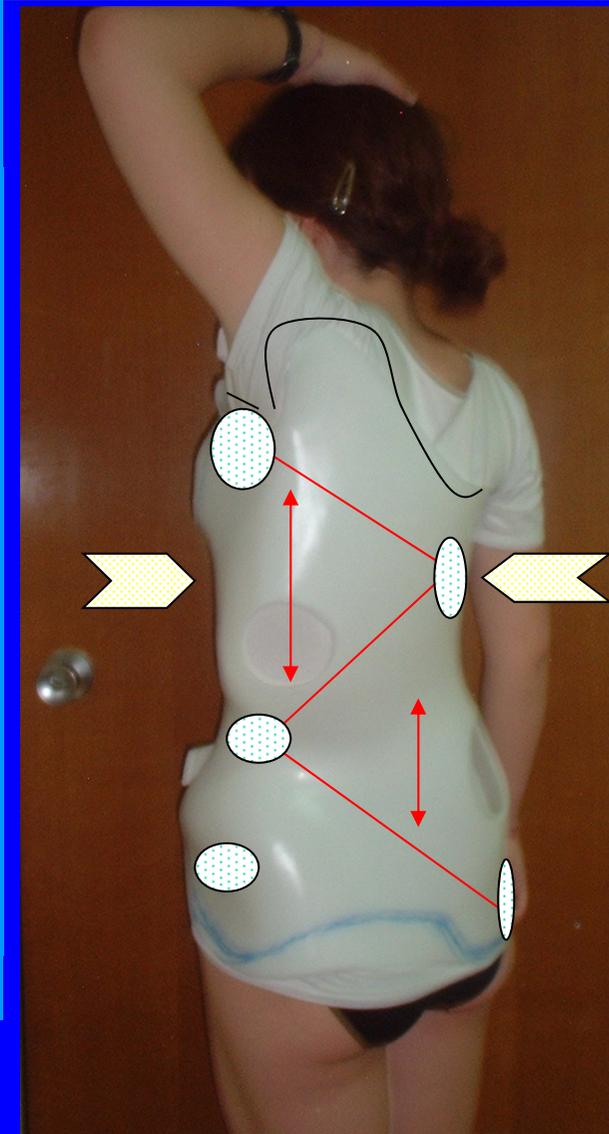
The pads for derotation, acting on the dorsal and ventral rib humps should be at the same level

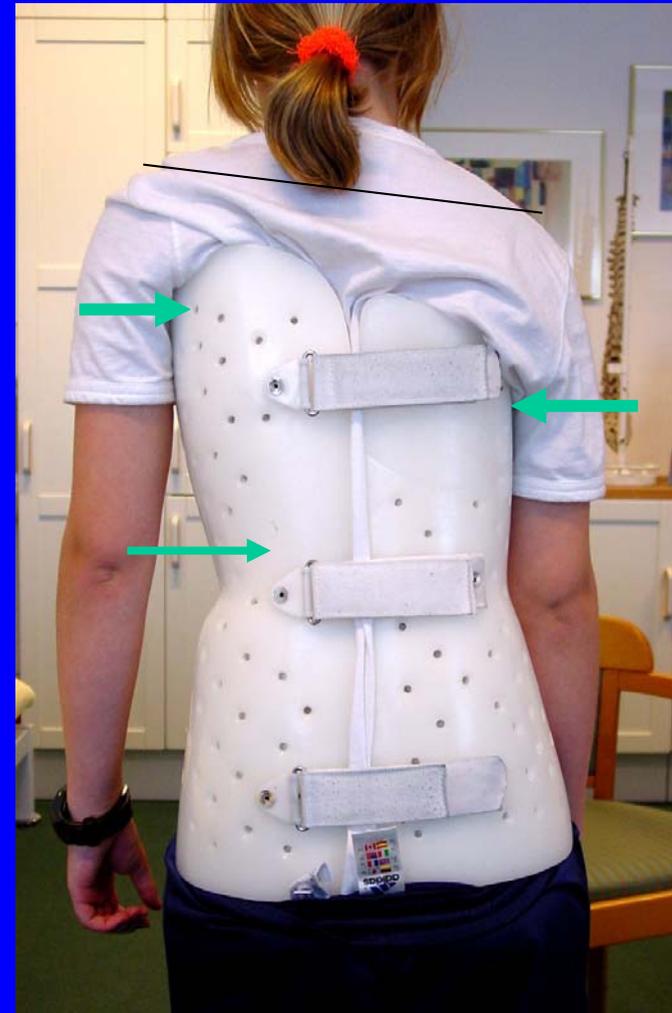
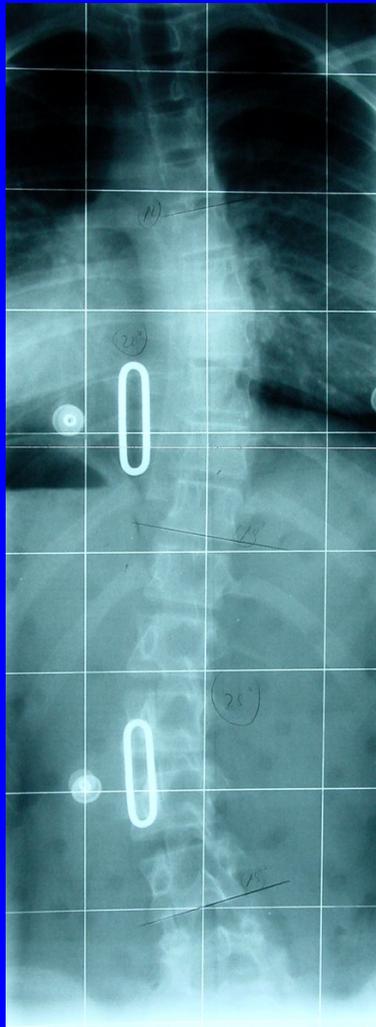
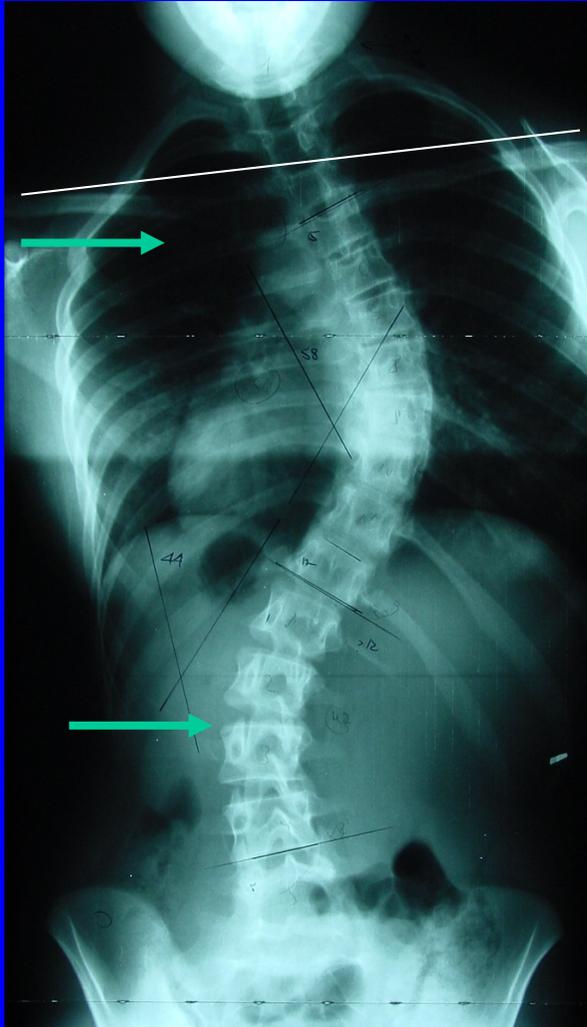


Mirror effect









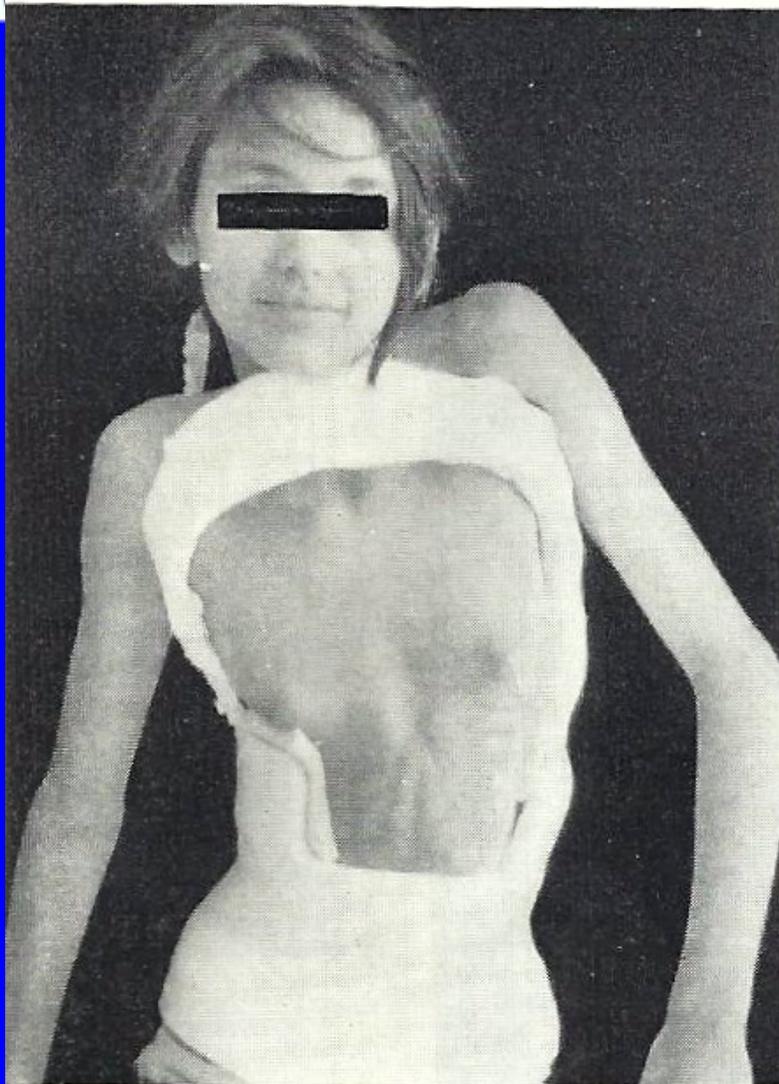


FIG. 78.

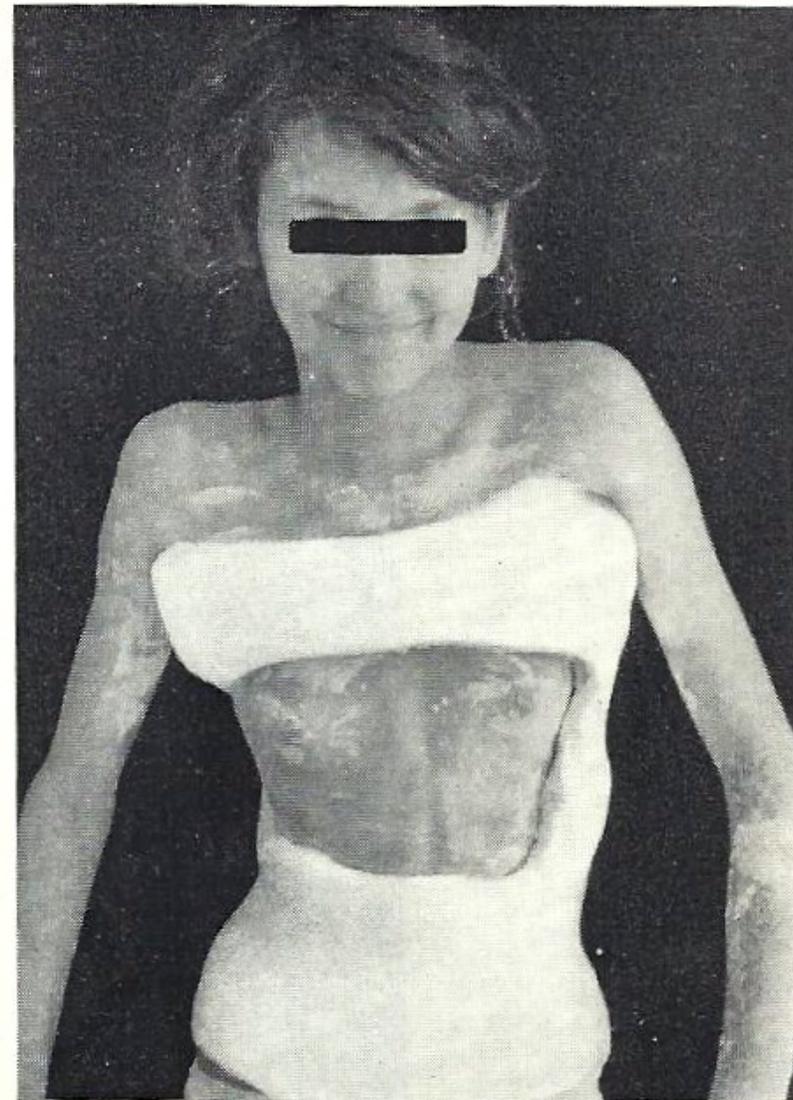
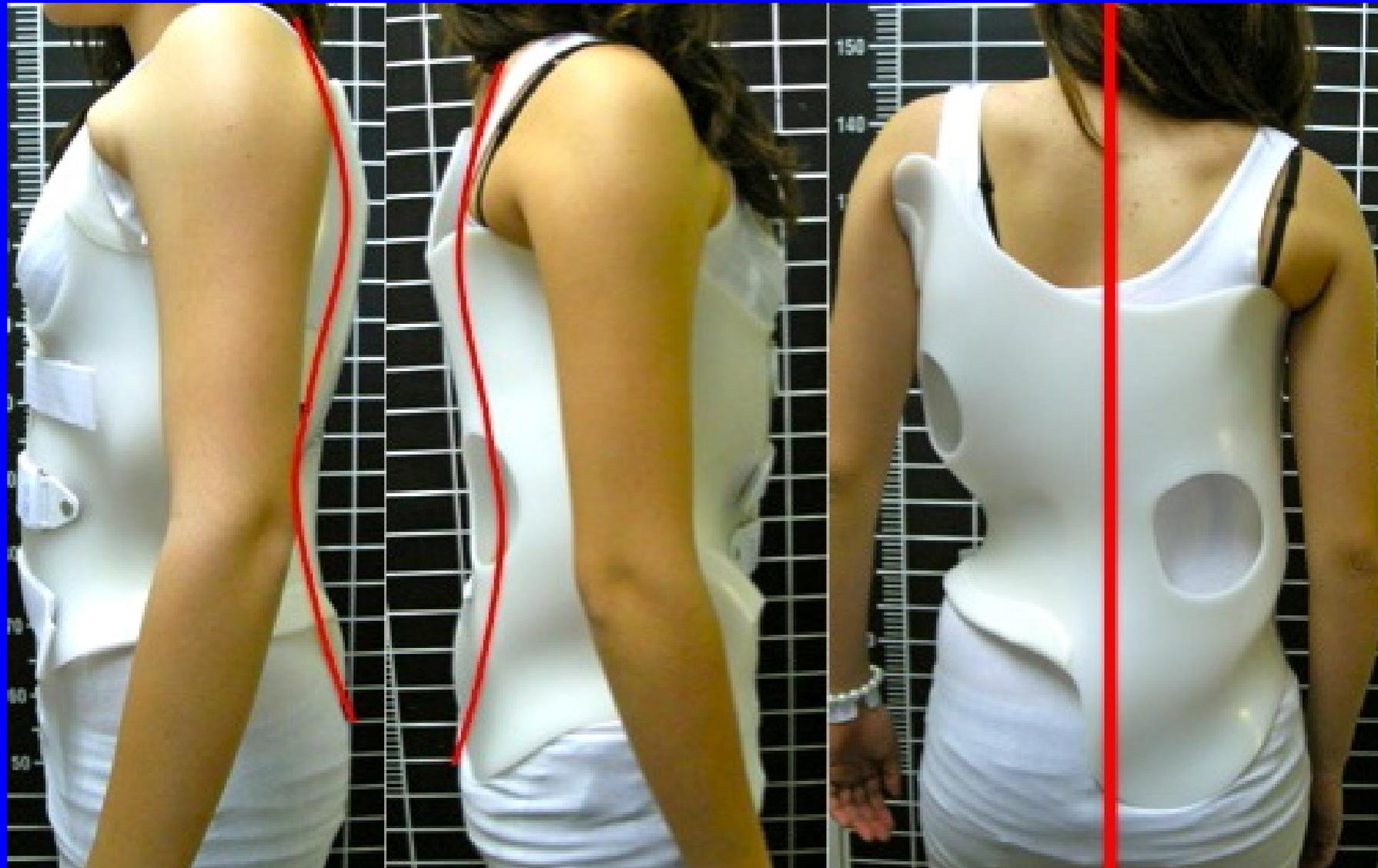
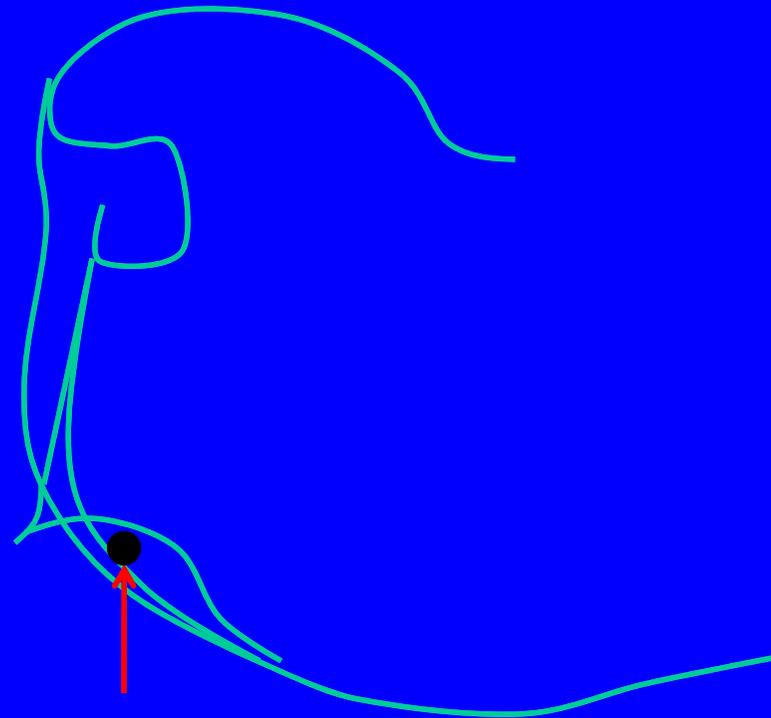
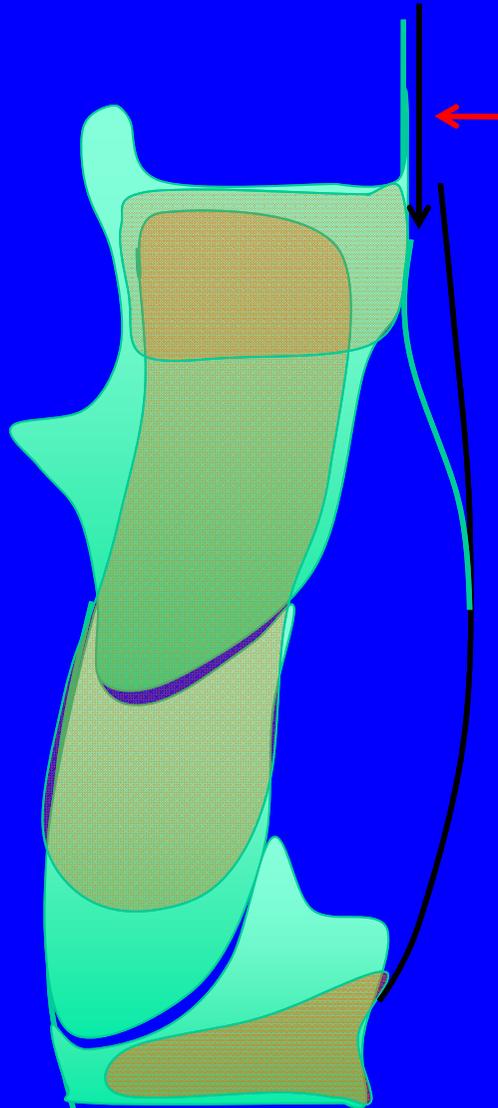


FIG. 79.

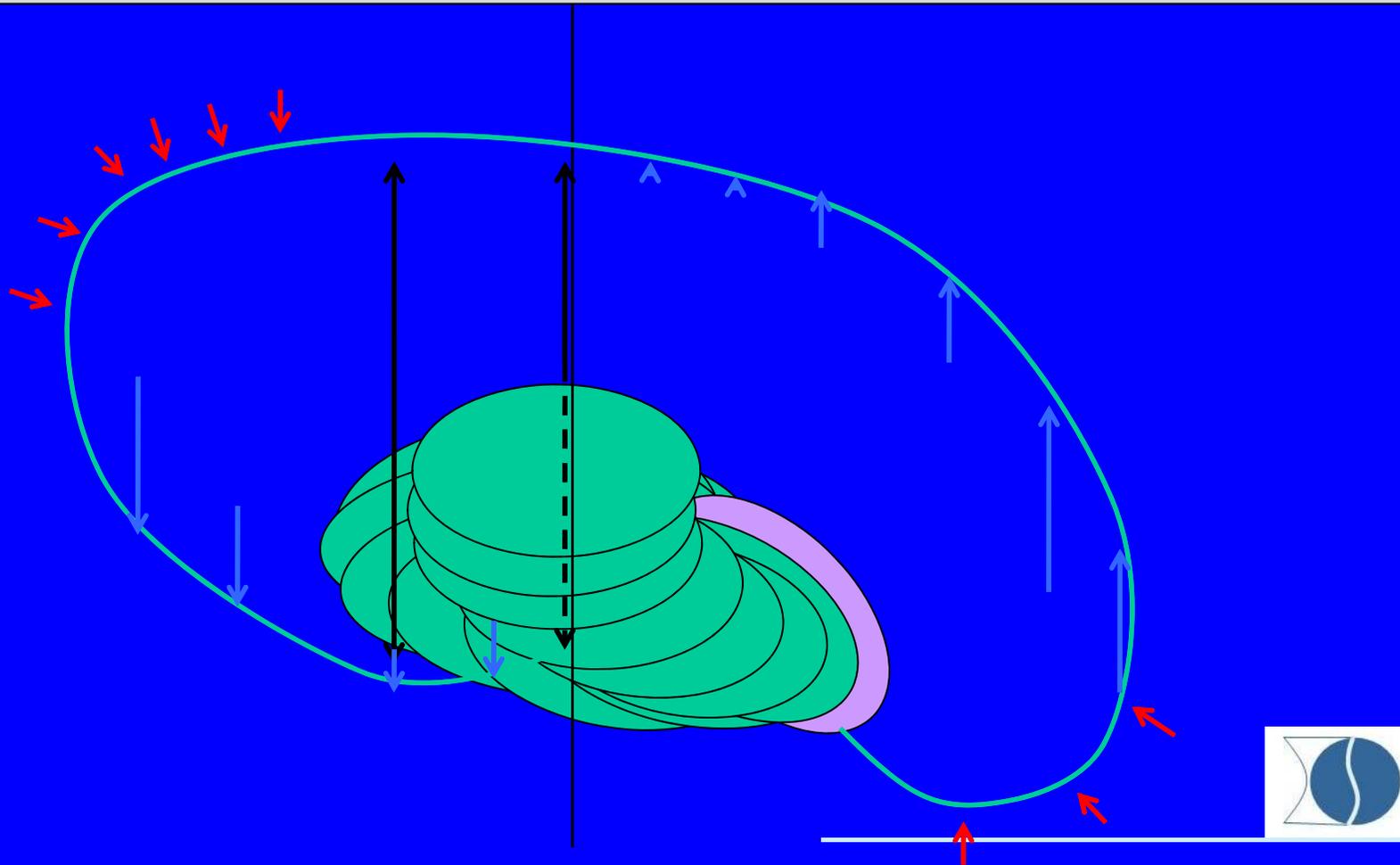
FIG. 78 et 79. — Dans le but d'une recherche de correction maxima, on peut provisoirement tolérer une légère surélévation de l'épaule. Vérifier cependant le comportement de la contre-courbure supérieure.



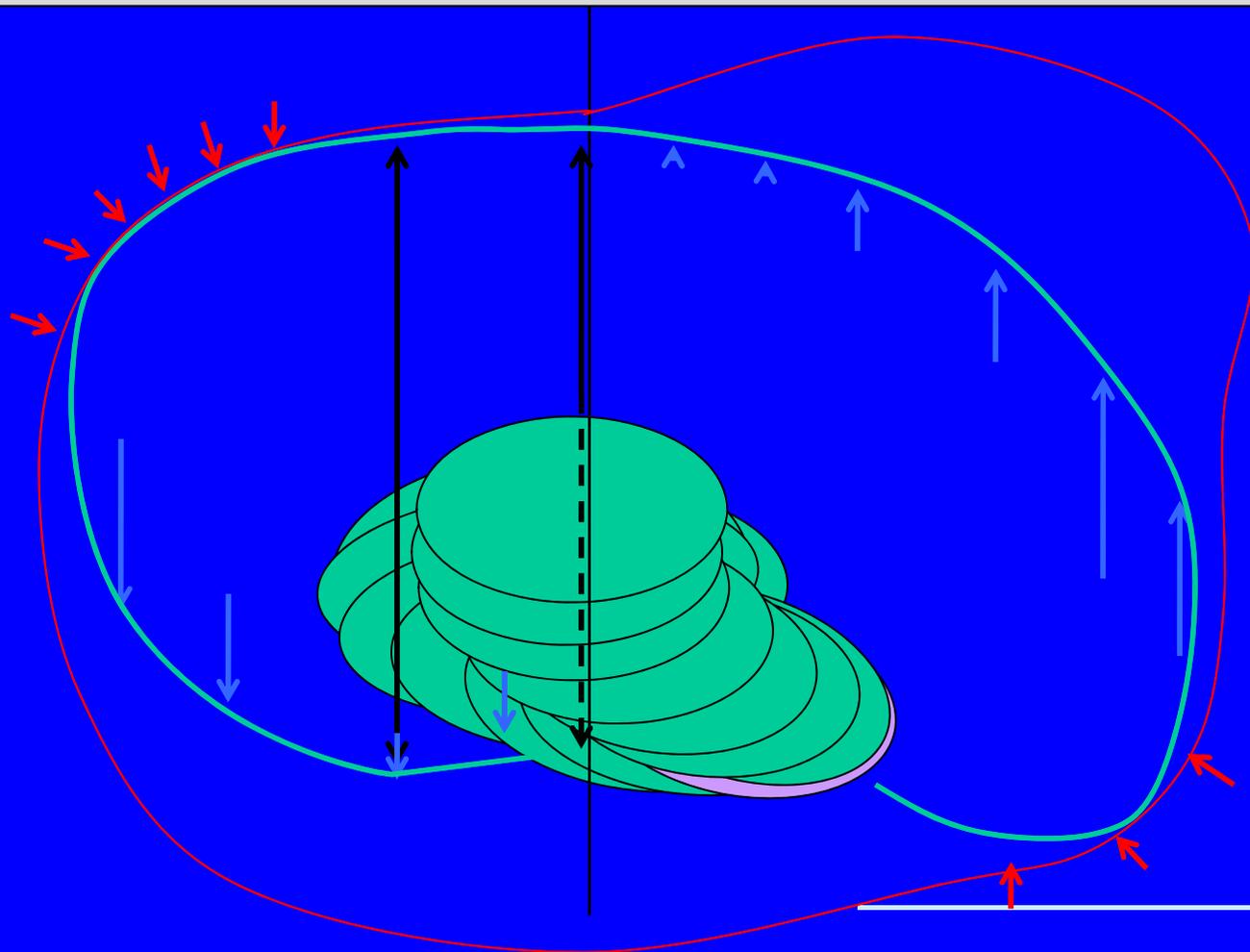
Classical Proximal Thoracic Pad



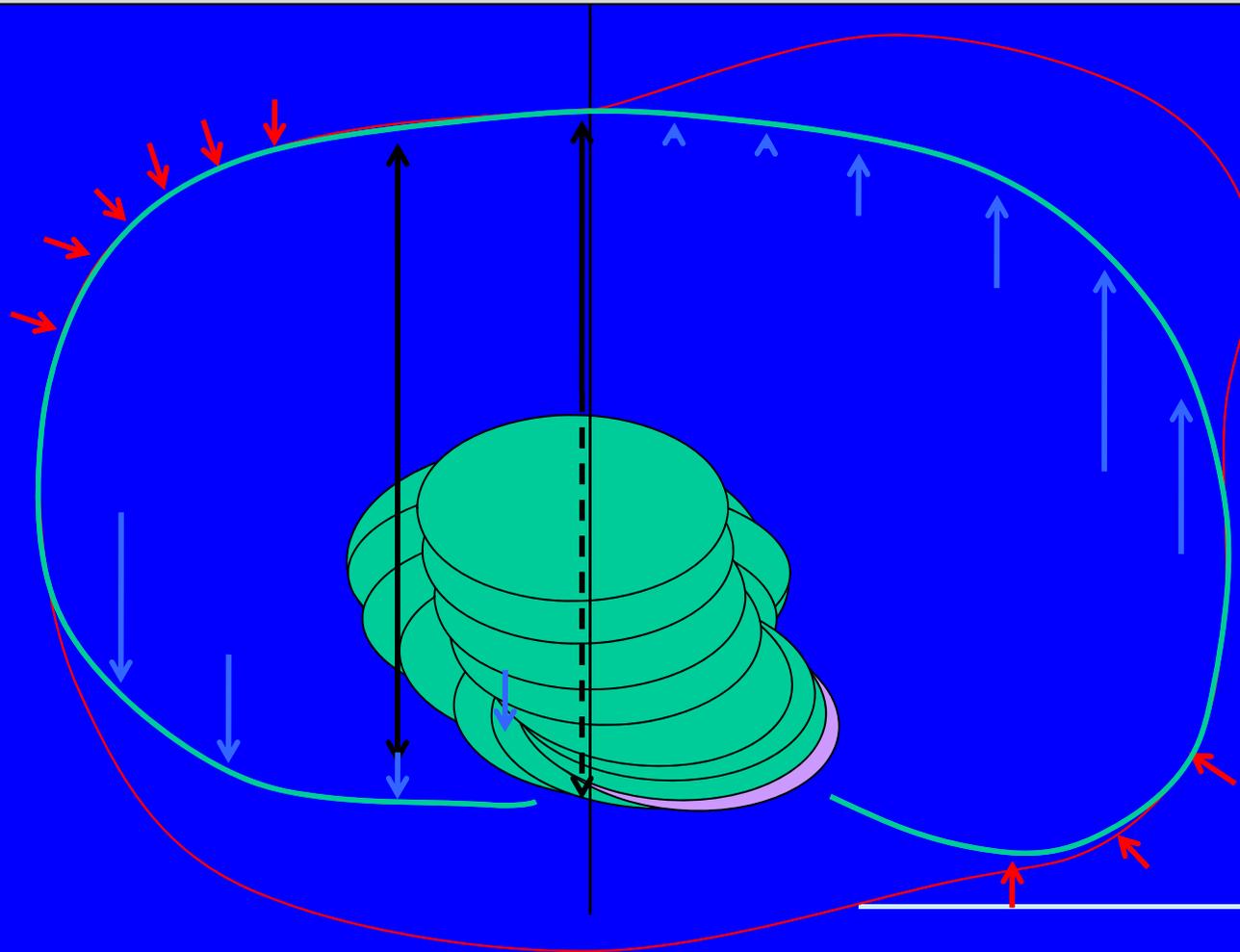
Breathing mechanics (Dynamic effect)



Breathing mechanics creating an internal pair-of-force for derotation and partial correction of the structural flat back

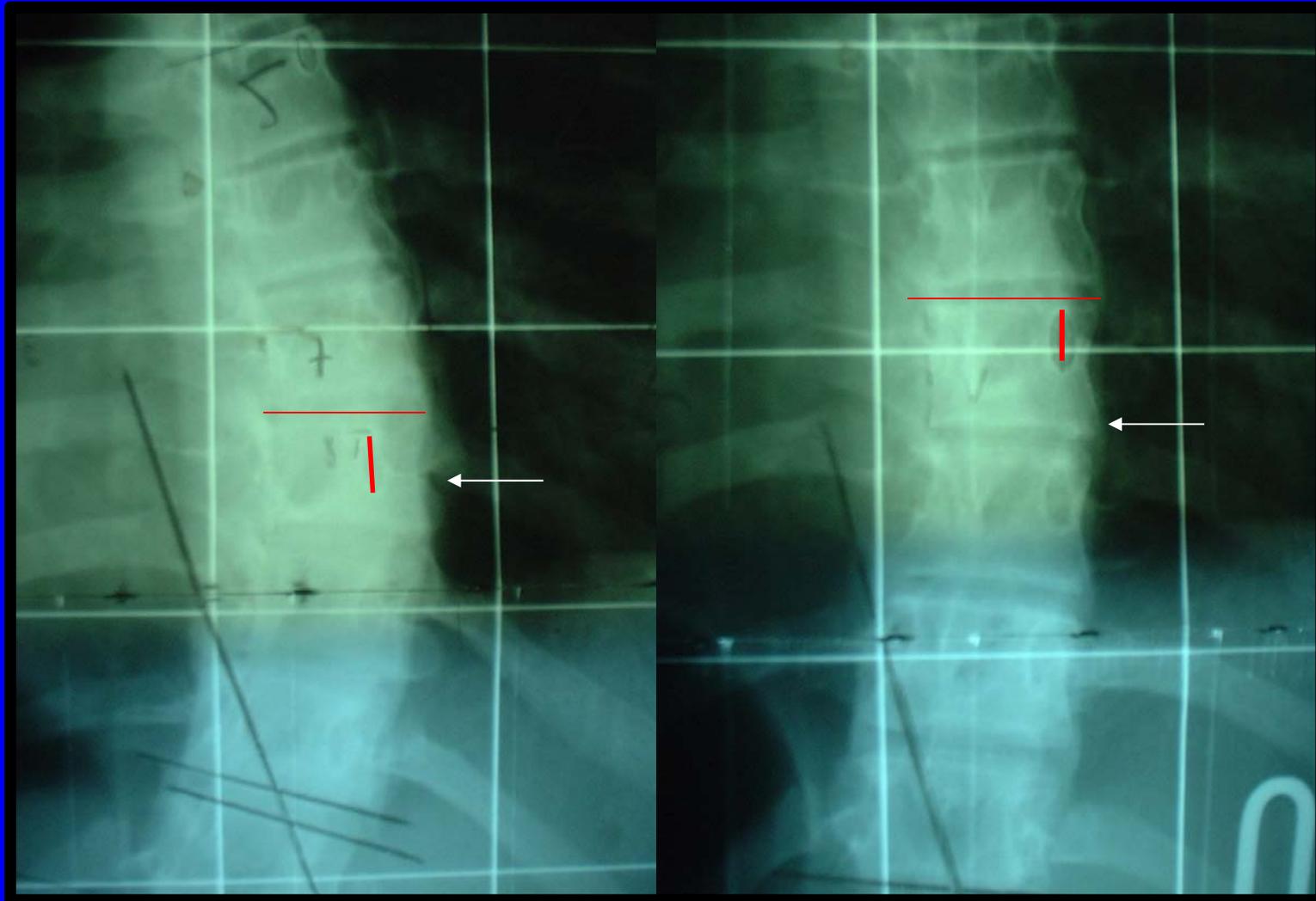


Breathing mechanics creating an internal pair-of-force for derotation and partial correction of the structural flat back

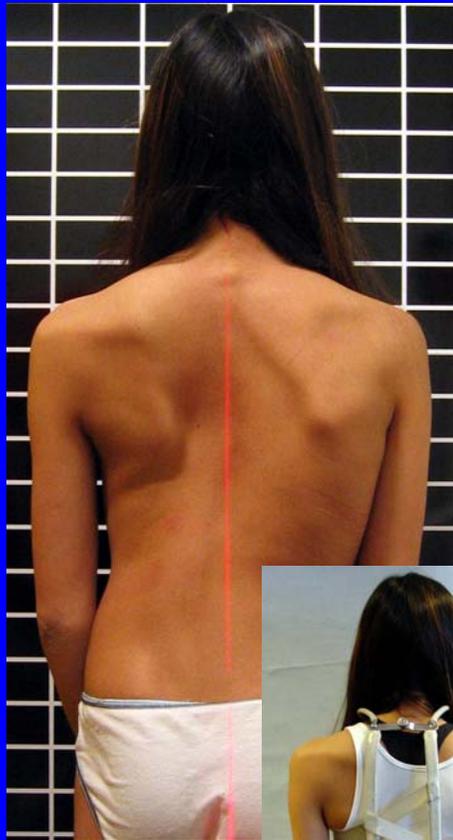


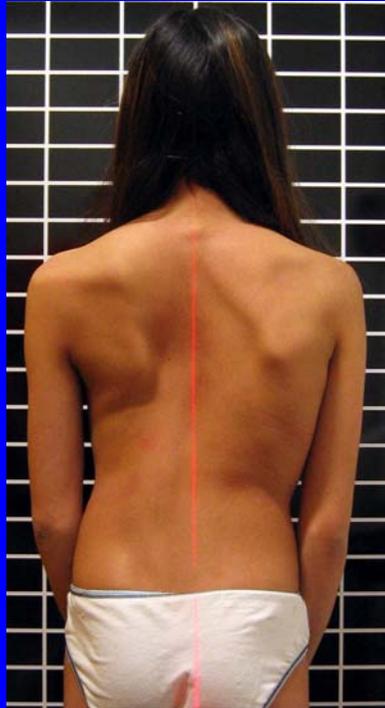


Frontal plane: Reduction of the Cobb angle

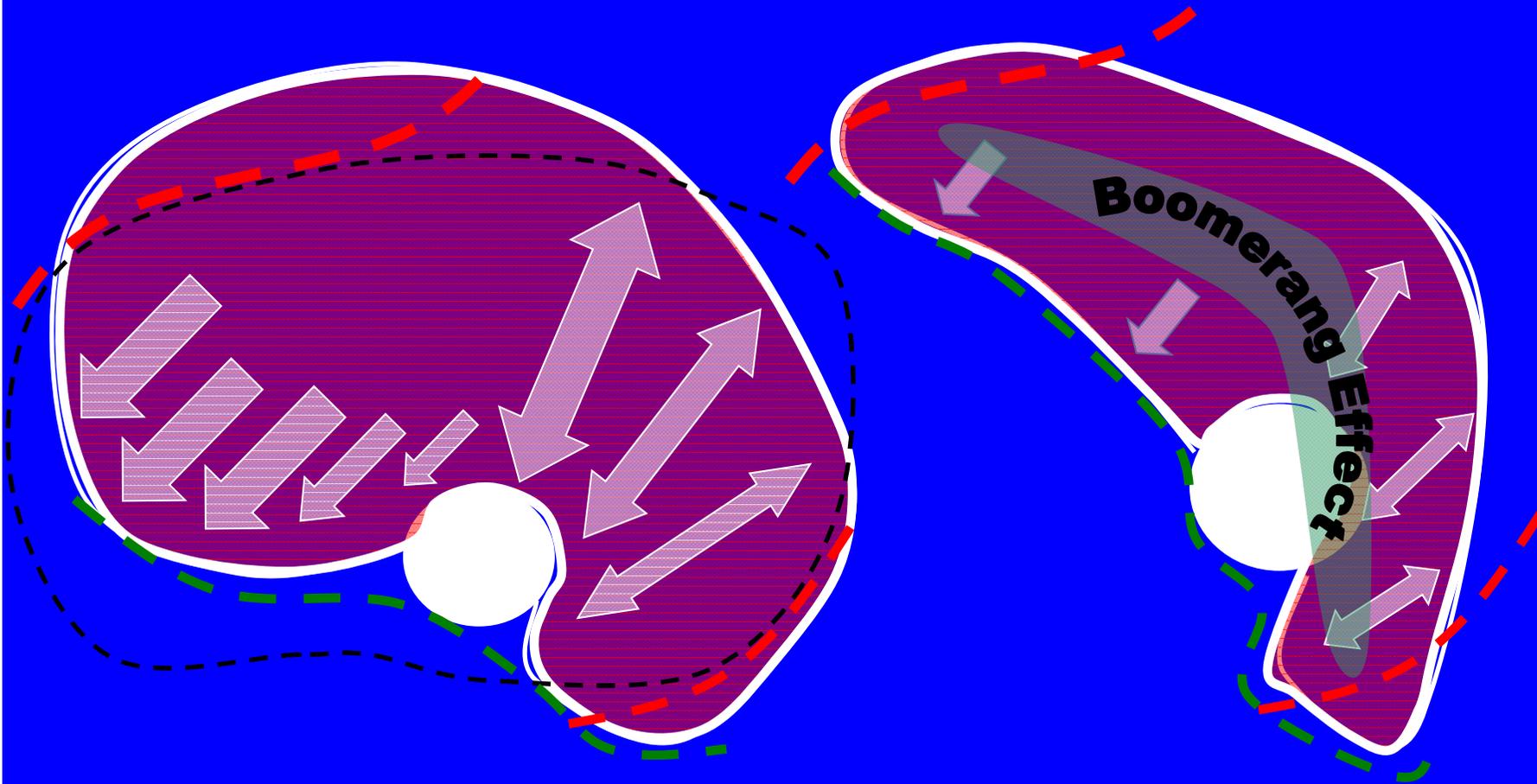


Transversal plane: Reduction of the axial rotation

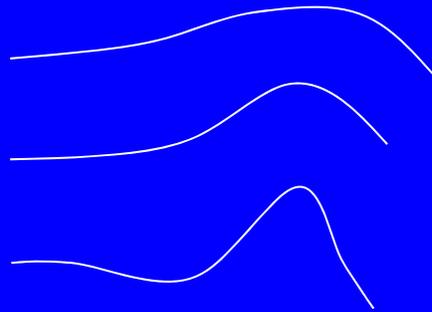




Comparison 12/04 vs. 3/06



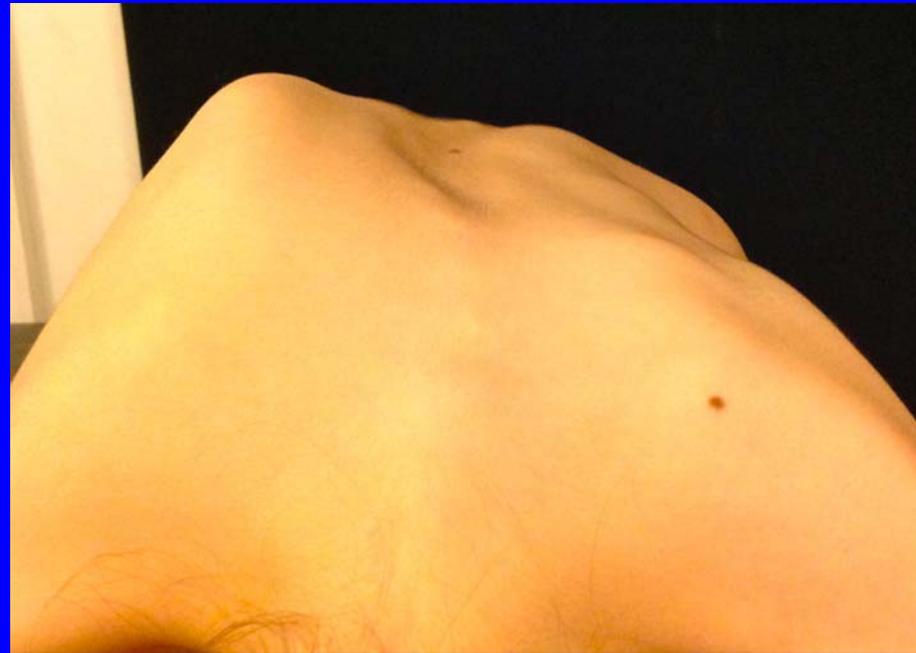
Limitations for Bracing



I Best case

II

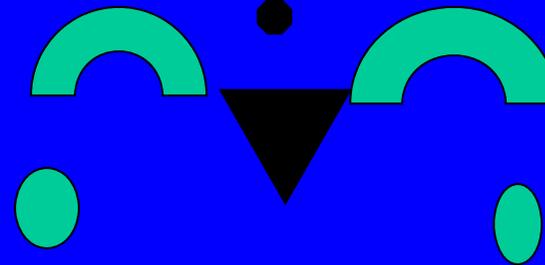
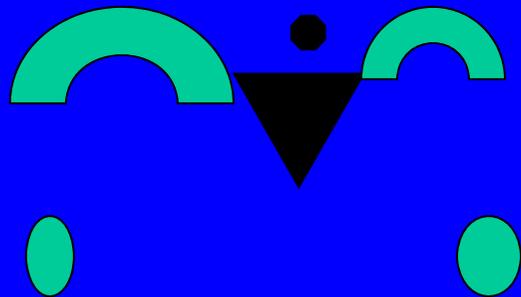
III Worst case



Dr. J. Chêneau

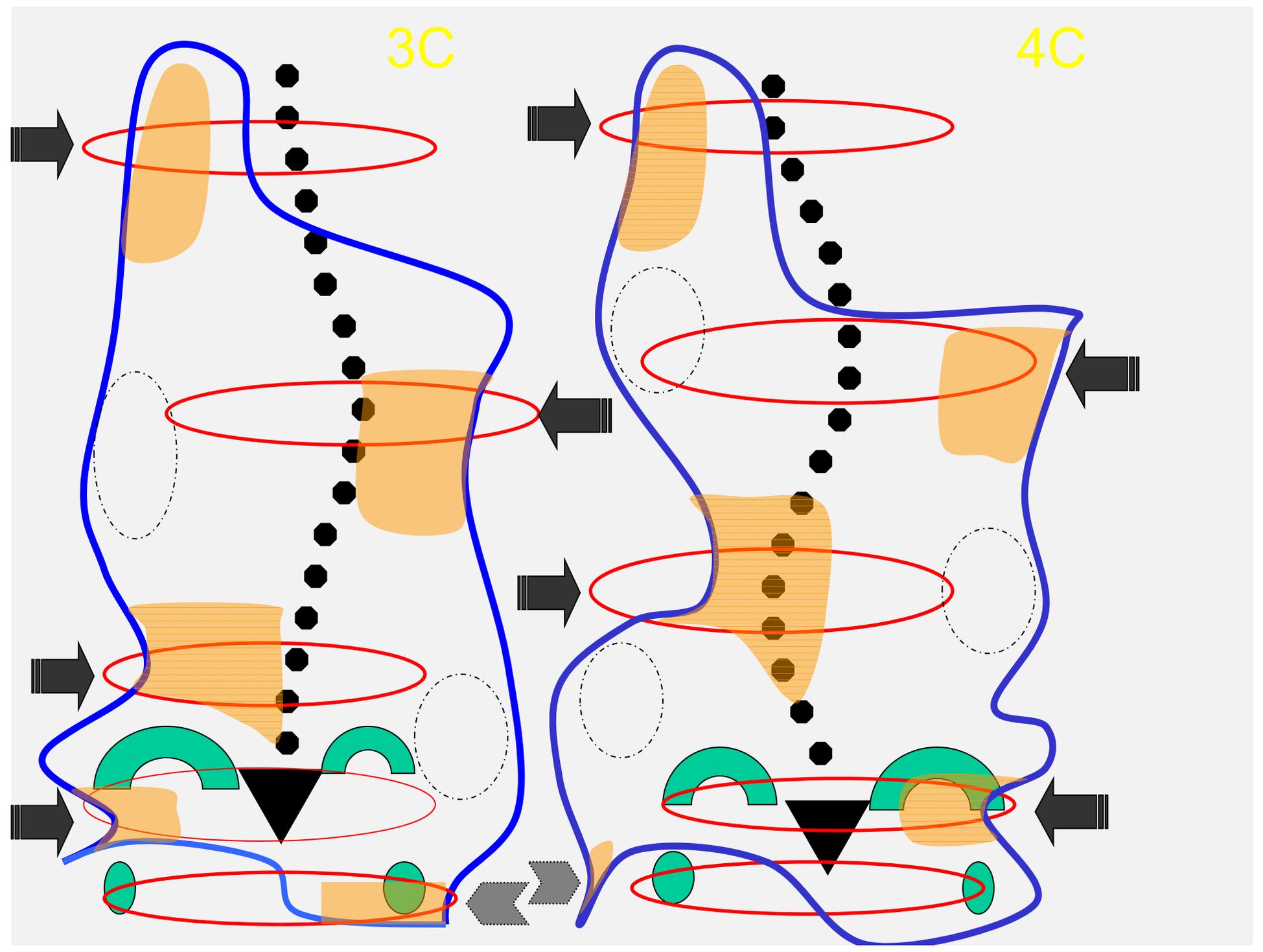
3c

4c



3C

4C



‘A specific scoliosis classification correlating with brace treatment: description and reliability’

Rigo M, Gallo D, Villagrasa M

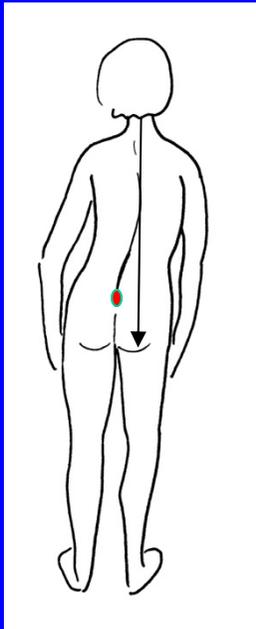
Scoliosis 2010 5:1

Previously described in Rigo M, Weiss HR: The Chêneau concept of bracing – Biomechanical aspects. *Studies in Health Technology and Informatics* 2008, 135: 303-319

- Clinical Criteria: 4 general types based on clinical observations and exploration (modified from Ch Lehnert-Schroth)
- Radiological Criteria: To confirm and select brace specifications

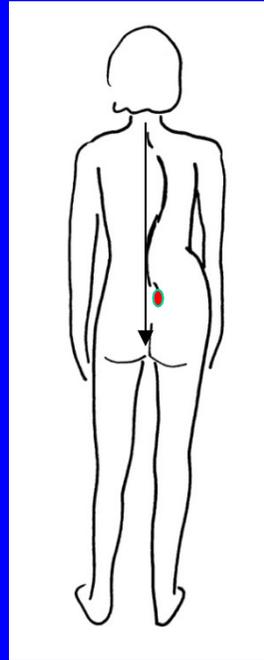


A



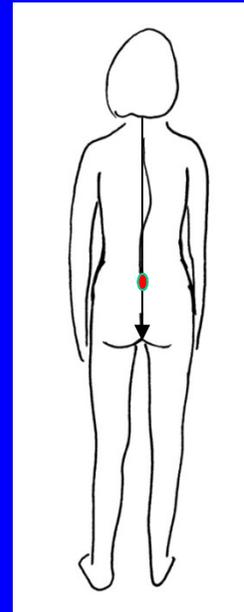
3 Curve Pattern

B



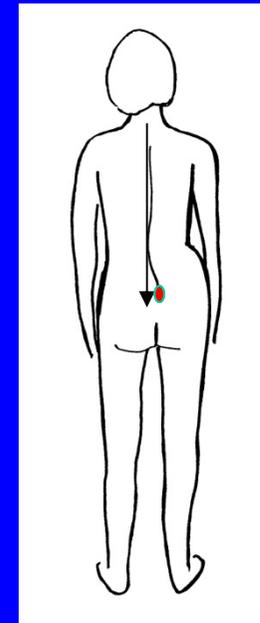
4 Curve Pattern

C



N3N4 Curve Pattern

E



Lumbar/TL Pattern

Clinical Criteria. Four Categories
Modified from Lehnert-Schroth



Radiologic Criteria 1

Curve pattern compatibility

- Single Major **High** Thoracic (upper or proximal)
- Single Major Thoracic
- Single Major Thoracolumbar
- Single Major Lumbar
- *Major Thoracic and Minor Lumbar*
- *Double Major Thoracic and Lumbar*
- *Double Major Thoracic and Thoracolumbar*
- *Double Major Thoracic*
- *Multiple*

Single
Composite

- Thoracic: T2-T11 (Disc T11-12)
- Proximal Thoracic: T3-4-5
- **Main T = High: T6-7 Low T9-11**
- Thoracolumbar: T12-L1
- Lumbar: L2-L4 (Disc L1-2)
- Lumbosacral: L5-S1 (Disc L4-5)

+

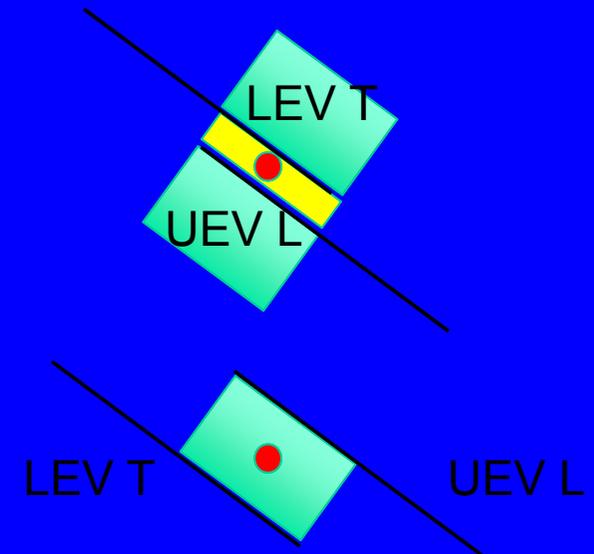
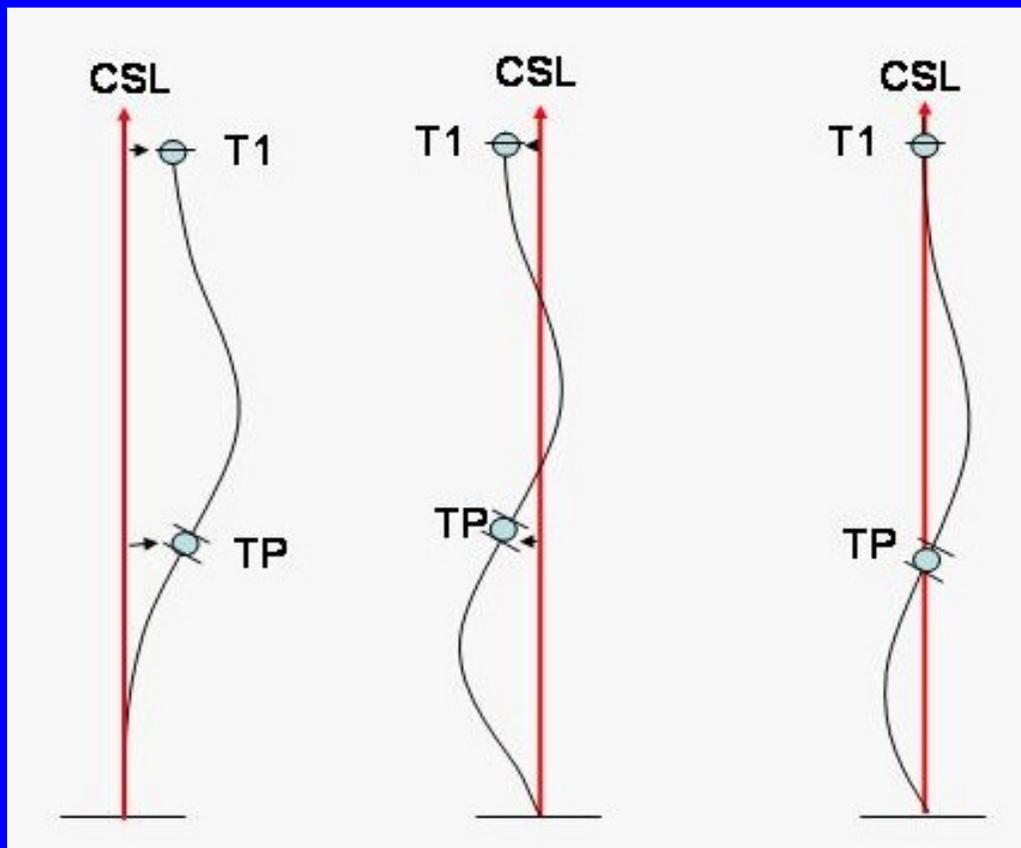
Major lumbar or TL / Minor Thoracic (Rigo)

Lonstein's Revision of the Moe & Ketleson (1970)

Double major = 2 structural curves with a Cobb angle not $\neq 5^\circ$

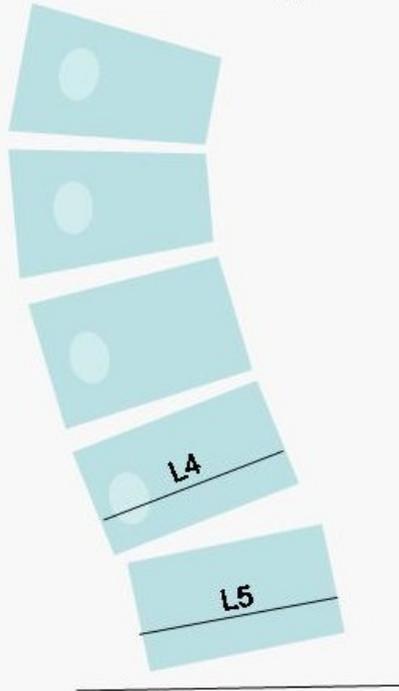


Radiologic Criteria 2 Transitional Point and T1 CSL Offset

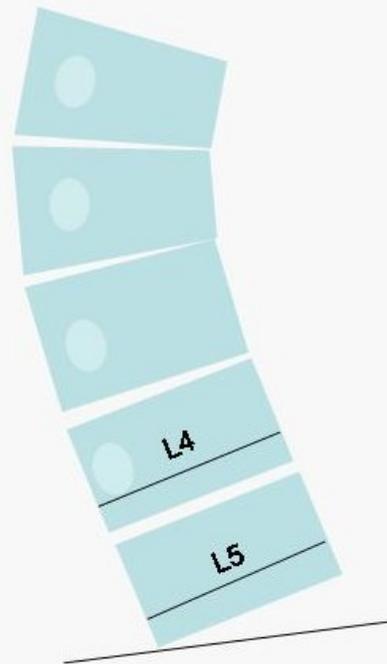


Radiologic Criteria 3 L5-L4 Counter-tilting

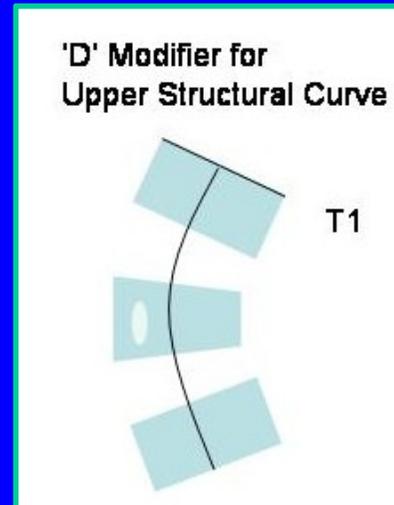
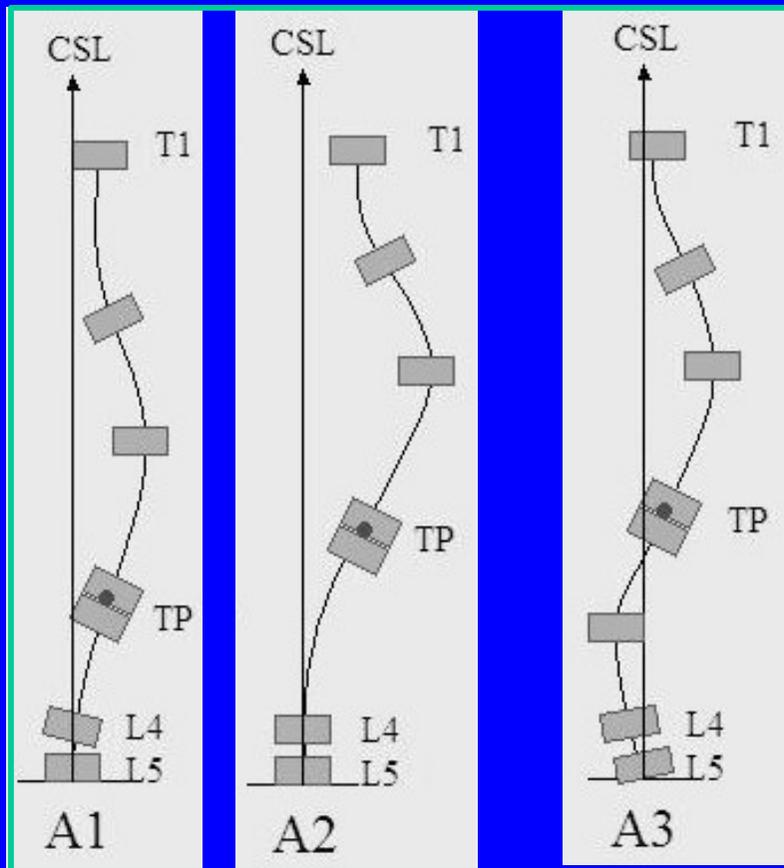
+ Counter-tilting



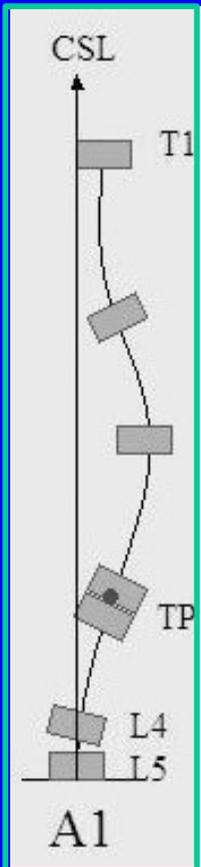
- Counter-tilting



Radiologic Criteria for Clinical 3 Curve Pattern (*Scoliosis 2010*, 5:1)



A1 type



Radiological
Criteria
1

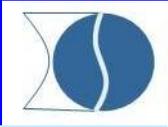
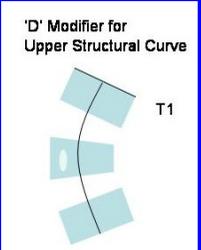
A1 = Long-Low thoracic
Apex = T9-11
L3 tilted to the convex thoracic side
L4 horizontal or tilted to the convex thoracic side

+

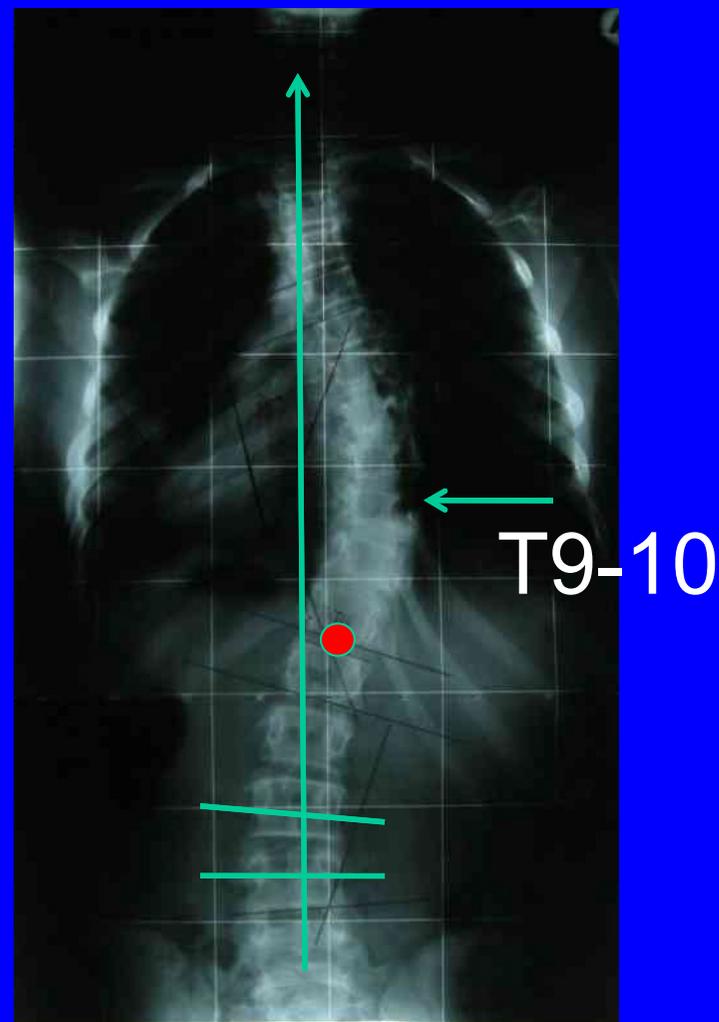
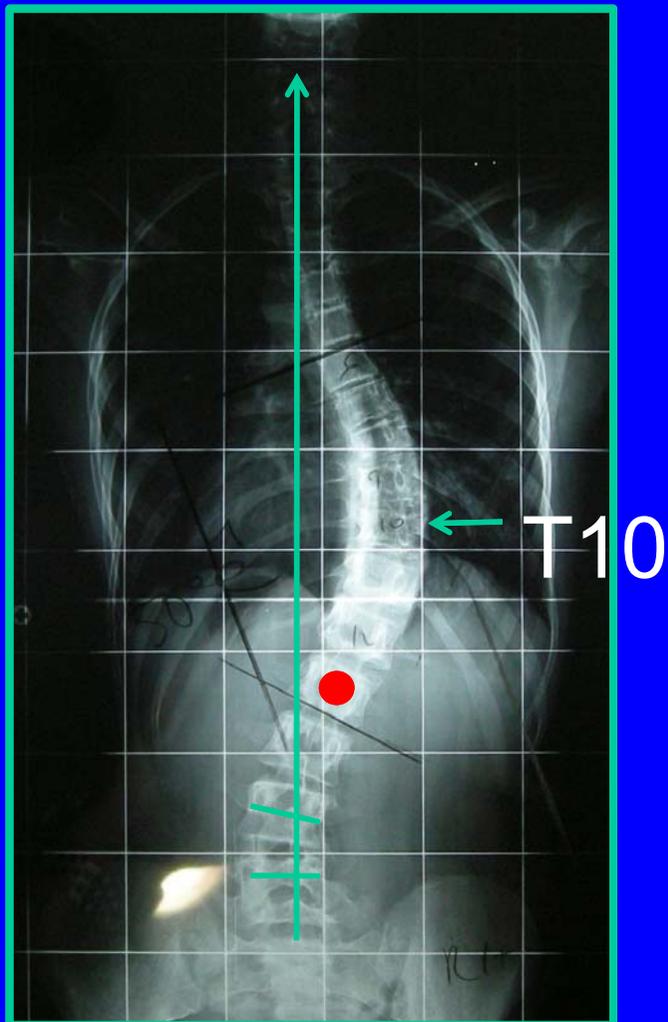
Radiological
Criteria
2

Transitional Point offset to the convex thoracic side
(100 % consistency)
T1 offset to the convex thoracic side
(Highly consistent, some times false negative)

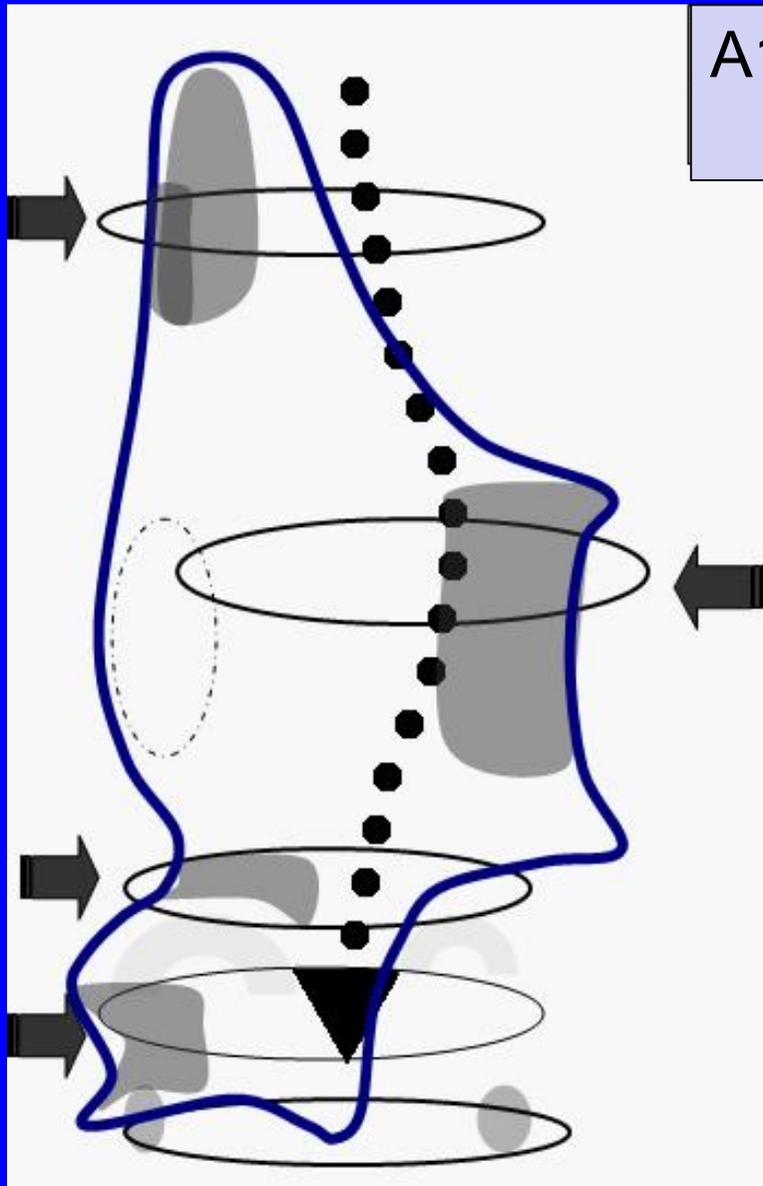
= A1 type confirmed
Just with radiological criteria 1 + 2
(with or without proximal - D mod)

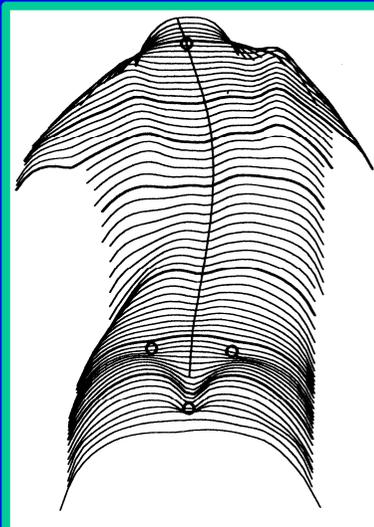


A1 Type (Radiological Criteria)



A1 Type design

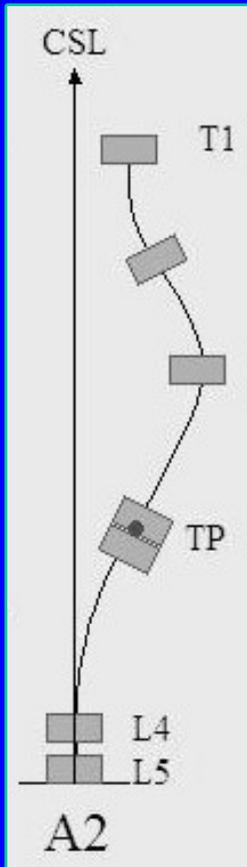




A1 Type design, Apex T11



A2 type



Radiological **A2 = Main Thoracic with non or minimal functional lumbar**
Criteria

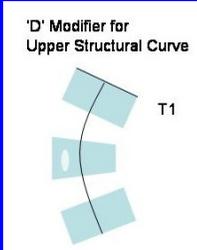
- 1 Apex = T8 (9)
- L3-L4 \pm horizontal

+

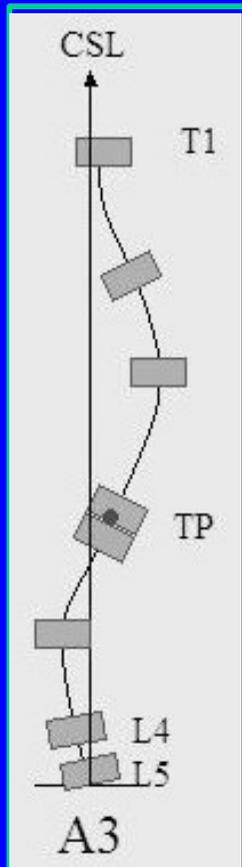
Radiological **Transitional Point offset to the convex thoracic side**
Criteria (100 % consistency)

- 2 T1 offset to the convex thoracic side
(Highly consistent, some times false negative)

= A2 type confirmed
Just with radiological criteria 1 + 2
(with or without proximal - D mod)



A3 type



Radiological **A3 = Main Thoracic with structural minor lumbar**

Criteria Thoracic Apex = T8 (T9)

1 Lumbar Apex = L2-3

L4 tilted to the concave thoracic side

+

Radiological **Transitional Point offset to the convex thoracic side**

Criteria (100 % consistency)

2 T1 offset to the convex thoracic side

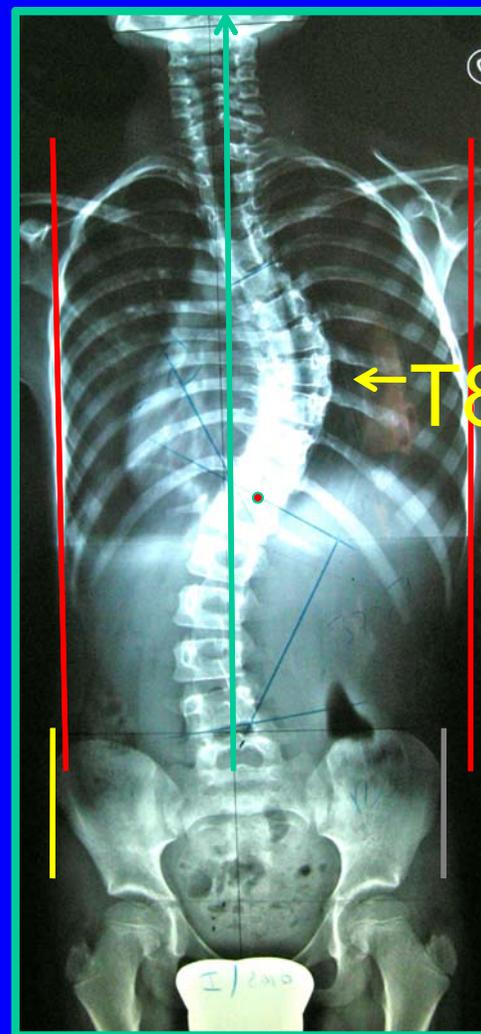
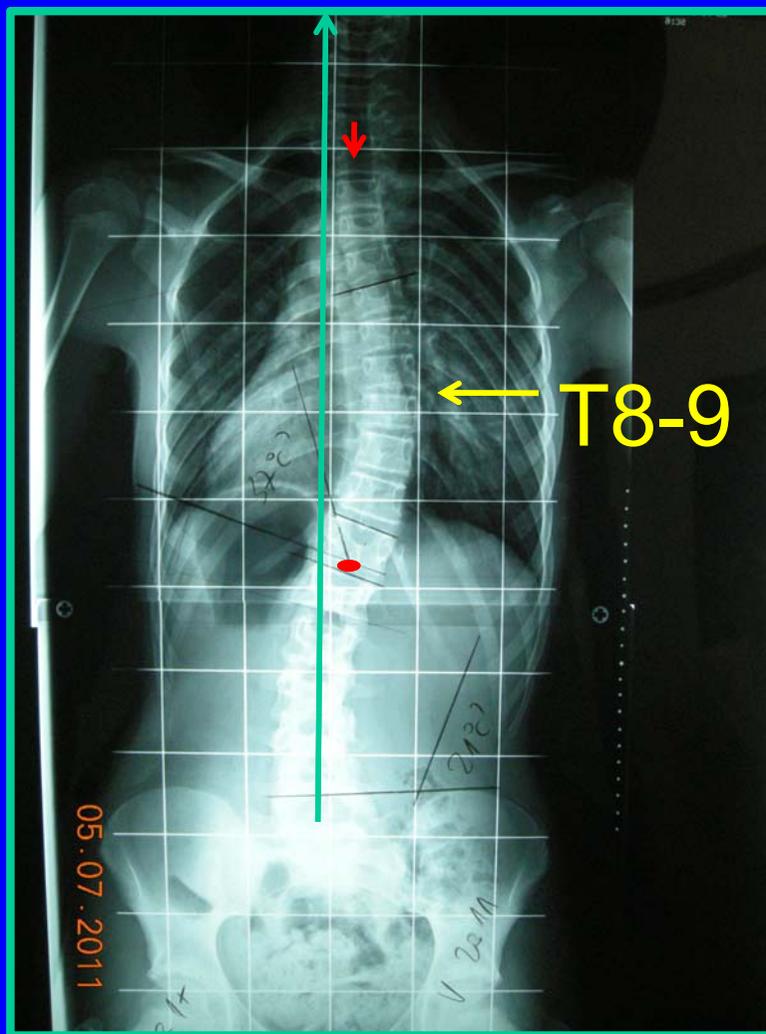
(Highly consistent, some times false negative)

= **A3 type confirmed**

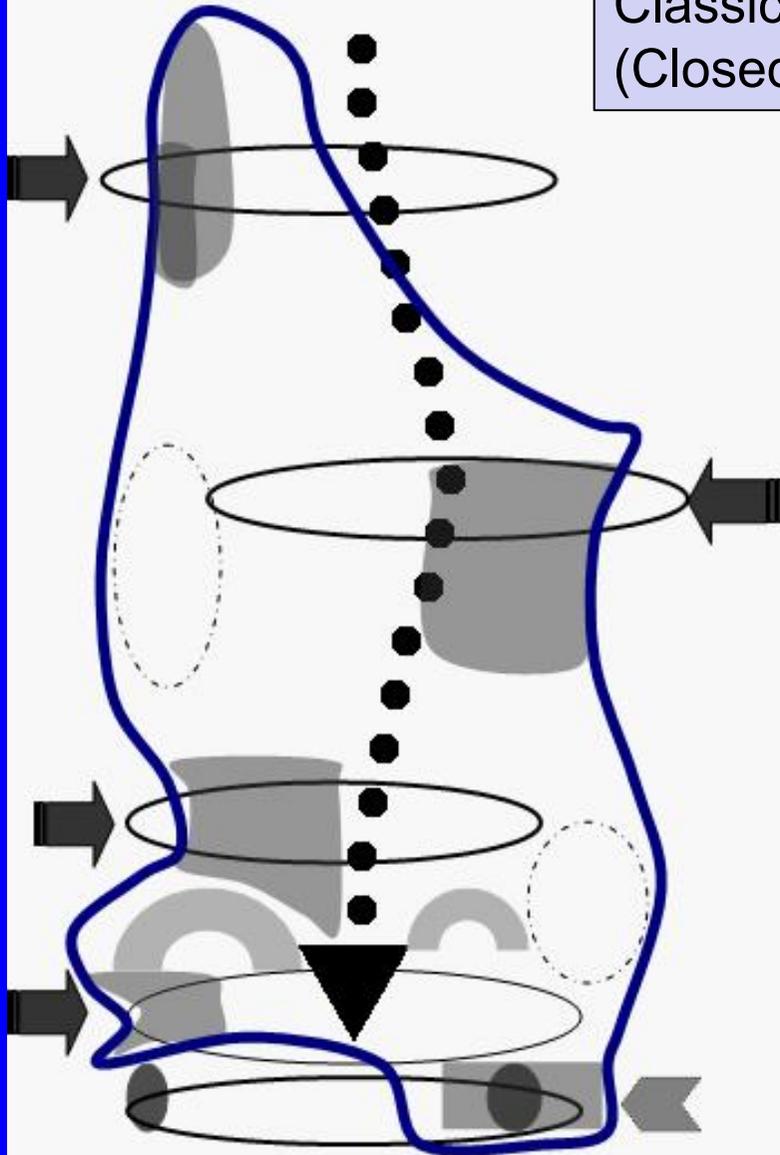
Just with radiological criteria 1 + 2
(with or without proximal - D mod)



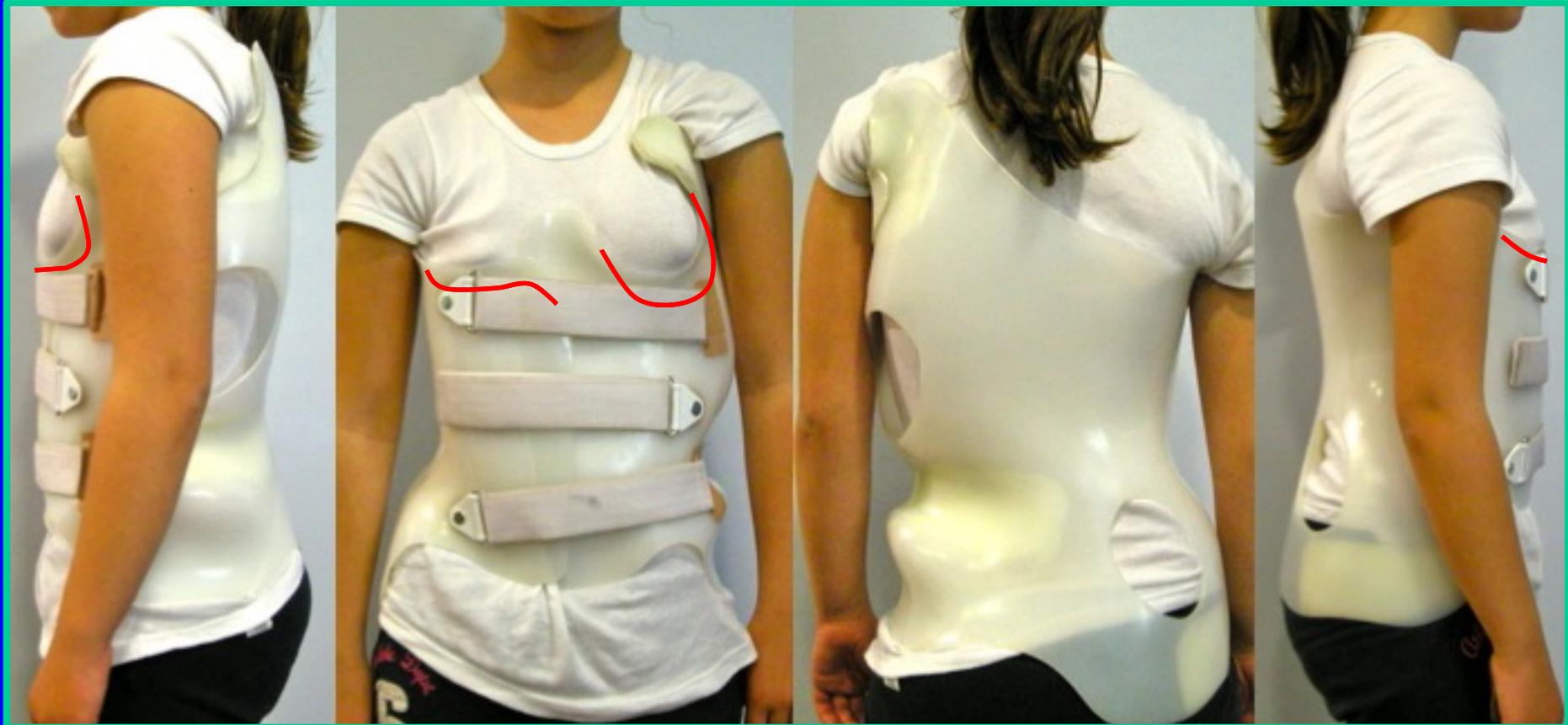
A2 and A3 Types



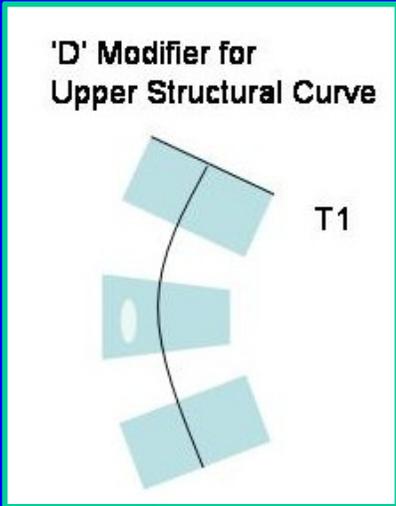
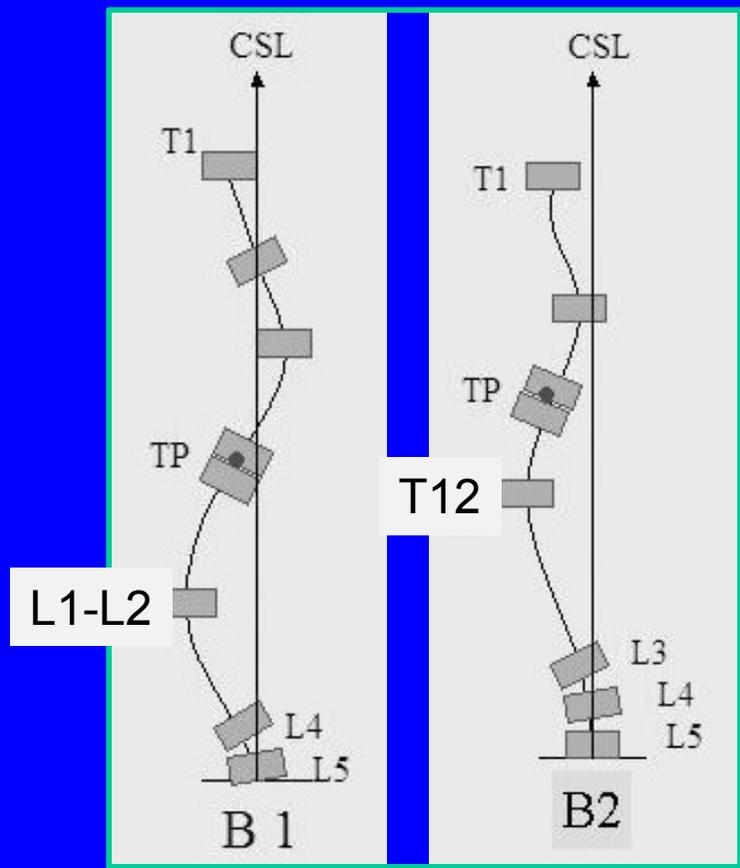
Classic 3C design for Types A2 and A3
(Closed Pelvis)



A2/A3 Type Design

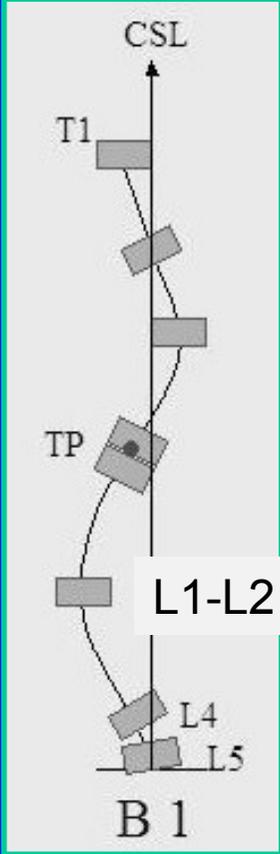


Radiologic Criteria for Clinical 4 Curve Pattern (Scoliosis 2010, 5:1)



Classification and blueprints

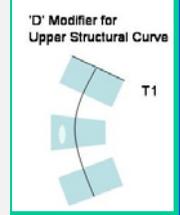
B1 Type



Radiologic
al
Criteria
1

+

B1 = Double Major Thoracic/Lumbar or TL; or Combined Major Lumbar or TL/minor Thoracic; or Combined Major Thoracic/minor Lumbar or TL
Thoracic Apex = T7-8-9
Lumbar Apex = L2 (L3) or Low TL Apex = L1



Radiological
Criteria
2

+

Transitional Point offset to the concave thoracic side
(100 % consistency)
T1 offset to the concave thoracic side
(100 % consistency)

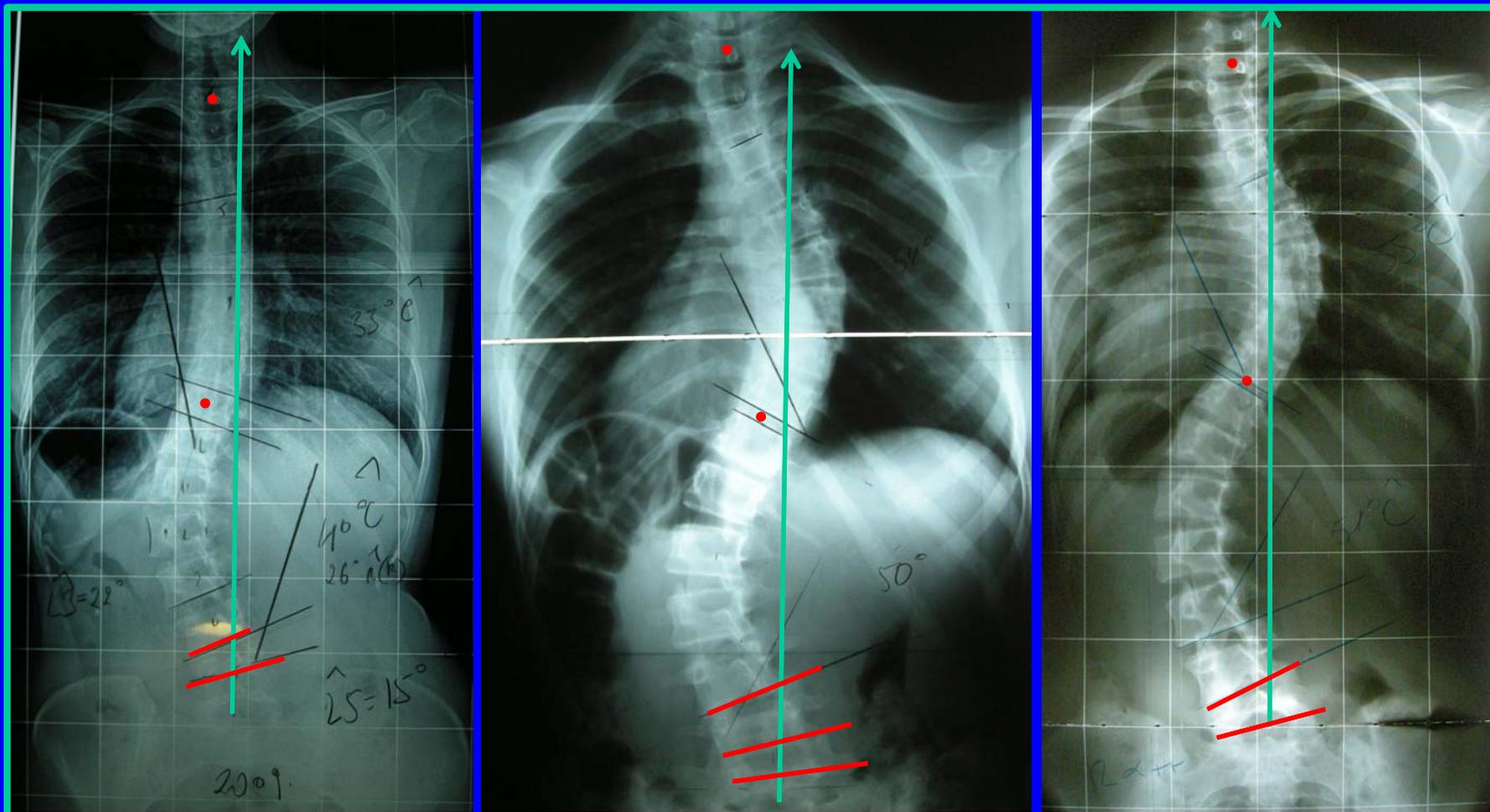
Radiological
Criteria
3

Positive L4-L5 counter-tilting
(100 % consistency)
Sometimes L3-L4 counter-tilting

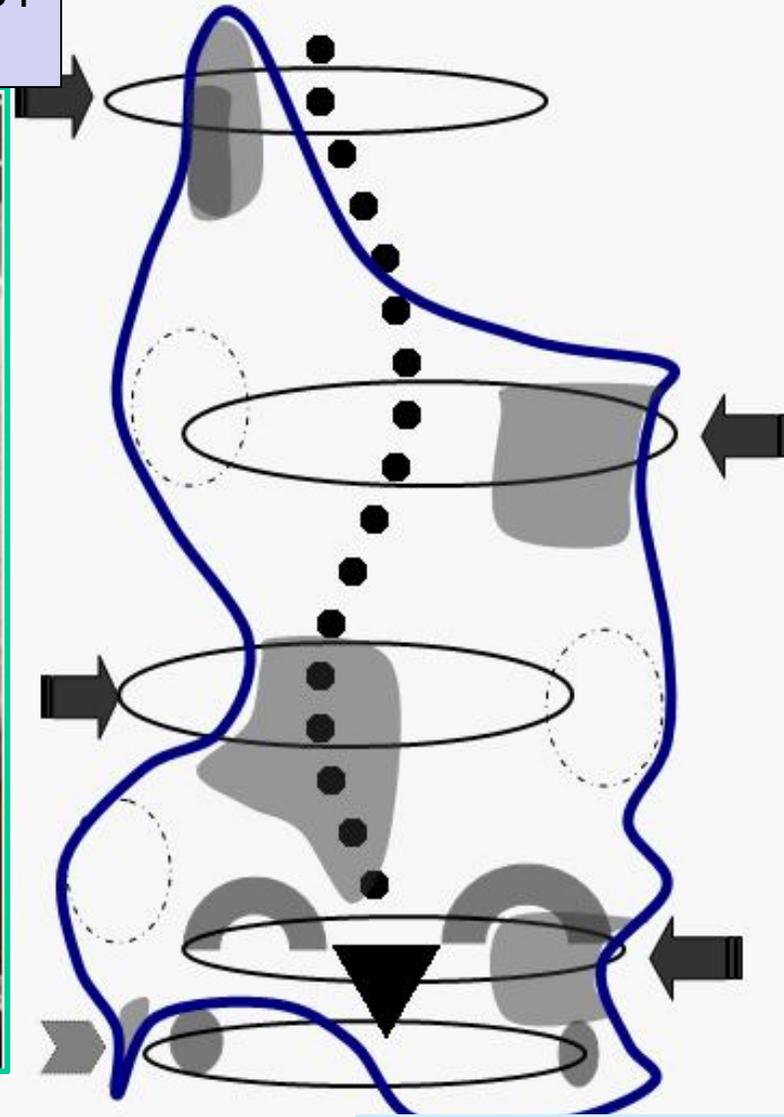
= **B1 type confirmed**
With radiological criteria 1 + 2 + 3
(with or without proximal - D mod)



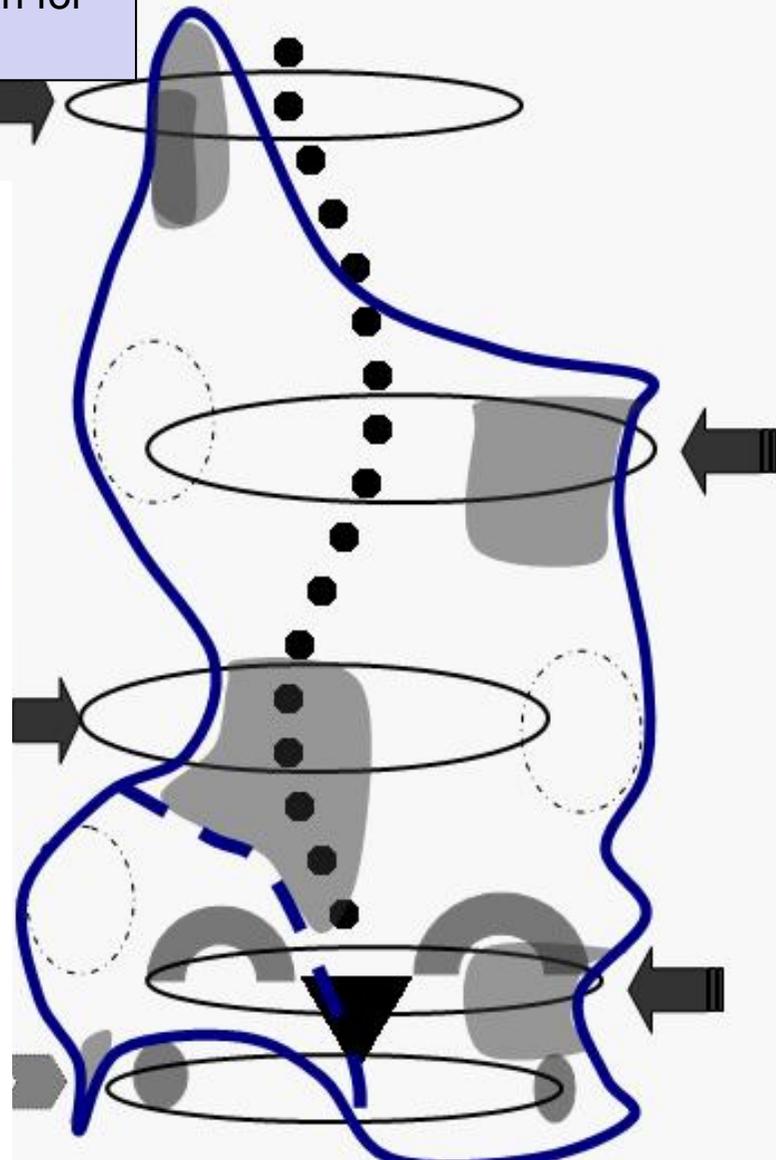
Examples of B1 Type



Classic 4C Design for Type B1
'Closed Pelvis'



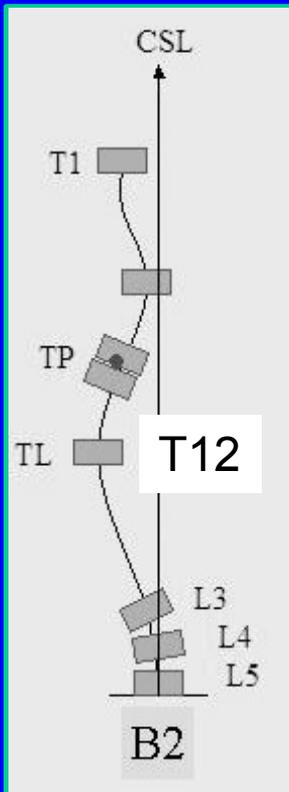
Modified –already classic- 4C Design for
Type B1 ‘Open Pelvis’.



B1 Type Design (open)



B2 Type



Radiological
Criteria
1

**B2 = Double Major Thoracic/High TL; or
Combined Major High TL/minor Thoracic;
or**

+

Combined Major Thoracic/minor High TL
Thoracic Apex = T7 (T8)
High TL Apex = T12

Radiological
Criteria
2

**Transitional Point offset to the concave thoracic side
(100 % consistency)**

+

**T1 offset to the concave thoracic side
(100 % consistency)**

Radiological
Criteria
3

**Positive L4-L5 counter-tilting
(100 % consistency)**

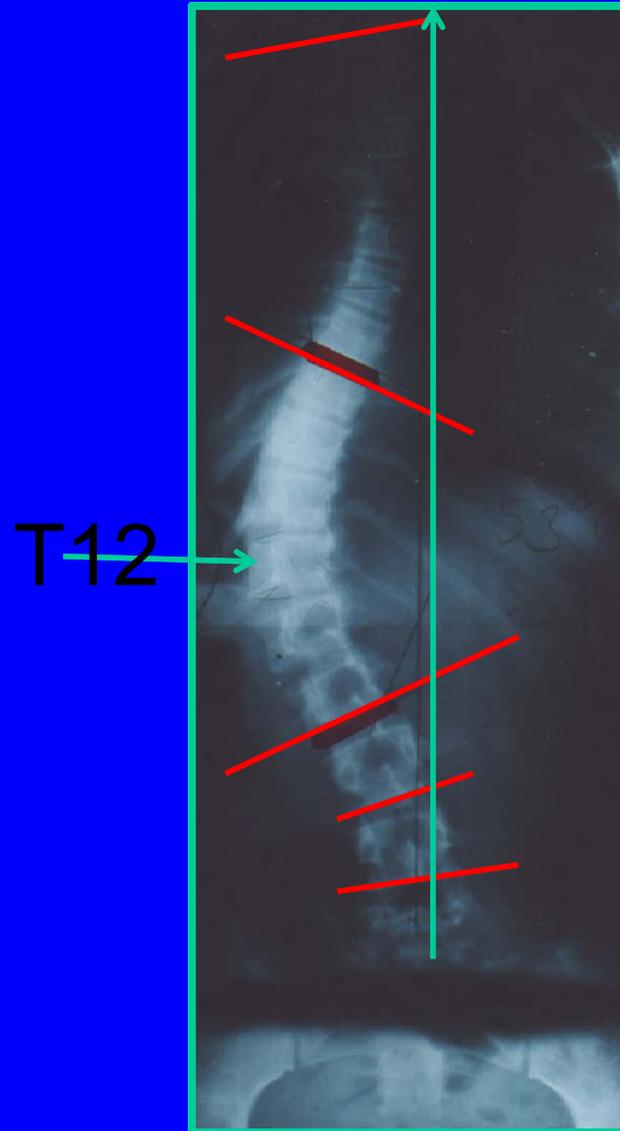
L3-L4 counter-tilting (Highly consistent). L2-3 possible

= B2 type confirmed

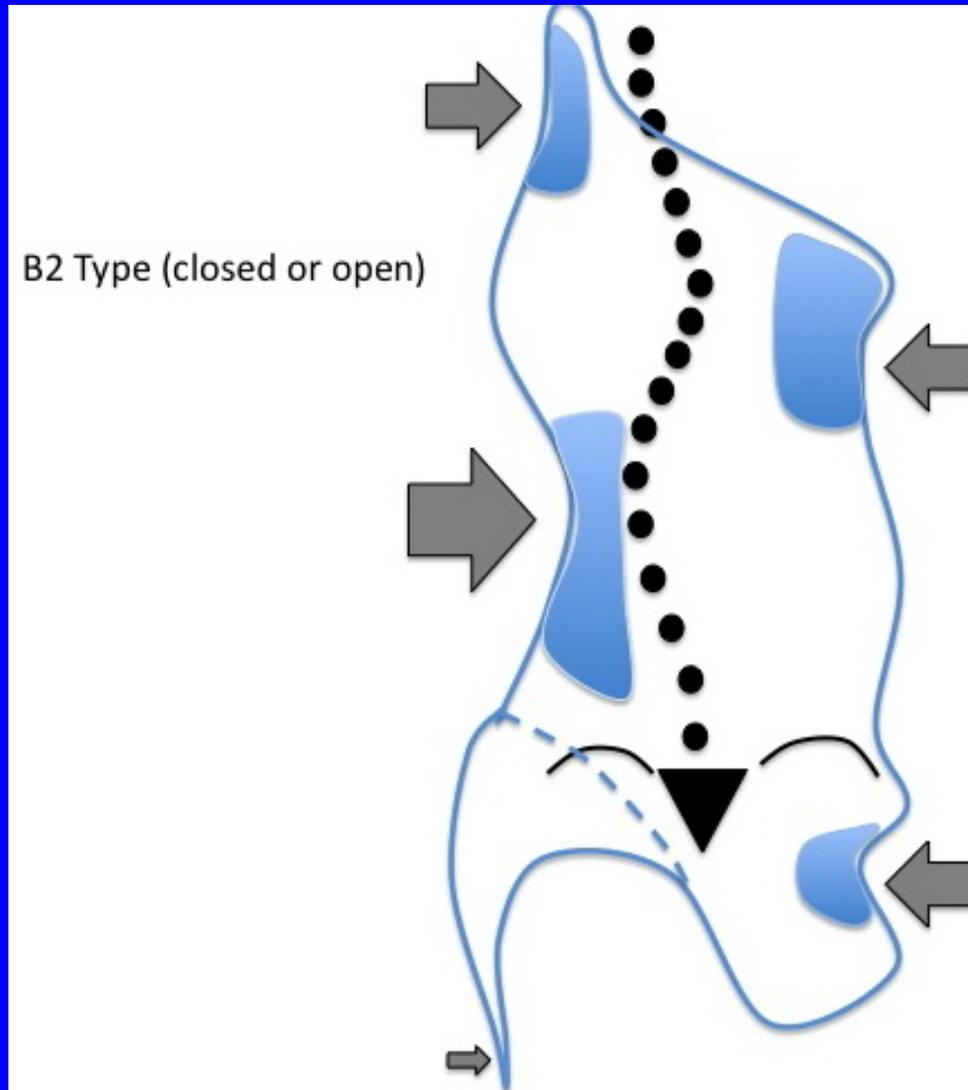
With radiological criteria 1 + 2 + 3
(No D modifier reported in this type)



Example of B2 Type



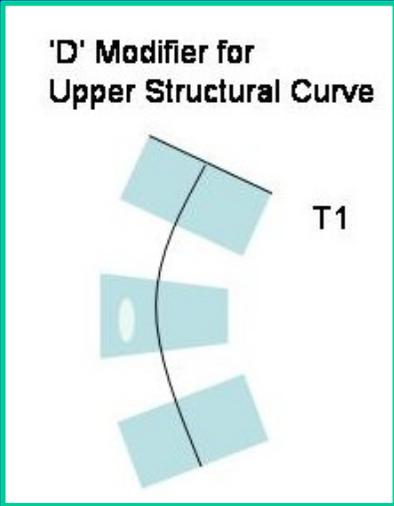
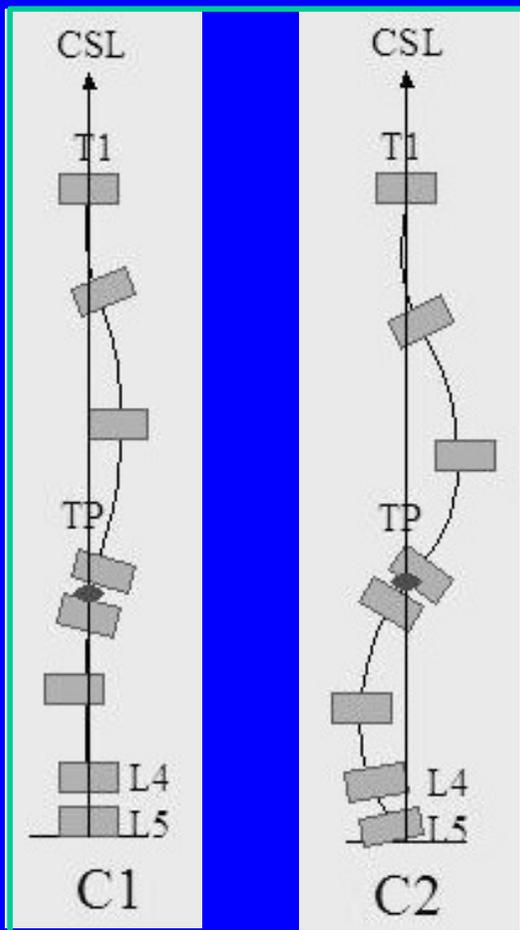
4C Design for Type B2 type with TL pad. Pelvis closed or open



B2 is very rare. First B2 type design (2000 or earlier)



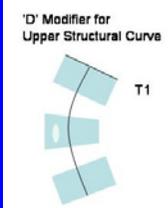
Radiologic Criteria for Clinical N3N4 Curve Pattern (Scoliosis 2010, 5:1)



C1 Type

Radiological Criteria
1

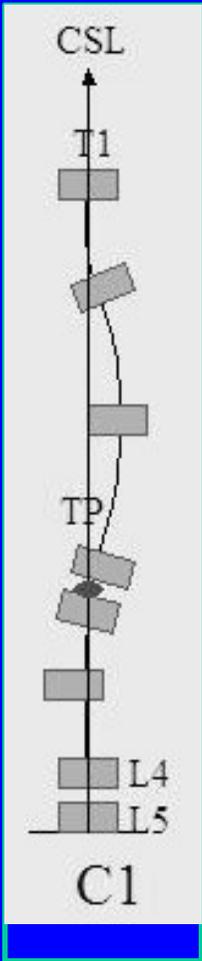
C1 = Single Thoracic with no Lumbar curve
Thoracic Apex = T8 (T7-T9)



+

Radiological Criteria
2

Transitional Point ± balanced or minimal offset to the convex thoracic side
T1 ± balanced or minimal offset to the concave thoracic side (very often to the convex -D)

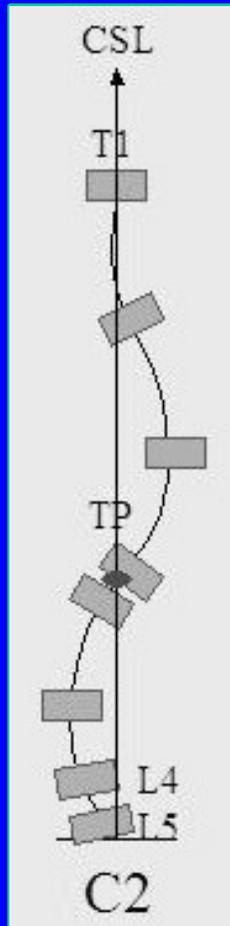


As far as there is no structural lumbar curve L4-L5 counter-tilting is negative

= C1 type confirmed
With radiological criteria 1 + 2 (without or with D)



C2 Type



Radiological
Criteria
1

+

Radiological
Criteria
2

+

Radiological
Criteria
3

C2 = Combined Thoracic Major/Lumbar Minor (Both structural)

Double Major Thoracic/Lumbar

Thoracic Apex = T8 (T7-T9)

Lumbar apex L2 / TL = L1

Transitional Point ± balanced or minimal offset to the convex thoracic side

T1 ± balanced or minimal offset to the concave thoracic side (very often to the convex -D)

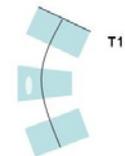
Negative L4-L5 Counter-tilting (False 4C)

(False positive due to real LLD on the convex thoracic side)

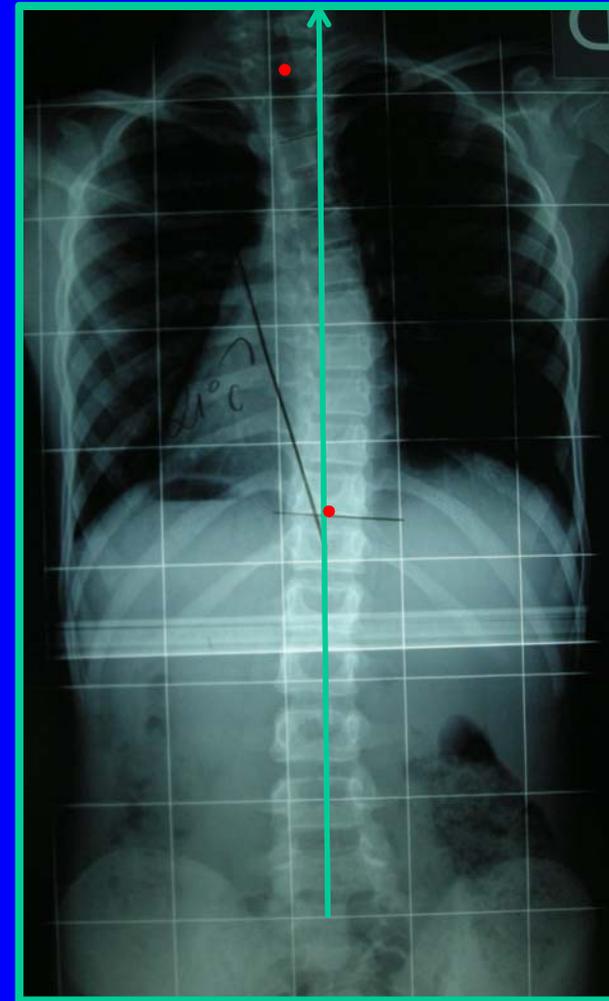
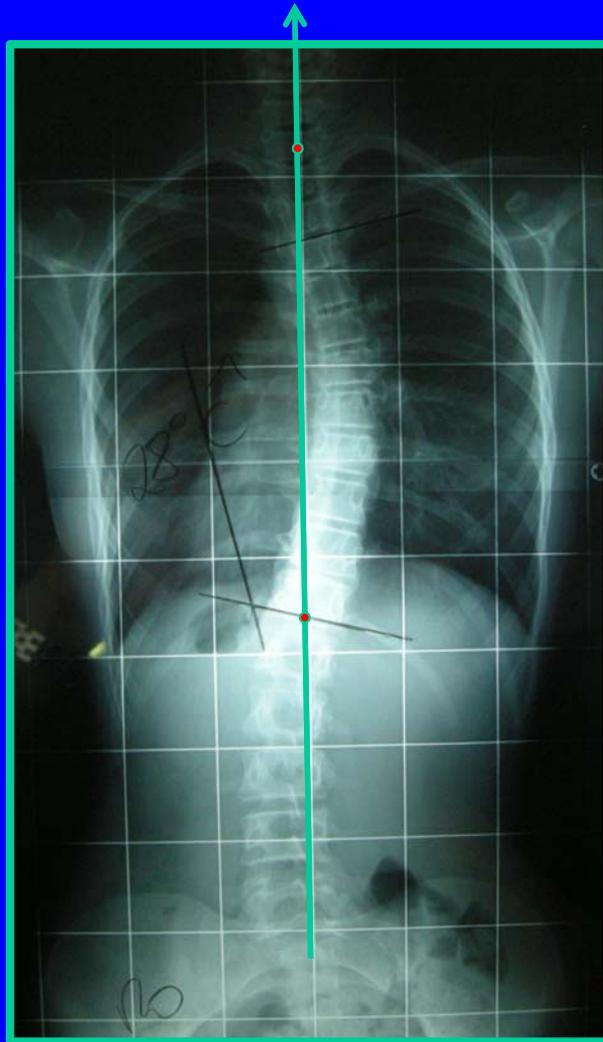
= C2 type confirmed

With radiological criteria 1 + 2 + 3 (without or with D)

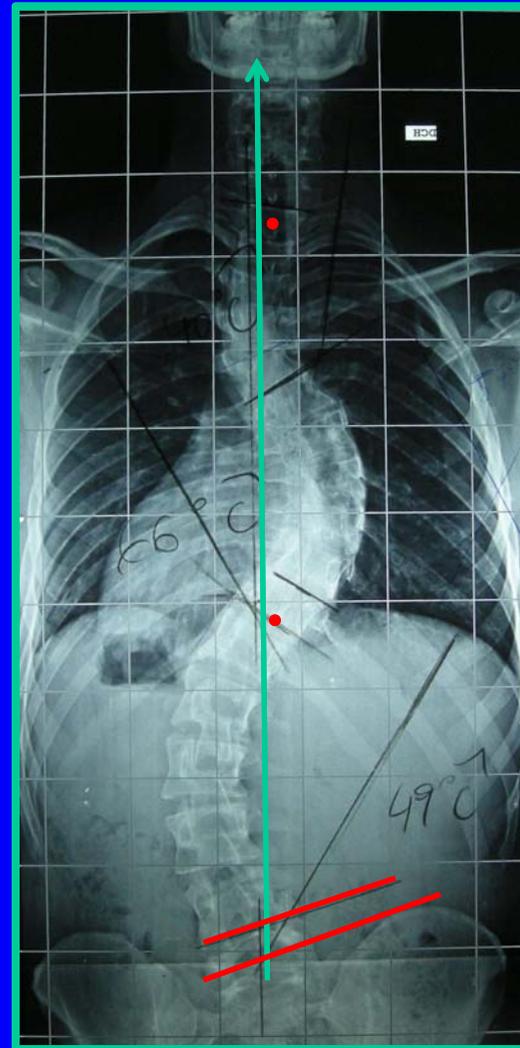
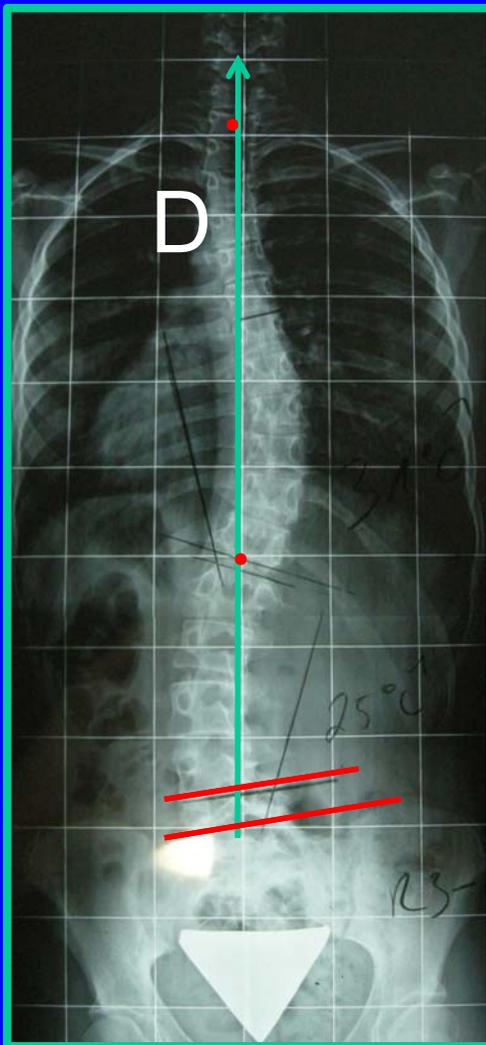
'D' Modifier for Upper Structural Curve



Examples of C1 Type

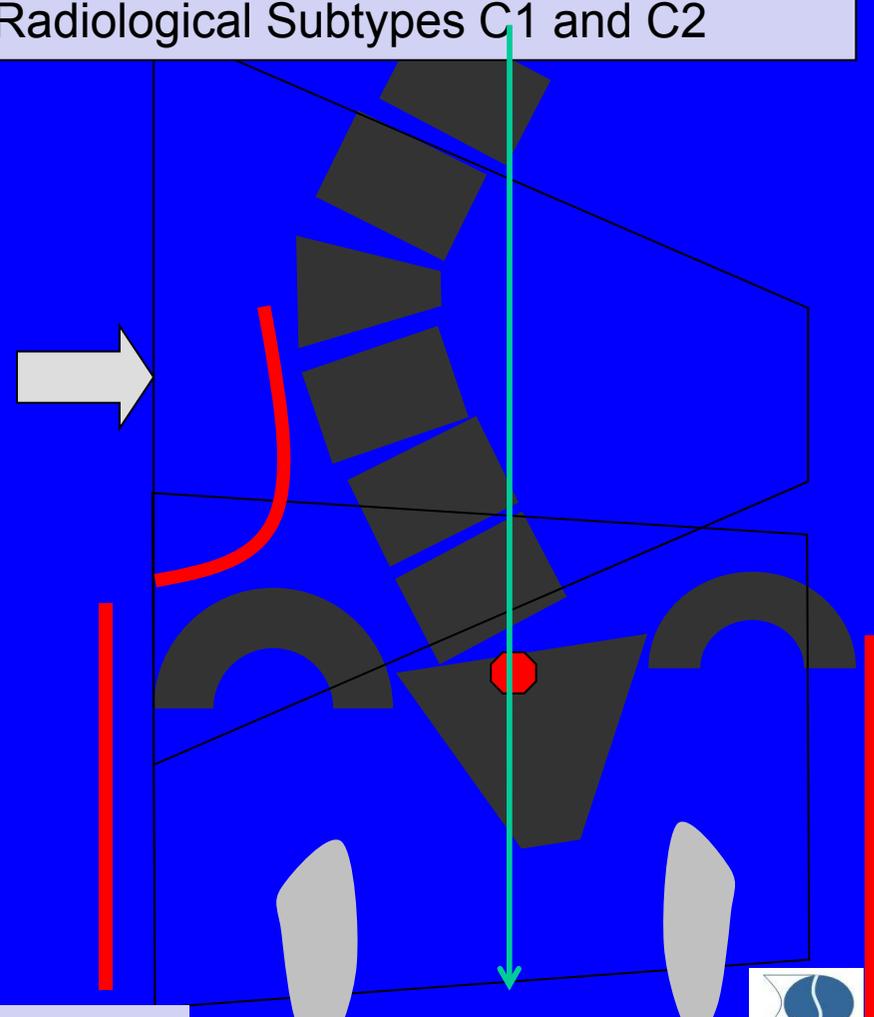
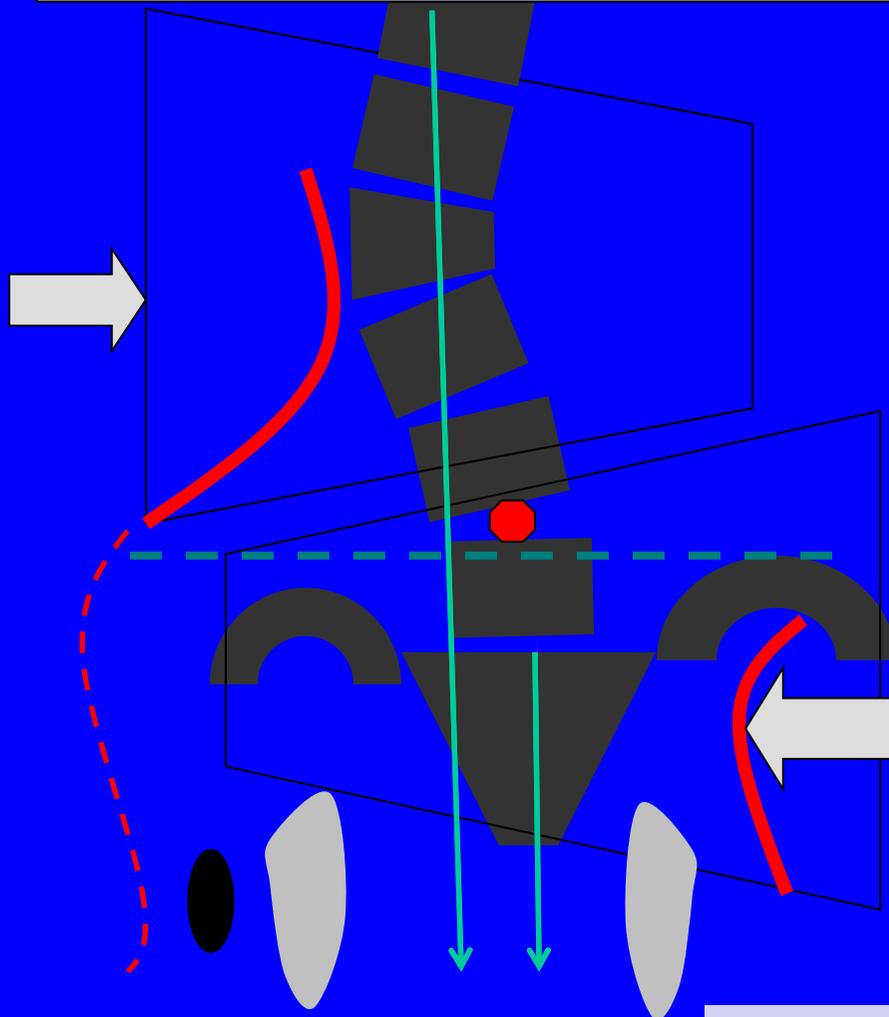


Examples of C2 Type



Correction in Clinical 4 Curve Pattern
Radiological Subtypes B1 and B2

Correction in Clinical N3N4 Curve Pattern
Radiological Subtypes C1 and C2



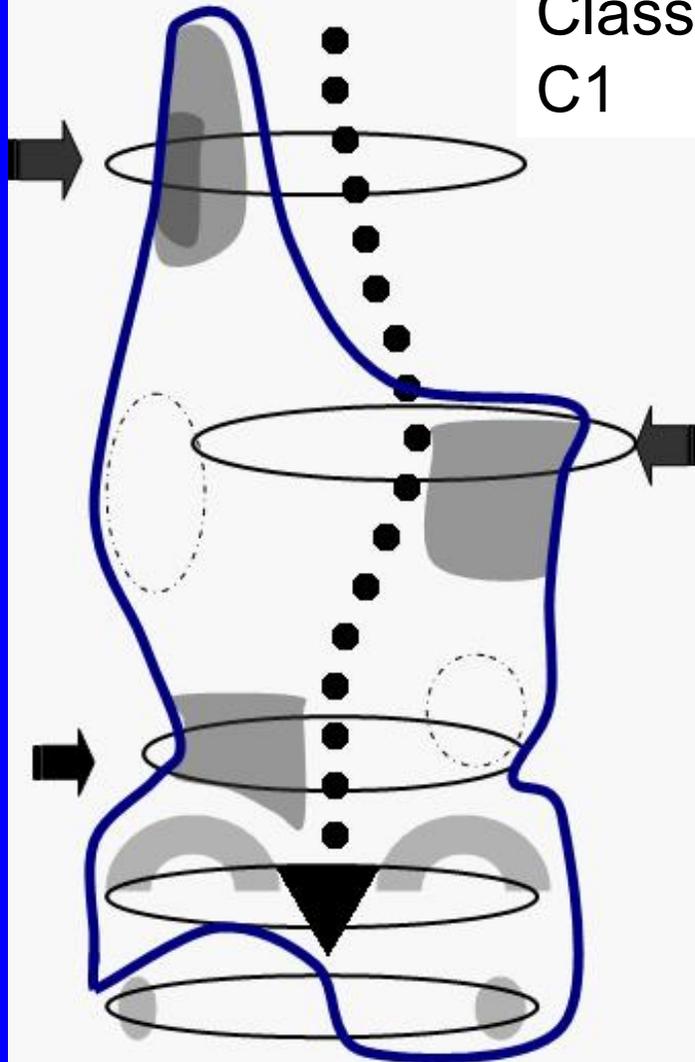
TP CSL

TP= Transitional Point
CSL= Central Sacral Line

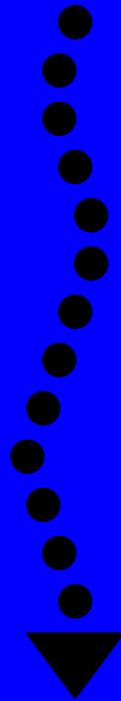
TP and CSL



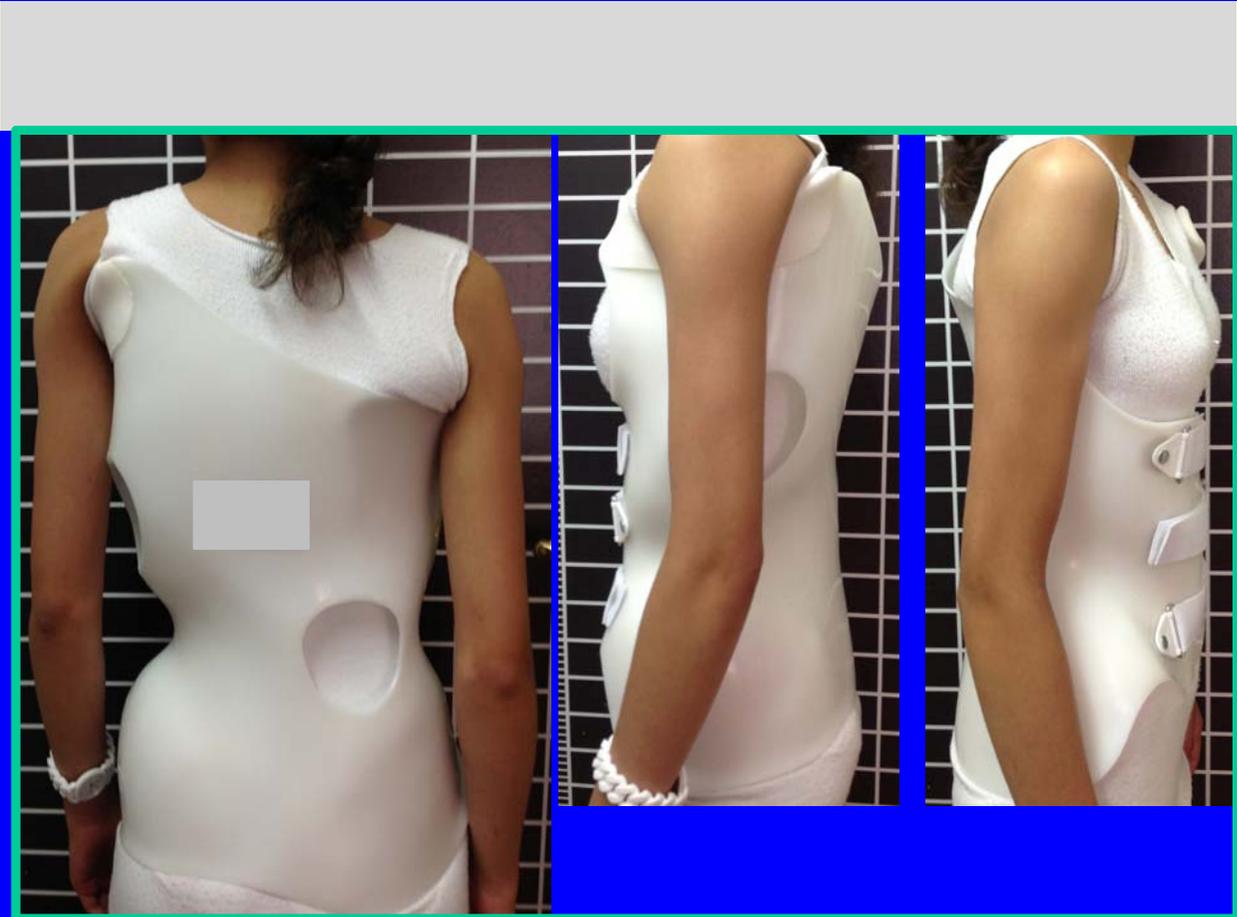
Classical design for C1



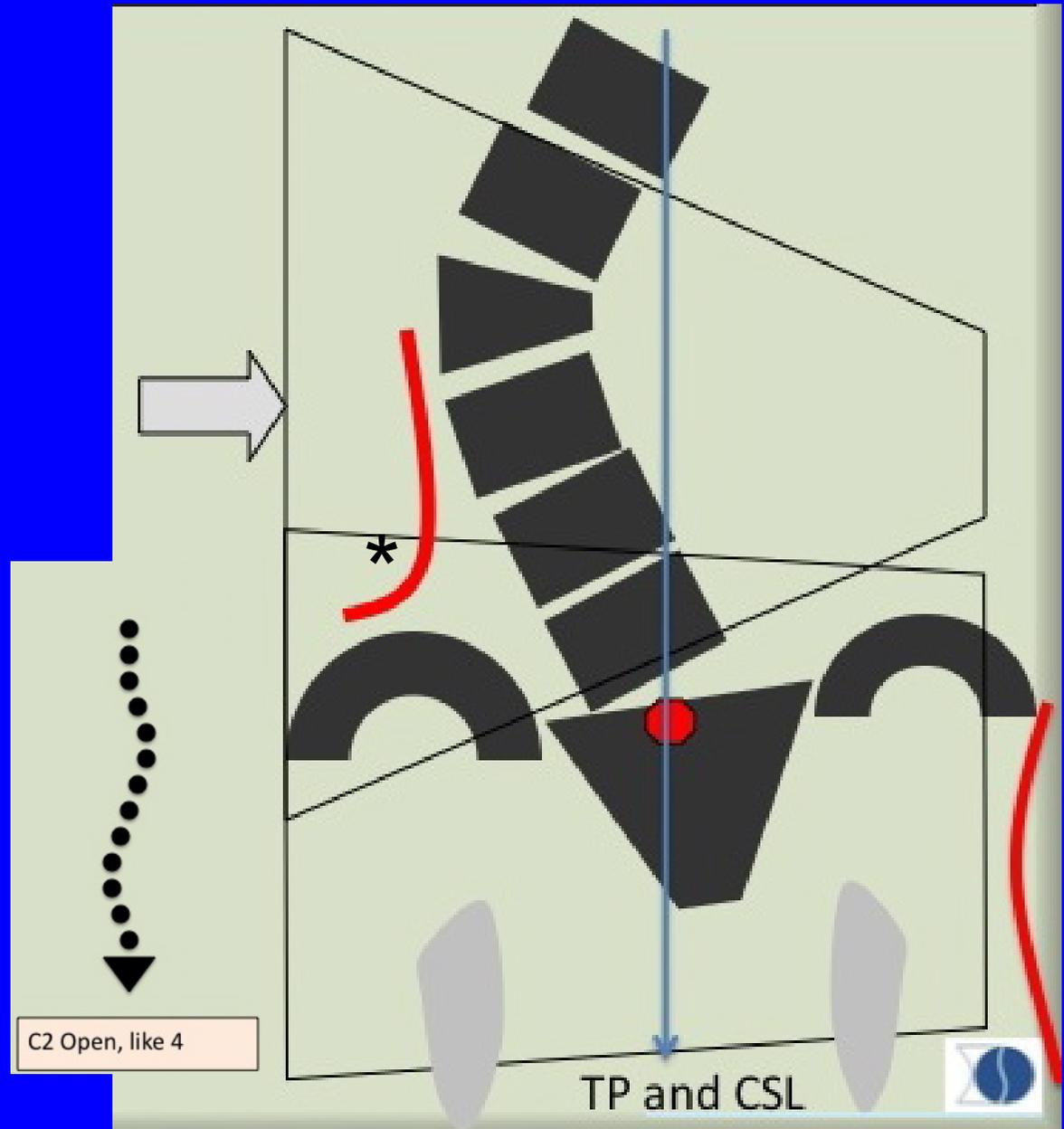
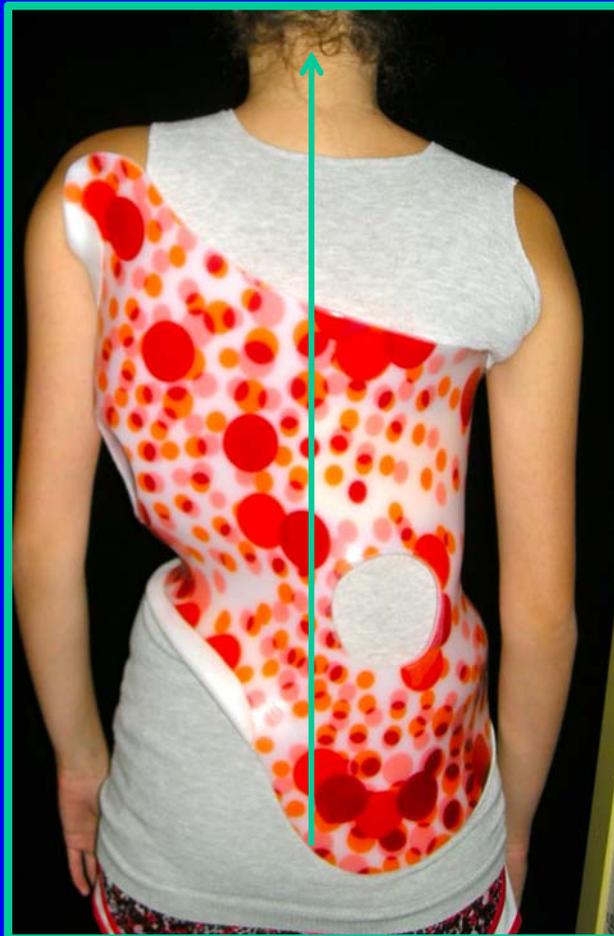
C2 Type Design – with D



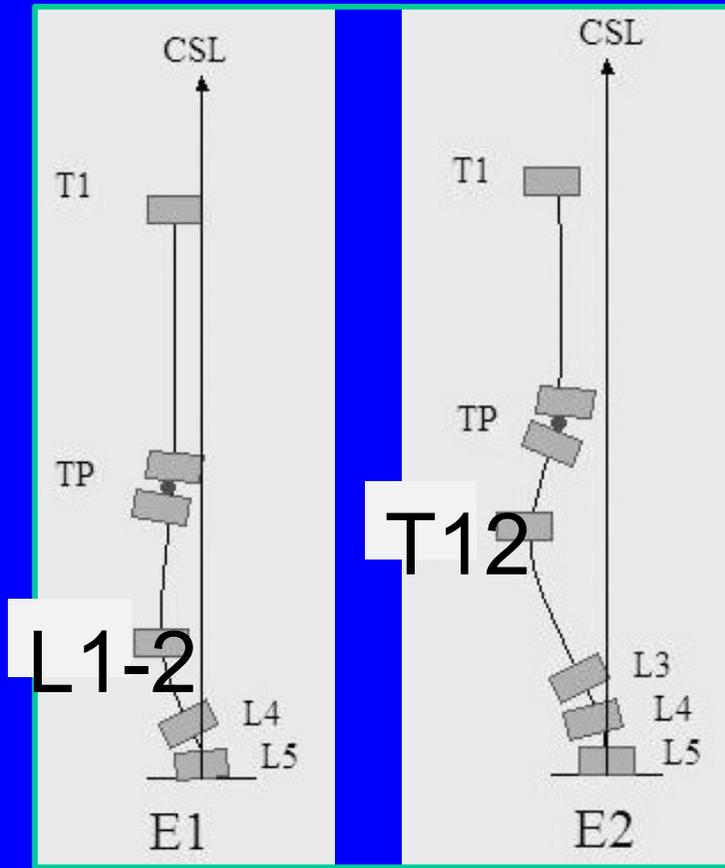
C2, with D



C2 Type Like B1 (pelvis approach C2 *)



Radiologic Criteria: Lumbar/Thoracolumbar Patterns



It is like B type but with NO structural curve



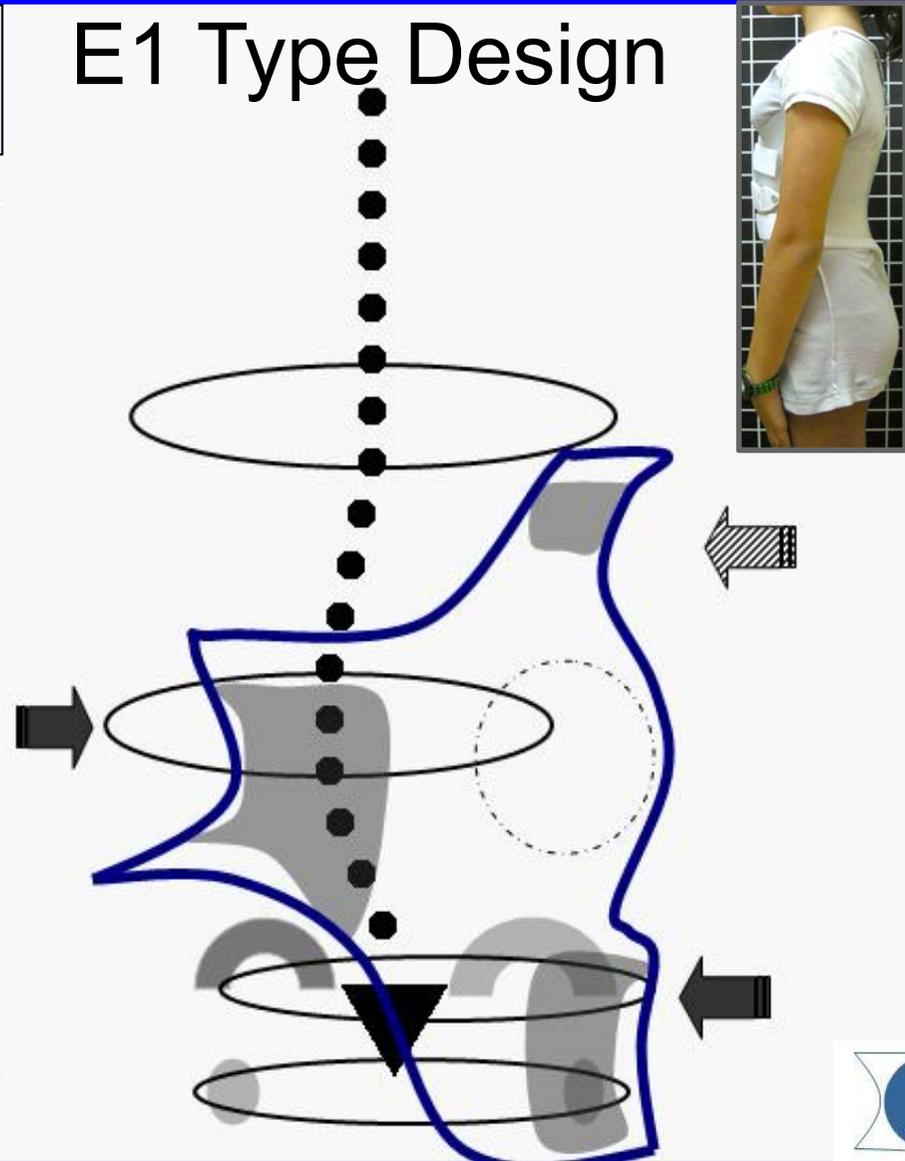
Examples of E1/E2 Types



E1 type – Left convex
L1



E1 Type Design



E1-E2 Border Type (T12-L1) – Right convex



The importance of the sagittal profile

→ Kotwicki T, Chêneau J: Biomechanical action of a corrective brace on thoracic idiopathic scoliosis: Chêneau 2000 orthosis. *Disabil Rehabil Assist Technol* **2008**, 3(3):146-153

→ K Zaborowska-Sapeta et al: Effectiveness of Chêneau brace treatment for idiopathic scoliosis: Prospective study in 79 patients followed to skeletal maturity. *Scoliosis* **2011**: 6:2



Good results from a 'Working Integrated Rehabilitation Team' using right Biomechanical principles and 'custom Cheneau brace'

Some studies showing good results in patients treated with 'Custom Chêneau Type Brace'

Weiss HR, Weiss G, Schaar HJ: Incidence of surgery in conservatively treated patients with scoliosis. *Pediatr Rehab* **2003**, 6 (3-4): 111-206

Rigo M et al: Retrospective results in immature idiopathic scoliosis patients treated with a Chêneau brace. *Studies in Health Technology and Informatics* **2002**, 88: 241-245

Landauer F, Wimmer C, Behensky H: Estimating the final outcome of brace treatment for idiopathic thoracic scoliosis at 6-month follow-up. *Pediatr Rehab* **2003**, 6 (3-4): 201-207

Rigo M, Reiter C, Weiss HR: Effect of conservative management on the prevalence of surgery in patients with adolescent idiopathic scoliosis. *Pediatr Rehab* **2003**, 6(3-4): 209-221

Ovadia D, Eylon S, Mashiah A, Wientroub S, Lebel ED: Factors associated with the success of the Rigo System Chêneau brace in treating mild to moderate adolescent idiopathic scoliosis. *J Child Orthop* **2012**, 6:327-331

Conclusion

- 1) The original Chêneau Brace, when performed with a proper design, provides the necessary 3D correction
- 2) The Chêneau type brace is not an orthopaedic product but a corrective concept. Knowledge and experience are necessary to produce the expected results

