DIFFERENCES BETWEEN 2D AND 3D PARAMETERS ARE STRONGLY DEPENDING ON THE STRUCTURAL DEFORMITY IN AIS

Mareille Post BSc, Stephane Verdun PhD, Pierre Roussouly MD, Kariman Abelin-Genevois MD. PhD

Centre Médico-Chirurgical de Réadaptation (CMCR) des Massues, Lyon, France

Aim of the study

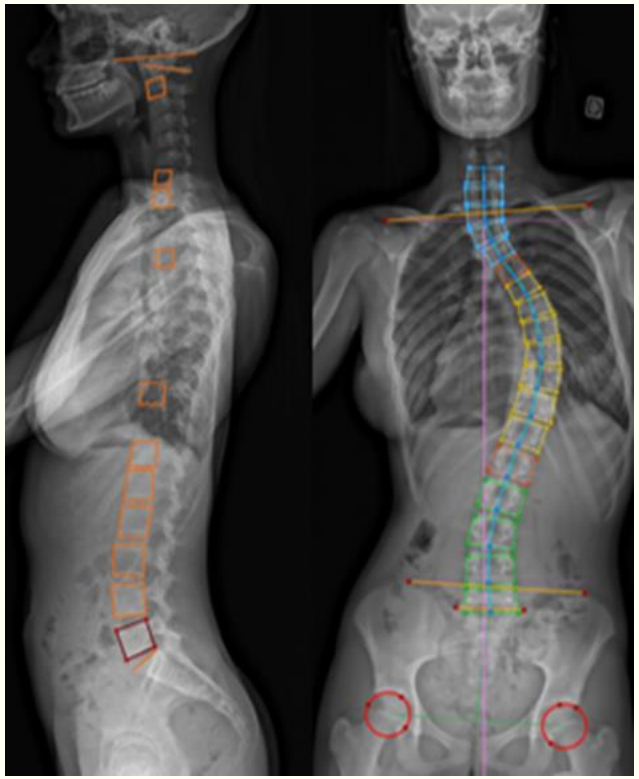
- In order to improve surgical planning of correction in AIS, we compared 2D and 3D analysis. A higher Cobb angle and apical vertebra rotation (AVR) influence the readability of the 2D lateral view. Therefore, there is a need to study the influence of Cobb angle and AVR on the concordance between 2D and 3D.

Method

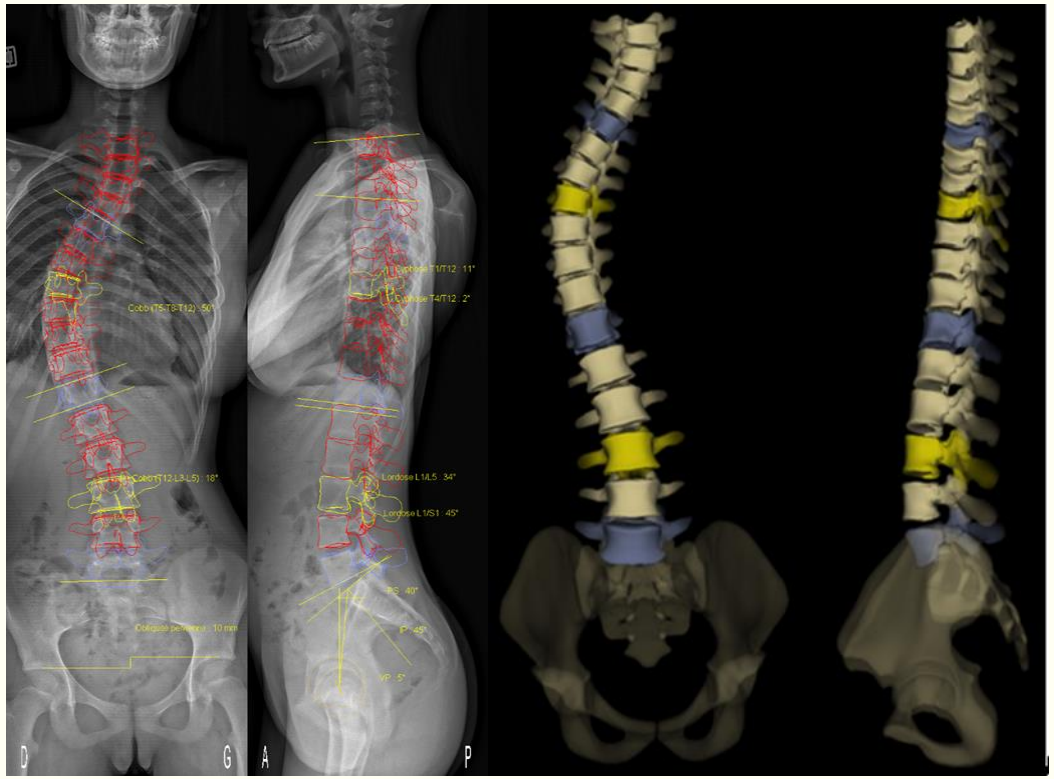
- Retrospective radiographic analysis of 93 AIS patients
  - 1 excluded for movement, 1 for abnormalities
- Simultaneously frontal and lateral x-ray images with EOS®
- 2D and 3D analysis
- Division of the cohort according to the overall mean Cobb angle (Cobb < 55° and Cobb ≥55°).
- Division of the cohort according to the apical vertebra rotation (AVR < 21° and AVR ≥ 21°)

Measurements

2D



3D



Parameters

Frontal parameters

- Cobb angle
- Apical vertebra
- Upper and lower limit
- Apical vertebra rotation (3D)

Spinopelvic parameters

- T1-T12
- T4-T12
- T10-L2
- L1-S1
- Pelvic incidence (PI)
- Sacral slope (SS)
- Pelvic tilt (PT)

Results, demographic information

	All cohort	Type 1	Type 2	Type 3	p-value
	N = 93	N = 44	N = 29	N = 20	
Cobb.1.2D	55 +/- 12.1	53.2 +/- 11.7	57.9 +/- 12.4	54.8 +/- 12.4	0,36
Axial.rotation.of.apex.3D	21.1 +/- 5.9	21.5 +/- 5.7	20.4 +/- 5.5	21.5 +/- 6.8	0,71

Division according to Cobb angle

	ICC (Cobb < 55)	ICC (Cobb ≥ 55)	Mean dif. (Cobb < 55)	Mean dif. (Cobb ≥ 55)
PI	0,94 (0,91-0,97)	0,9 (0,82-0,95)	0,033 (-6,9 - 7)	1,1 (-8,1-10)
PT	0,97 (0,95-0,98)	0,95 (0,9-0,97)	0,0087 (-3,5 - 3,5)	0,52 (-3,6-4,6)
SS	0,92 (0,87-0,95)	0,9 (0,82-0,95)	0,024 (-6 - 6)	0,54 (-7-8,1)
Cobb.1	0,78 (0,59-0,88)	0,86 (0,74-0,93)	2,1 (-5,9 - 10)	1,6 (-6,6-9,8)
TK.T1T12	0,9 (0,78-0,95)	0,89 (0,62-0,96)	-2,9 (-14 - 7,8)	-3,4 (-12-5,3)
TK.T4T12	0,89 (0,82-0,93)	0,87 (0,77-0,93)	-0,75 (-12 - 10)	-1 (-12-9,5)
TLJ.T10L2	0,62 (-0,03 - 0,85)	0,51 (-0,1 - 0,81)	6,6 (-4,2-17)	8,8 (-1,7-19)
L1S1	0,76 (0,22-0,9)	0,75 (0,11-0,91)	-5 (-15-5,2)	-6,7 (-19-5,5)

Division according to AVR

	ICC (Rotation < 21)	ICC (Rotation ≥ 21)	Mean dif. (Rotation < 21)	Mean dif. (Rotation ≥ 21)
PI	0,95 (0,9-0,97)	0,91 (0,85-0,95)	-0,026 (-6,5-6,5)	0,9 (-8,1-9,9)
PT	0,99 (0,98-1)	0,94 (0,9-0,97)	0,27 (-1,4-1,9)	0,16 (-4,8-5,2)
SS	0,9 (0,83-0,94)	0,92 (0,87-0,96)	-0,3 (-7-6,4)	0,74 (-5,8-7,2)
Cobb.1	0,94 (0,88-0,97)	0,9 (0,77-0,95)	1 (-5,2-7,3)	2,7 (-6,5-12)
TK.T1T12	0,9 (0,78-0,95)	0,89 (0,69-0,95)	-2,7 (-13-7,1)	-3,5 (-14-6,5)
TK.T4T12	0,89 (0,81-0,94)	0,88 (0,78-0,93)	0,34 (-10-11)	-2 (-12-8,2)
TLJ.T10L2	0,69 (-0,04-0,89)	0,46 (-0,1-0,77)	6,1 (-2,9-15)	8,8 (-3,1-21)
L1S1	0,73 (0,08-0,9)	0,77 (0,26-0,91)	-5,7 (-16-4,4)	-5,7 (-18-6,5)

Results

- Difference between 2D and 3D were strongly related to the curve magnitude and AVR.
- Concordance was higher for pelvic parameters compared to thoracic and thoracolumbar parameters.
- Average intraclass correlation coefficients were excellent for and higher when Cobb was inferior to 55° or AVR was less than 21°.

Conclusion

- 3D analysis of the spine from biplanar stereoradiography allows a more accurate evaluation of the sagittal alignment when Cobb angle ≥ 55° or AVR ≥ 21°.

- Which concludes that 3D analysis should be routinely used to evaluate server cases of AIS to guide the surgical strategy to restore a proper sagittal alignment.

Disclosure declaration

- No potential conflict of interest for any of the authors