

Implication of three-dimensional hip orientation in the compensation mechanisms of ASD patients

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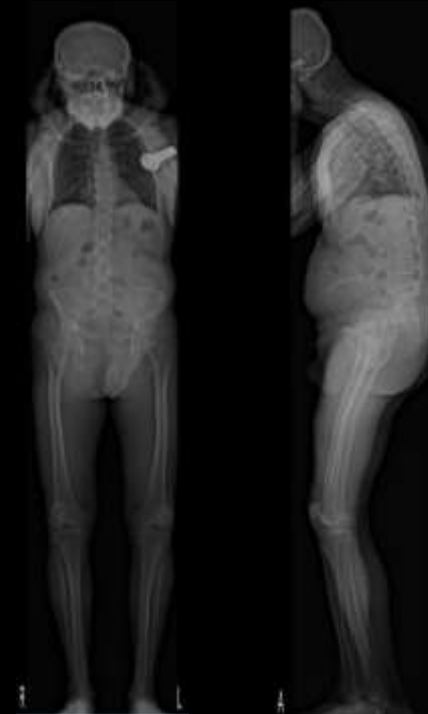
Sagittal Alignment

- Compensation mechanisms of altered sagittal alignment include:
 - ↑ Knee flexion
 - ↑ Pelvic retroversion

Pelvic Retroversion

- Maximal retroversion has been suggested to be influenced by hip morphology
- Only few studies investigated hip morphology in ASD patients
 - Majority in the presence of THA
 - None in 3D and in standing position

Jalai et al., 2017
Ferrero et al., 2016
Diebo et al., 2015
Barrey et al., 2013
Schwab et al., 2012



Barrey et al., 2013
Le Huec et al., 2011



Barry et al., 2017
Buckland et al., 2015
Phan et al., 2015
Schroeder et al., 2014

AIM

To determine how 3D hip orientation, assessed in standing position, could compromise the ability to recruit compensatory mechanisms in patients with ASD

Retrospective study

Methods

ASD subjects (<i>non operative</i>)	Control subjects
N=81 63F : 18M Age = 45 ± 20 y [20-82] Weight = 67 ± 16 kg Height = 164 ± 3 cm	N=81 63F : 18M Age = 34 ± 11 y [20-60] Weight = 70 ± 14 kg Height = 169 ± 10 cm

Exclusion criteria:
previous orthopaedic surgeries

Inclusion criteria for ASD subjects

Age >18 years

+

Presence of back pain

+

At least 1 of the SRS-Schwab criteria

Pelvic tilt > 20°

Coronal Cobb > 30°

PI - LL > 10°

SVA > 40 mm

Schwab F. et al.,
Spine, 2012

EOS® biplanar Xrays

Low dose

(G. Charpak, Nobel Prize 1992)

Full body

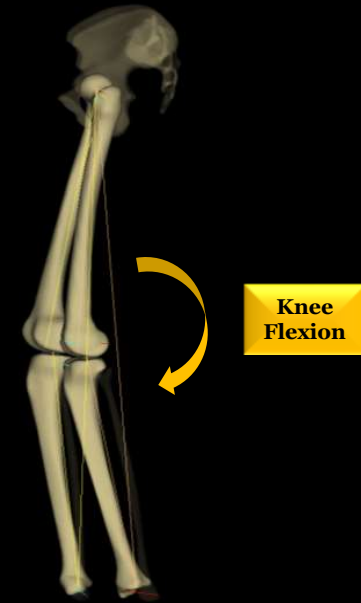
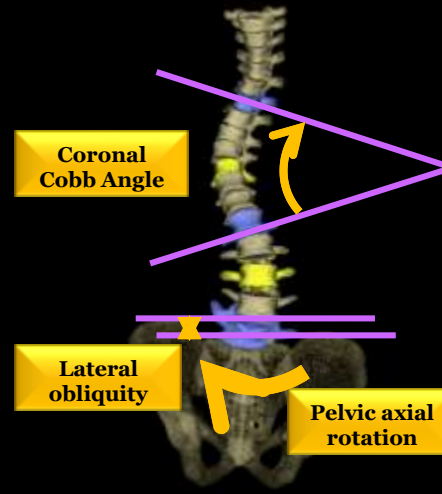
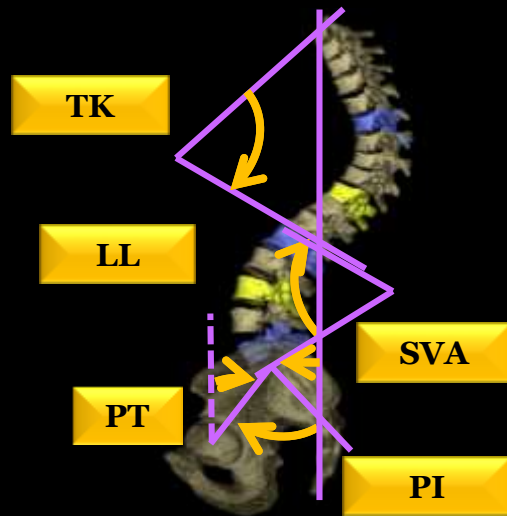
Free standing position

Dubousset et al., 2005

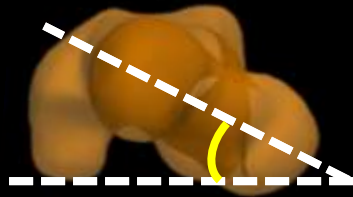


3D reconstruction of
Spine
Pelvis
Lower Limbs

3D Spino-pelvic and global postural alignment parameters

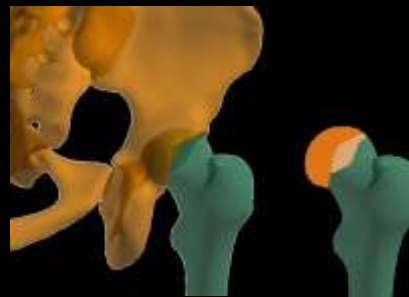


3D Proximal Femur parameters



Femoral Anteversion

Tonnis et al., 1999



% of Femoral Head Coverage (% FHC)

Humbert et al., 2008



Neck-shaft angle (NSA)

Cook et al., 1991

3D Hip Parameters



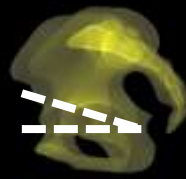
**Acetabular
Anteversion**

Anda et al., 1990



**Acetabular
Abduction**

Stem et al., 2006



**Acetabular
Tilt**

Lazennec et al., 2004



**Anterior Acetabular
Sector Angle**

Anda et al., 1986



**Posterior Acetabular
Sector Angle**

Anda et al., 1986

Statistics

ASD

vs.

Controls

3D Spino-Pelvic Parameters

→ Student t-test or
Mann-Whitney's Test

Pearson's correlations

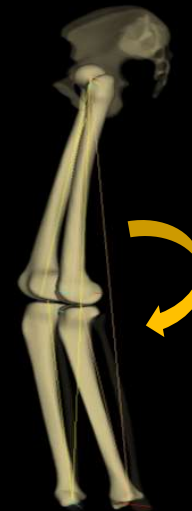
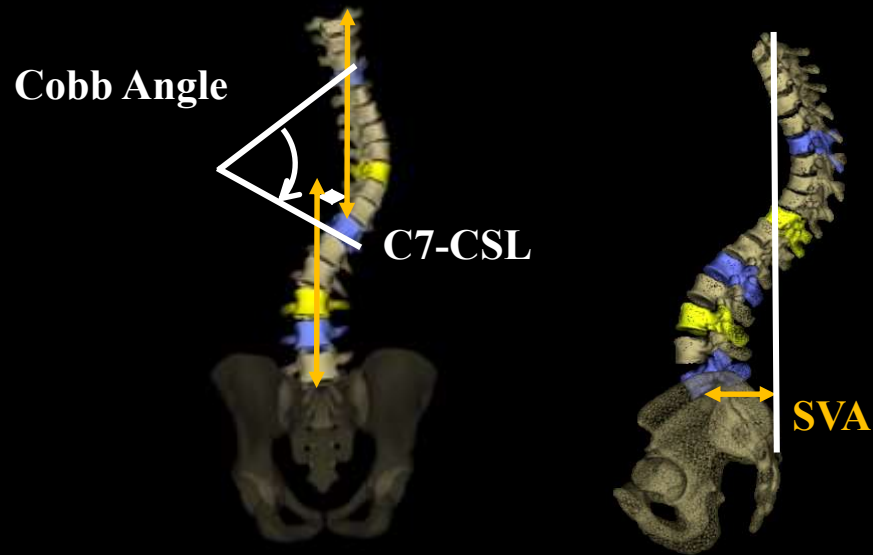
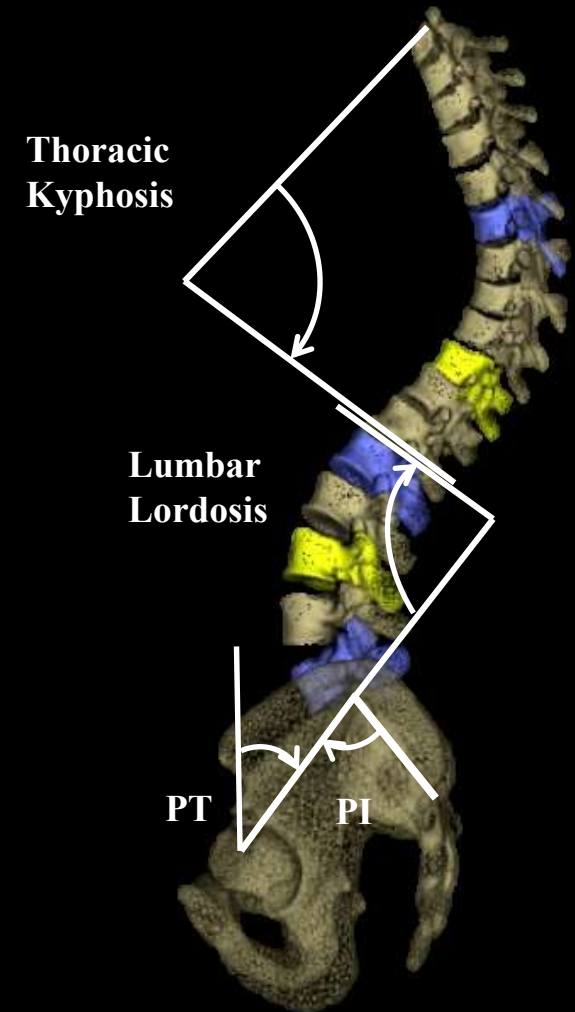
Hip parameters

&

Knee Flexion

Results : Spino-Pelvic Parameters ($p < 0.05$)

Parameter	ASD	Controls
SVA (mm)	15	-17
PT (°)	20	11
Knee flexion (°)	4	-1
PI-LL (°)	5	-11
C7-CSL (°)	15	8
Frontal Cobb (°)	32	3
TK (°)	38	46
LL (°)	50	63




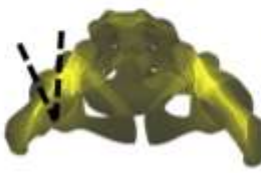
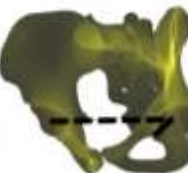
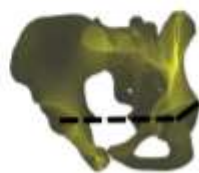
Results

*p<0.05

Parameter (°)	ASD	Controls
Acetabular tilt *	15	-17
PT *	20	11
Knee flexion *	4	-1
PI-LL *	5	-11

	(1)	(2)	(3)	(4)
	Acetabular tilt (°)	Acetabular anteversion (°)	Anterior Acetabular Sector Angle (°)	Posterior Acetabular Sector Angle (°)
ASD	33	22	56	99
Controls	26	17	60	97
Correlation with Knee flexion (Pearson's r)	0.21	0.22	-0.16	0.14

all p-values were <0.05

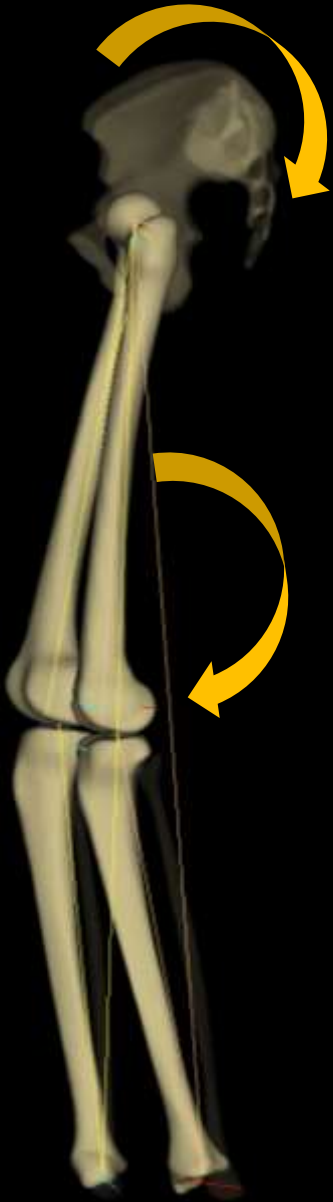
(1)
(2)
(3)
(4)

Discussion & Conclusion

- First 3D study to investigate hip orientation in ASD in standing position.
- ASD had altered hip orientation characterized by:
 - increased posterior coverage (acetabular anteversion, tilt & PASA)
 - decreased anterior coverage (AASA)
- which can together lead to posterior femoro-acetabular conflict and limit pelvic retroversion.



An increase in acetabular tilt, anteversion, PASA as well as a decrease in AASA were significantly correlated to an increase in knee flexion.



These findings seem to explain the chain of compensatory mechanisms in ASD.

Conflict of interest: None



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