



## **MRI in early stages of adolescent idiopathic scoliosis indicate a neuro-osseous growth mismatch associated with curve progression**

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### **Background**

Distinguishing non-progressive from progressive AIS still mainly relies on growth estimation and curve features. There are multiple hypotheses regarding the etiology of AIS. These include progressive wedging of the vertebra in the coronal plane, lengthening of the anterior column in the sagittal plane, and a neuro-osseous mismatch in spinal development. The purpose of this study was to determine if spinal and medullary characteristics on MRI can predict curve progression in mild and moderate AIS.

### **Methods**

From 2010-2015 we prospectively included patients presenting with AIS. Irrespective of curve severity, patients underwent MRI. Patients were followed until skeletal maturity or surgery and categorized as progressive when the Cobb angle increased by  $\geq 10$  degrees at follow-up.

We included patients with curves  $< 40$  degrees on presentation. At the apex of the curve on MRI scans, we measured the coronal and sagittal vertebral wedging along with the wedging of the disc above and below.

On the subset of scans available for 3-D reconstruction (n=64), we measured the true lateral chord space (LCS) ratio on transverse cuts of the curve apex. This is a measure of the lateral displacement of the medulla in the spinal canal.

## **Results**

We included 142 patients with a mean age of  $14 \pm 2$  years and a mean Cobb angle at presentation of  $27 \pm 9^\circ$ .

In the coronal plane, wedging of the apical vertebra was  $1.6 \pm 5.0^\circ$  in the progression group and  $-0.5 \pm 3.9^\circ$  in the non-progression group ( $p=0.002$ ). We found no significant difference in disc wedging cranial or caudal to the apical vertebra ( $p>0.053$ ).

In the sagittal plane we found no difference in wedging of the vertebra or surrounding discs ( $p>0.249$ ).

Of the available 3-D reconstructed MRI scans (n=64), the mean LCS ratio was 1.5 (IQR: 1.1-1.7) in the progression group and 1.0 (IQR:0.8-1.3) in the non-progression group ( $p<0.001$ ) (See figure).

## **Conclusions**

Using MRI in mild and moderate AIS, we found minor differences in vertebral wedging in progressive curves. We found significant displacement of the medulla towards the concavity of the curve in the progression group. This finding supports the theory of a neuro-osseous growth mismatch as a part of the etiopathophysiology of AIS and may play a predictive role in prognosis of milder cases of AIS.