

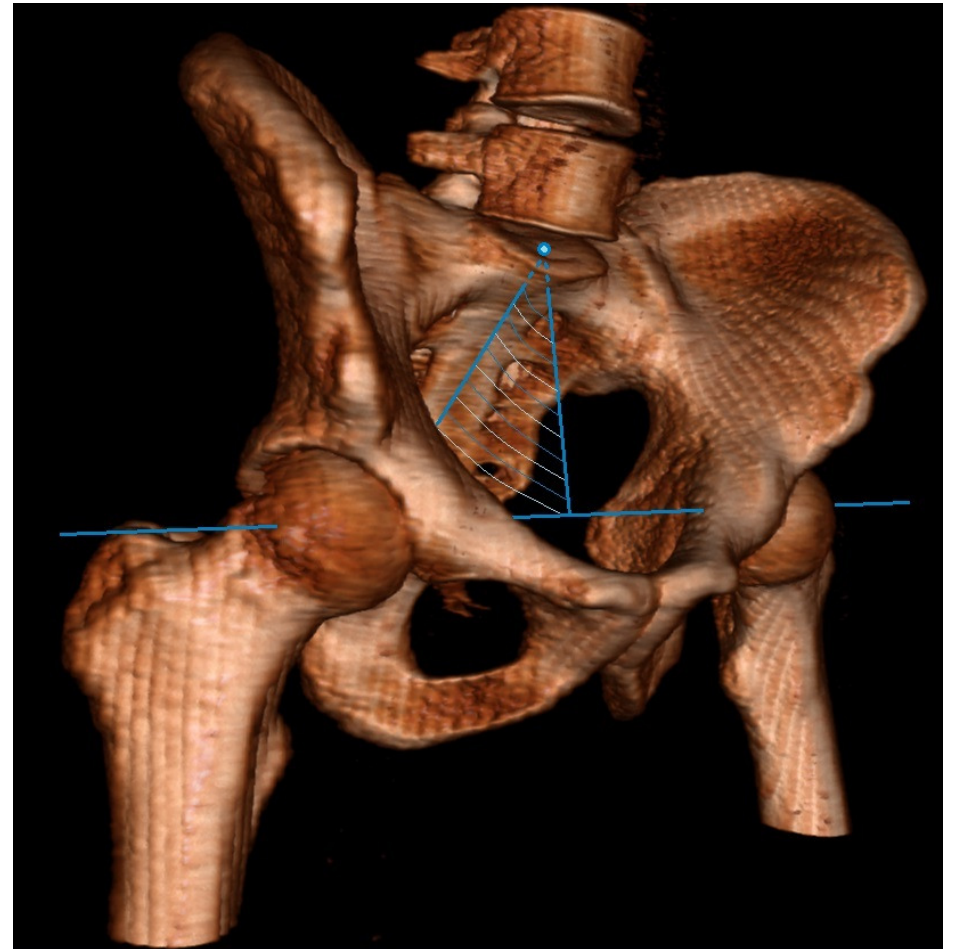
# The Role of Sagittal Pelvic Morphology in the Development of Adult Degenerative Scoliosis

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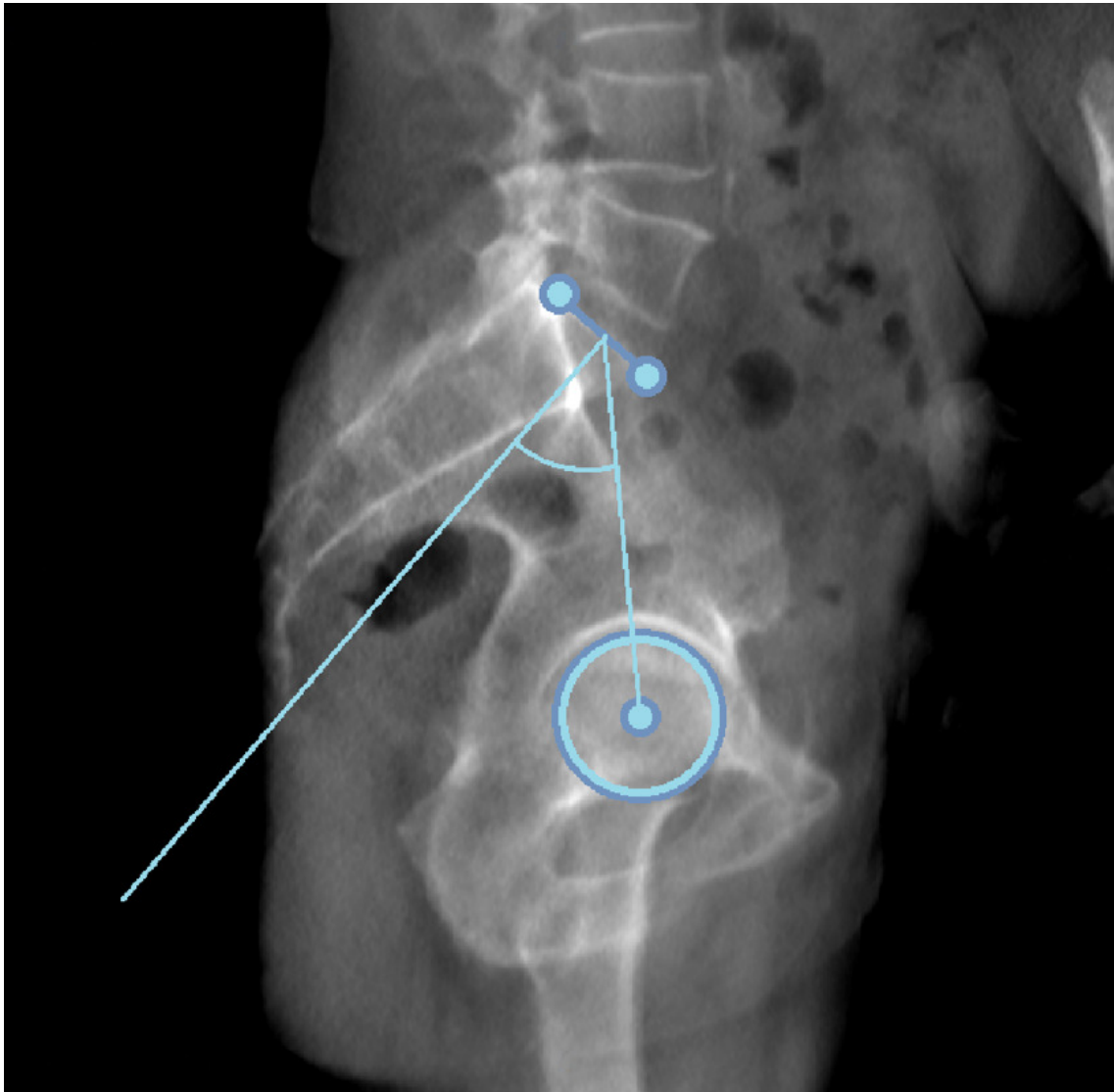
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# Introduction

The mechanical basis of spinal deformities is becoming better understood. Specifically on the role of spino-pelvic morphology, which is known to dictate the alignment and biomechanics of the spine. Recent observations in different types of adolescent idiopathic scoliosis indicate that individual pelvic morphology is related to the spinal levels in which scoliosis develops: primary lumbar adolescent scoliosis is associated with a higher pelvic incidence (PI) than thoracic scoliosis and non-scoliotic controls. We hypothesize that adult degenerative scoliosis (ADS) of the lumbar spine follows the same mechanical principles and is associated with a high PI. Therefore, we analyzed an existing database of total-body CTs obtained for indications not related to the spine, to accurately measure the differences in Pelvic Incidence (PI) in ADS patients and a sex-age matched non-scoliotic controls.



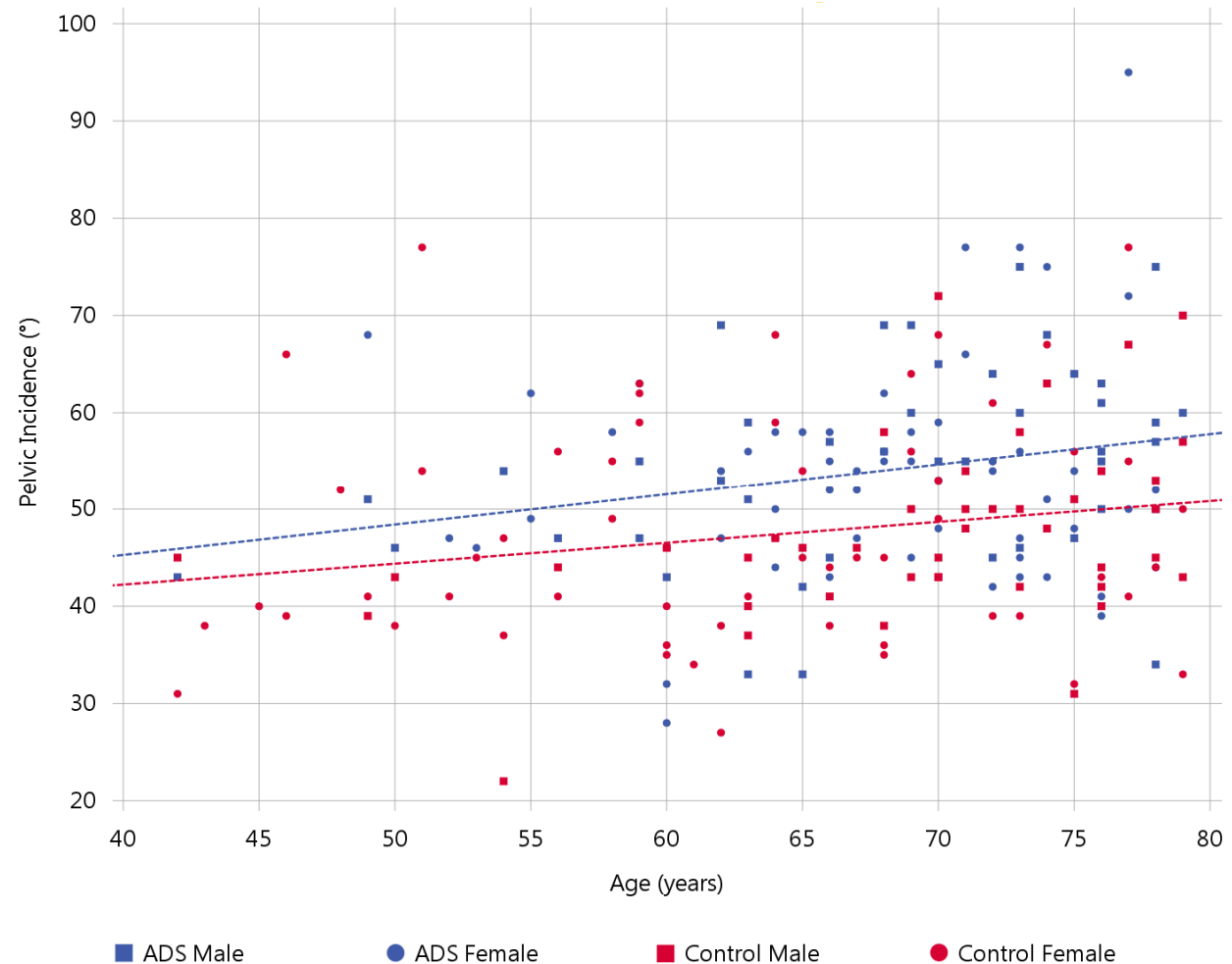
# Material and Methods



CT-scans of 202 subjects were analyzed: 101 ADS patients were matched to a control patient of the same sex and closest age. With multi-planar reconstruction the PI was measured as the angle between the line from the exactly superimposed femoral-heads-axis to the mid-point of the sacral endplate, and the perpendicular line from the mid-point of the sacral endplate. For this method, the intraclass correlation coefficients were 0.993 for inter- and 0.998 for intra-observer reliability.

# Results

Of the sex-age matched included subjects, the median age was 68-69 years and 57% were female. In ADS patients the mean Cobb angle was  $21^{\circ} \pm 8^{\circ}$  and ranged from  $10^{\circ}$  to  $47^{\circ}$ . The PI was  $54.1^{\circ} \pm 10.8^{\circ}$  in ADS patients and  $47.7^{\circ} \pm 10.8^{\circ}$  in non-scoliotic controls ( $p < 0.001$ ). There was no difference between sex, a weak correlation between age and PI in both groups ( $R=0.197-0.225$ ;  $p=0.024-0.048$ ). The median ADS curve apex was the disc L2-3 and median curve length was 4 vertebral levels. The mean supine Cobb angle was  $21^{\circ} \pm 8^{\circ}$  (ranged  $10^{\circ}$  to  $47^{\circ}$ ). There was no significant correlation between PI and the apex level ( $p = 0.883$ ), the curve length ( $p = 0.418$ ) or the Cobb angle ( $p = 0.518$ ).



# Conclusion

	ADS	Control
N	101	101
Median year of age	69	68
Female	57%	57%
Mean Cobb angle ( $\pm$ SD)	$21^\circ \pm 8^\circ$	
Range	$10^\circ$ to $47^\circ$	
Convexity of lumbar curve	56% left-sided	
Median apex	L2-3	
IQR	L2 to L3	
Median curve length (included number of vertebrae)	4	
IQR	3 to 5	
Pelvic incidence*	$54.1^\circ \pm 10.8^\circ$	$47.7^\circ \pm 10.8^\circ$

Adult degenerative scoliosis develops de novo in the lumbar spine of patients with a higher PI than controls, similar to adolescent idiopathic scoliosis of the lumbar spine. This suggests a shared mechanical basis of both deformities. It is known that pelvic morphology dictates spinal sagittal alignment, which determines the segments of the spine that are prone to develop scoliosis. We hypothesize that whether and during which phase in life this will occur, depends on the mechanical properties of the passive stabilizers of the spine, predominantly the discs, either during maturation, or during degeneration.

# Disclosure declaration

None of the authors has any potential conflict of interest