Relationship Between Rib Hump and Three-dimensional Spinal Deformity in AIS

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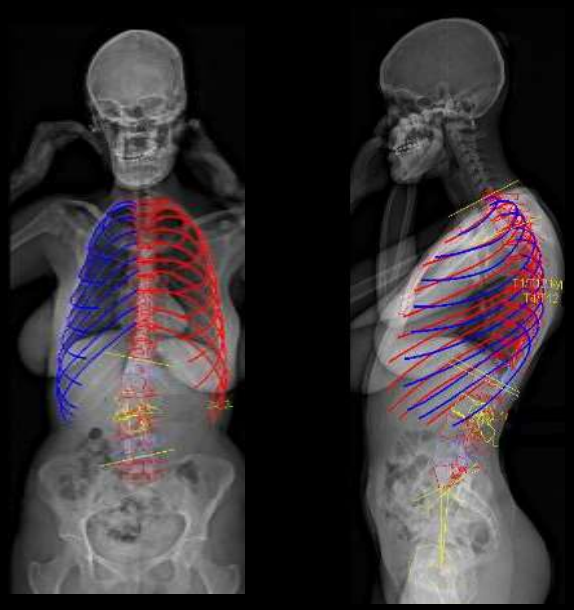
Background

- **Adolescent Idiopathic Scoliosis (AIS) is the 3D deformity of:**
  - spine + rib cage
- **Subjects with AIS often seek treatment with the aim of correcting their rib hump.**
- **Current surgical treatment for AIS mainly focuses on the correction of the spinal deformity.**



Lenke LG, 2001
Shi Z, 2013
Schwieger, 2016

It is not yet known how the rib hump is related to the 3D spinal deformity

Aim

Quantify the **relationship** between the
rib cage deformity &
3D spinal deformity in subjects with AIS

Population

122 pre-operative AIS

101 F

Age: 14.6±1.8 years

Type of scoliosis:

- Thoracic T: 78
- ThoracoLumbar TL: 44

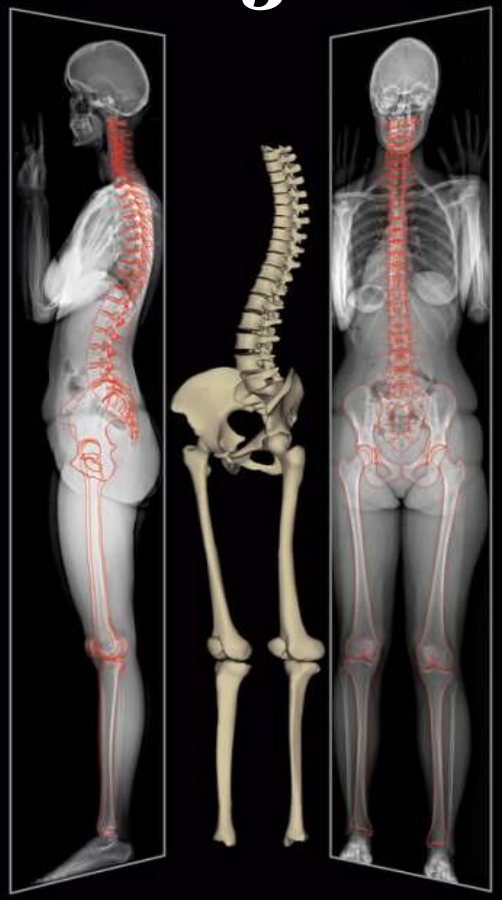
Cobb: 41±20° [10-110°]

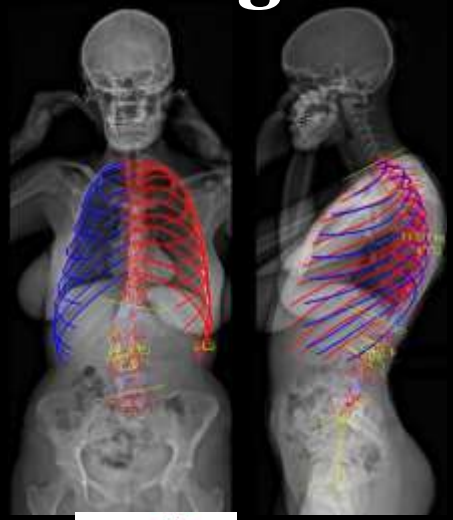
60 Controls
41 F

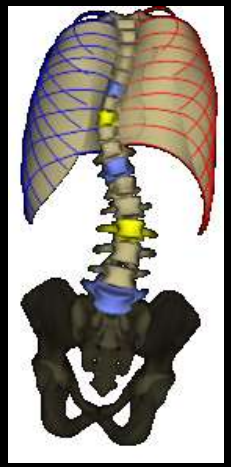
IRB approval USJ – FM 300

Low dose EOS® biplanar Xrays

3D reconstruction of : Spine + Rib Cage







Aubert B et al., 2016
Dubousset et al., 2005

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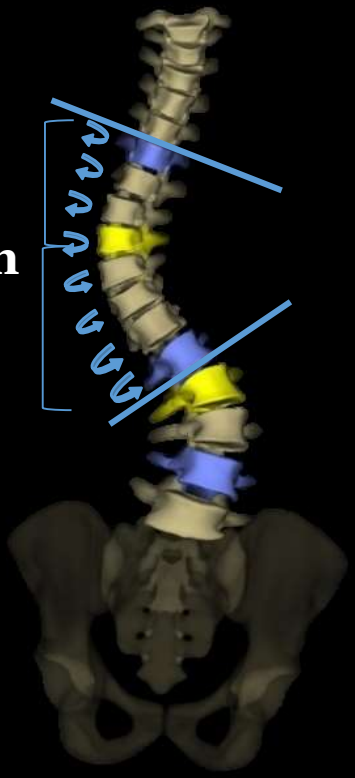
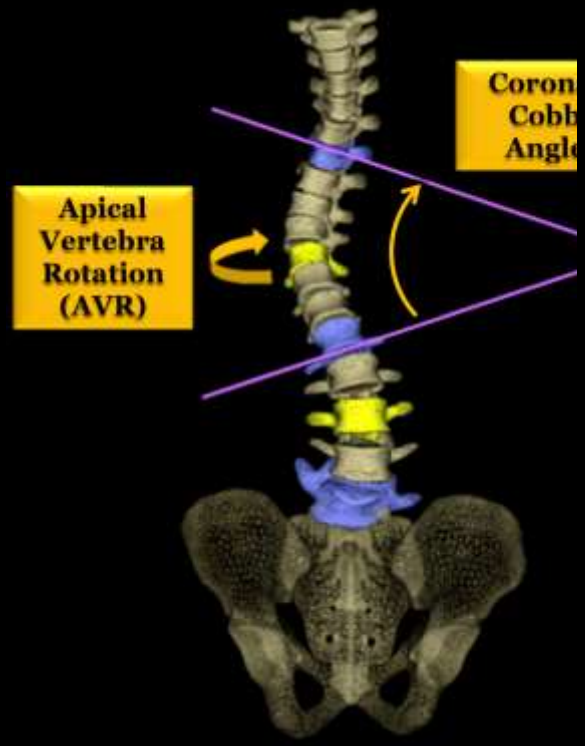
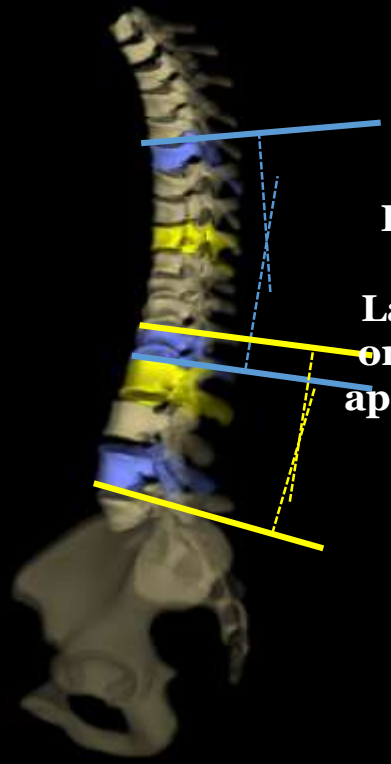
Spino-pelvic parameters

Σ Torsion Index





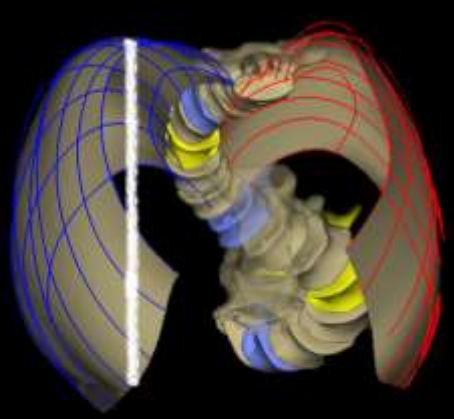


HypoKyphosis Index:
Lack of kyphosis or lordosis at the apex, compared to controls

Skalli W. et al., 2016

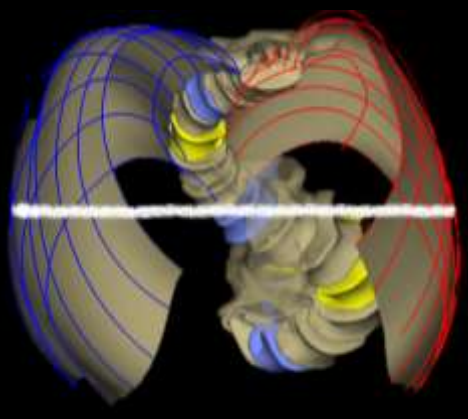
Rib cage parameters

Maximum thickness



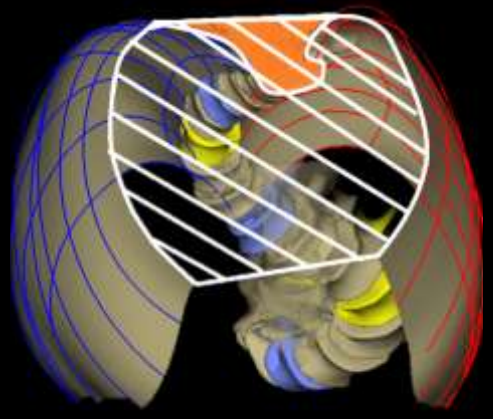
(mm)

Maximum width



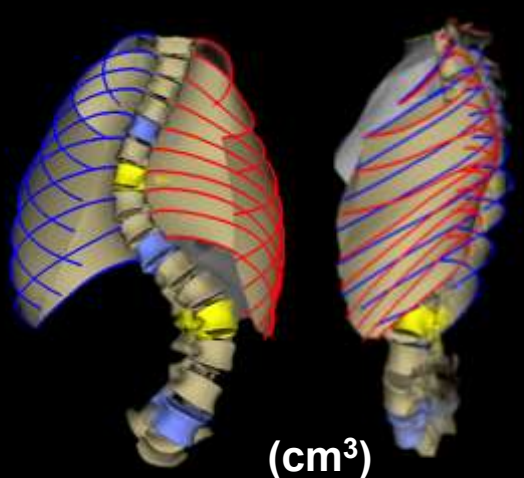
(mm)

Volumic Spine Penetration Index SPI



(%)

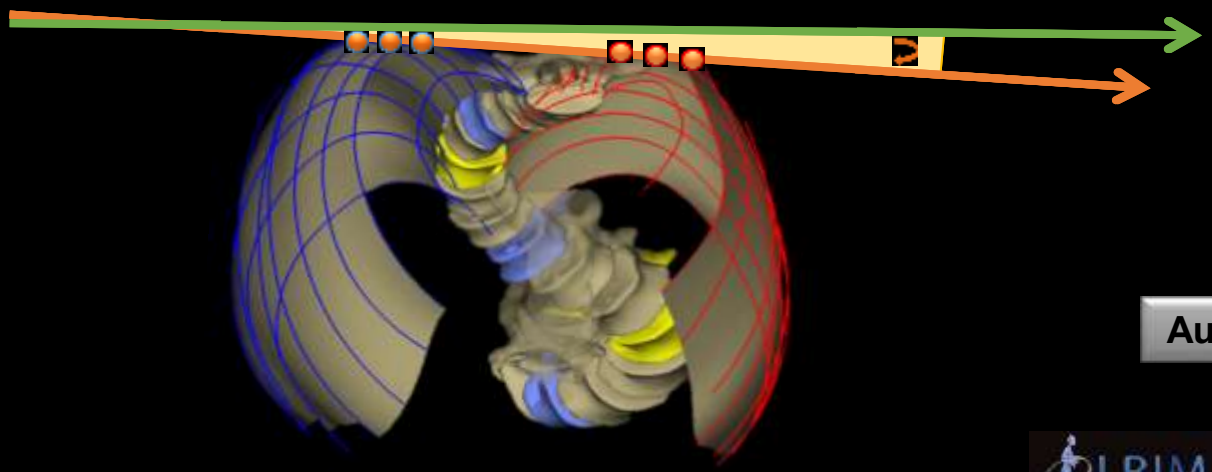
Rib cage volume



(cm^3)

Gibbosity

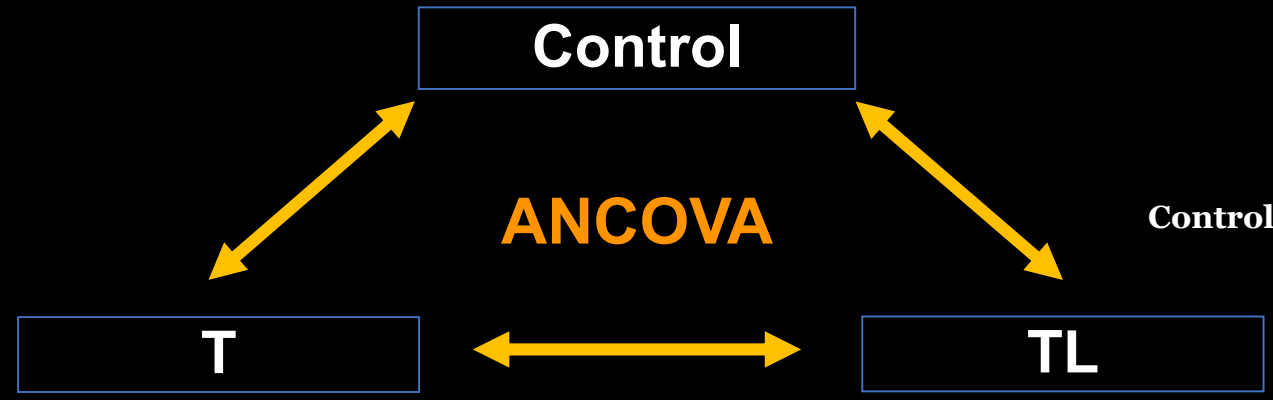
(°)



Aubert B et al., 2016

Statistics

1. Comparisons



2. Stepwise multiple linear regression (SMLR)

Dependent variables
Significant differences between groups in rib cage parameters

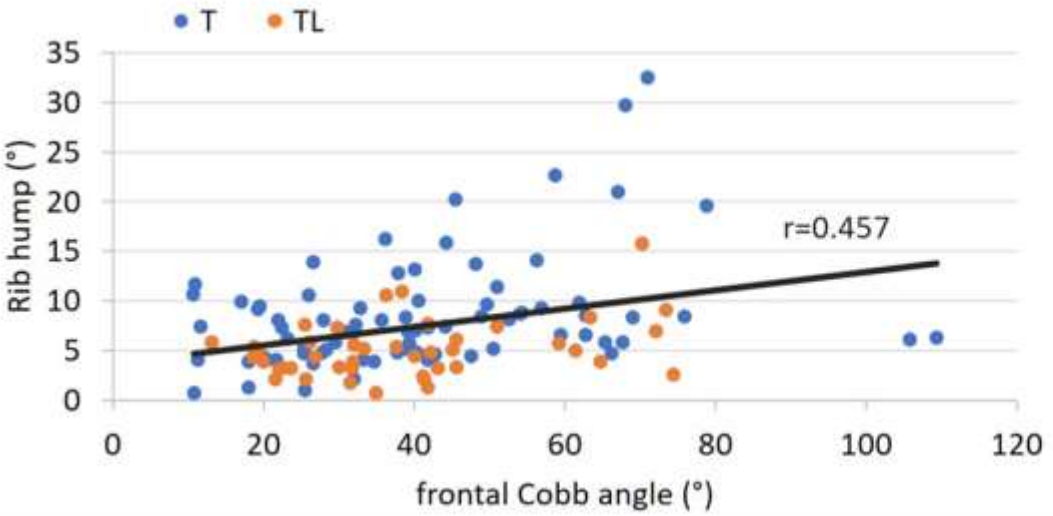
Independent variables
Cobb angle
TI
HI

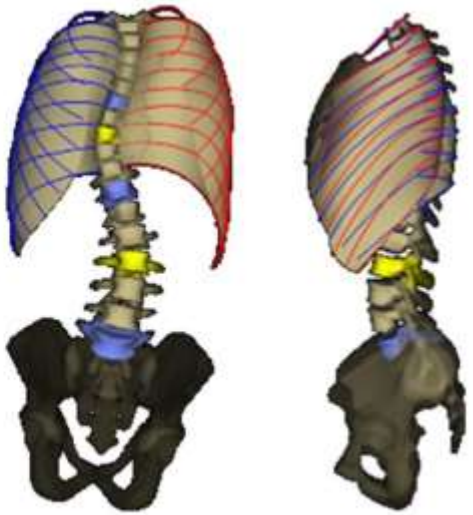
Results & Discussion

1a Rib cage parameters in 3D: Controls vs AIS (T & TL)

	T	TL	Controls	p-value
Max thickness (mm)	142 ± 16	140 ± 14	143 ± 16	0.51
Max width (mm)	230 ± 19	228 ± 17	288 ± 22	0.72
Rib hump (°)	9 ± 6	5 ± 3	4 ± 3	* T vs Controls & T vs TL: p<0.001
Volume (cm3)	5069 ± 993	4979 ± 1072	5246 ± 1348	0.52
Volumic spinal penetration index (%)	6 ± 2	5 ± 1	4 ± 1	* T vs Controls: p=0.006

1b Rib hump and frontal Cobb in AIS (T & TL)



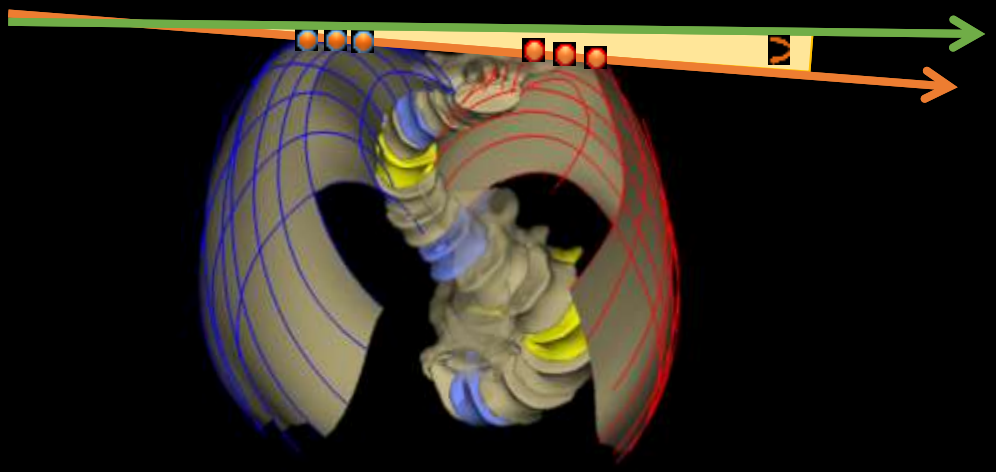


Factors influencing Gibbosity in AIS (SMLR)

The only significant determinant factor of gibbosity was

Cobb angle

(R^2=0.208, β=0.78)

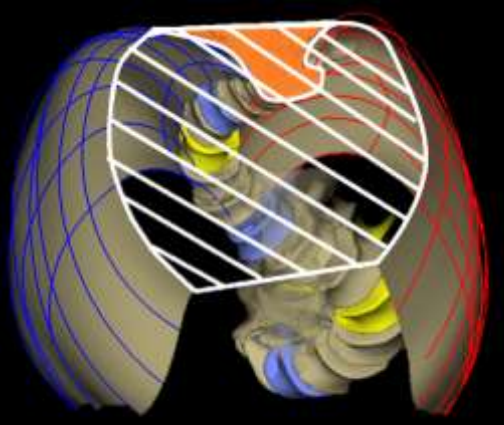


Factors influencing VSPI in AIS (SMLR)

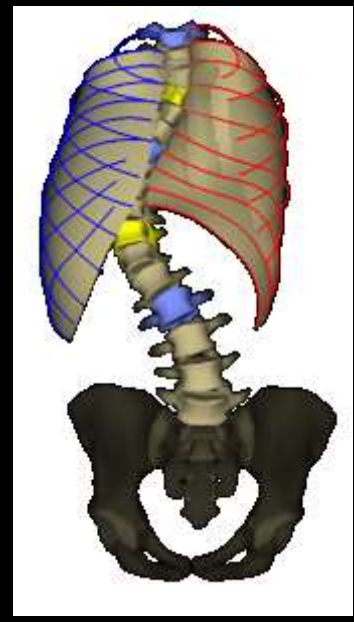
The only significant determinant factor of VSPI was

Torsion Index

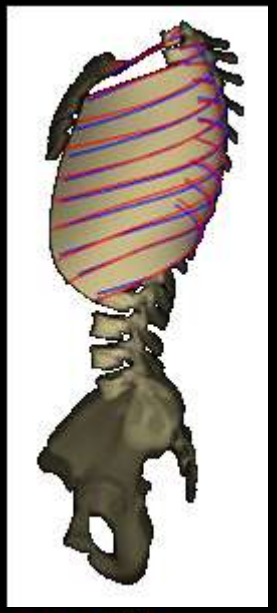
(R^2 =0.138, β=0.19)



Conclusion



- Patients with major **thoracic scoliosis** had more **deformities in the rib cage** compared to those with toracolumbar scoliosis



- SMLR results showed: Surgical **correction of both frontal and axial spinal deformities** in scoliosis may help to **improve rib cage anatomy**

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No conflict of interest

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