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## **Risk factors for adjacent segment degeneration after adolescent idiopathic scoliosis surgery (AIS): the intervertebral disc stability concept**

Kariman Abelin-Genevois<sup>1</sup>, Pascal Swider<sup>2</sup>, Erik Estivalèzes<sup>2</sup>, Jérôme Briot<sup>3</sup>, Franck Accadbled<sup>4</sup>, Jérôme Sales de Gauzy<sup>4</sup>

<sup>1</sup>Hôpital Femme Mère Enfant, Bron, France

<sup>2</sup>Laboratoire de Biomécanique UMR CNRS 5502, Toulouse, France

<sup>3</sup>CHU Purpan, Toulouse, France

<sup>4</sup>Children's Hospital, Toulouse, France

**Purpose:** Ideal surgical management of adolescent idiopathic scoliosis (AIS) aims for an optimal correction of the deformity while preserving mobility. An unbalanced rigid spine puts the mobile segment at higher risk of disk degeneration. The goal of our study is to clarify the long term outcome of AIS after spinal fusion.

**Method:** Forty-five patients undergoing surgical treatment for AIS were prospectively followed with MRI at 2 years minimum follow-up. Modifications in total volume and nucleus size of the discs in the mobile segment were extrapolated from 3D reconstruction of the intervertebral discs. We analysed disc morphometric changes according to the fourth lumbar vertebra (LIV) position to the stable vertebra (SV), neutral vertebra (NV) and end vertebra.

**Results:** In selective arthrodesis the main factors affecting the discs below fusion were the length of the free motion segment and position of LIV to SV and NV. In fusions extended to the lumbar spine, disc volumes were significantly influenced by the spino-pelvic morphology. Long term follow up (at average 5.5 years after fusion in 17 patients) however demonstrated the constant remodelling in the discs. Volumes remained in the range of postoperative values as hydration was constantly enhanced.

**Conclusions:** long spinal fusions in AIS induce significant geometrical changes below the fusion. Significant differences were observed according to the level of distal fusion. Major mechanical forces applied to the junctional segments are transmitted through the intervertebral discs aggravated by the overloading mechanical stress between rigid and mobile segment.

**Significance:** Optimal positioning of the two first segments under a long spinal fusion for AIS is essential to avoid early degenerative changes and may protect from the adding on phenomenon. The authors define the concept of a disc stable zone.