THREE-DIMENSIONAL VERTEBRAL WEDGING IN MILD AND MODERATE ADOLESCENT IDIOPATHIC SCOLIOSIS

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Introduction

Wedging of both the vertebrae and discs have been associated with increasing vertebral deformation as the adolescent idiopathic scoliosis (AIS) progresses [Taylor, 1981]. There have been many studies on vertebral wedging [Stokes, 2001; Wang, 2012] but most of them are based on frontal plane spinal radiographs. Some authors underline the limitation of bi-dimensional (2D) evaluations because the maximum scoliotic deviation lies in an oblique plane [Aubin, 1998]. A few studies were based on 3D reconstructions, but were using cadaveric specimen [Masharawi, 2008; Parent, 2004]. Moreover, no study was done on the initial stages of AIS. The objectives of this study were to characterize 3D wedging in mild (less than 20° Cobb angle) and moderate (more than 20° but less than 50°) scoliotic girls before any form of treatment to document the initial stages of scoliosis progression.

Methods

38 postero-anterior and sagittal bi-planar radiographs were taken of 25 AIS girls in the standing position following a similar protocol to Allard et al. [1980]. Data were included in the present study for patients 9.4–15.9 years old before any orthopaedic treatment. For each reconstruction of the spine, 8 markers delimitating the vertebral body had been placed and digitized from radiographs to obtain the 3-D coordinates of each landmark. The approaches described by Parent [2002, 2004] and Stokes [2001] were combined to estimate 3D wedging. The wedging angle was defined by deducting the superior and inferior angles from 180° (see figure 1).

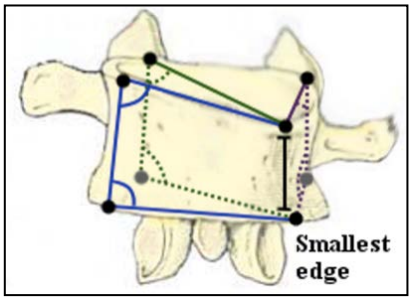

Figure 1: Markers and angle measurements.

Patients were divided into 2 groups according to the severity of the main curve. Multiple analysis of variance was used to determine if the individual vertebral level with respect to the apex, a group of 3 vertebrae above and below the apex and wedging angles taken with respect to the frontal, sagittal and opposite to the smallest edge of the vertebral body differed with increasing severity.

Results

Wedging differs with increasing severity of the scoliotic curve in the opposite and frontal angles ($p<0.05$). Wedging also differs according to the level of the vertebra (above or below the apex) in the opposite and sagittal ($p<0.05$) angles. Vertebrae under the apex have a larger wedging angle than the apex and the above vertebrae.

Discussion

The main findings of this study are that vertebral wedging is present even in girls with a mild scoliosis, less than 20° and that it progresses. Wedging is more pronounced in the 3 vertebral bodies immediately located under the apex without any distinction to their individual position with respect to the apex. Considering that the sagittal angles were larger than those measured in the frontal plane or with respect to the diagonal vertical edge, vertebral wedging taken in medio-lateral radiograph could provide valuable indication.

References

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