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Case Report

Adolescent Idiopathic Scoliosis: Short, Apical, Single or Multiple Fixations

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Abstract

Objective: To create a new instrumentation principle in the treatment of Adolescent Idiopathic Scoliosis (AIS), with short, apical, single or multiple attachments.

Methods: A new principle of AIS treatment was created. Correction was established: one curve, one fixation, two curves, two fixations, three curves, three fixations.

Result: Five cases were reported, presenting the new principle of AIS treatment.

Conclusion: In the five reported cases, excellent correction of the Cobb and SCA angles can be observed.

Keywords: *Scoliosis; Multiple Fixation; Apical; Correction; New Principle*

Introduction

Adolescent Idiopathic Scoliosis (AIS) is a Three-dimensional deformity of the spine which includes the curvature of the coronal plane and the rotation of the axial axis, with maximum rotational deviation and translation occurring at the apex of the curve [1]. Scoliosis is a frequent pathology that affects 2 to 3% of the population, more commonly 80 to 90% are diagnosed in adolescence. About 10% of patients require treatment and 0.1% require surgical treatment [2].

The development of implants in spinal surgery has allowed the surgical treatment of these deformities through more selective correction, so that only the vertebrae that present the most intense morphological changes are included in the arthrodesis area. The use of this method of fixation and more selective arthrodesis allows for the correction of the deformity by means of shorter arthrodeses, preserving segments of the vertebral spine. This treatment approach restores spinal alignment, allowing even greater spine flexibility when compared with classic correction techniques for this deformity [3,4].

The authors of this paper also created a new three-dimensional Classification for adolescent idiopathic scoliosis (AIS) and similar structured deformities. There are 3 components: "quantitative factor" that divides into 3 basic types to define the shape of the deformity, the "localizing factor" showing the location of the main curve, and "sagittal factor" to show the reality of the total sagittal plane C1 to S1 [5].

The Cobb method measures the amplitude of the curve by measuring and calculating the angle between the lines, respectively traced, that reach to the upper terminal plate of the cranial vertebra and the lower terminal plate of the caudal vertebra, the local scoliotic curve to be measured [6].

Garcia., *et al.* created a new tool to measure the coronal plane of the spine globally, demonstrating the true balance of this plane, an indispensable factor in the correction of scoliosis, called the Sacral Clavicular Angle (SCA). To measure the SCA, a line parallel to the base of the sacrum is made, a second central line is made, perpendicular to the first, throughout the length of the spine. A third line is made passing at the upper meeting points of the clavicles with the two second ribs, thus forming two angles, which in non-scoliotic persons, measures 90° by 90°. It was standardized to measure the largest angle with the goniometer, on the side that exceeds 90°, so the degrees exceeding 90° is the value of the SCA [7].

Objective of the Study

The objective of this study is to present the new principle of AIS treatment with short, apical and multiple fixations.

Materials and Methods

Approved project, CAAE: 68440217.3.0000.5138, Submitted by Santa Casa de Belo Horizonte, 05/17/17.

The Vertebral Spine Group of the Santa Casa Orthopedics and Traumatology Service and the Vertebral Column Institute, both based in Belo Horizonte, introduced a new principle of instrumentation in the surgical treatment of AIS, using short, apical, single or multiple fixation. The method establishes that, with one curve, there is one fixation, two curves, two fixations, three curves, three fixations. The ideology of the new principle is to accurately identify the apex of curvatures, considered the "soul" of the deformity, to concentrate the instrumentation, which should be short, apical, multiple in cases of more than one structured curve, preserving vertebral mobility, not fixing neutral vertebrae, fixing structured secondary curves, thus providing better balance of the coronal plane, performing multiple and less invasive accesses, dissection of the spine and trying to decrease blood loss.

Third generation material was used, associated with trans-pedicular fixations, short, apical, or multiple, attached to the longitudinal rods, locked with transverse devices, adjusting the systems for corrections of curvatures (Figure 1).

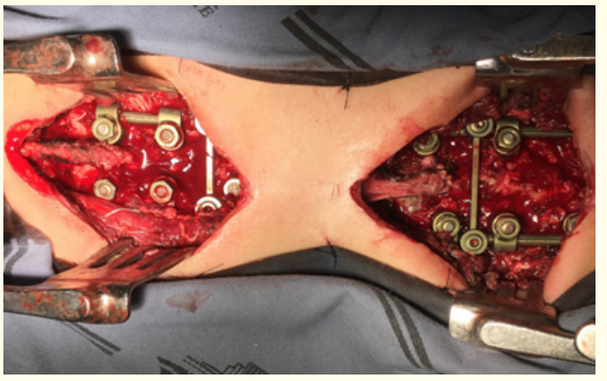

Figure 1: *Photograph of a patient operated on AIS, with two structured curves, performed two surgical approaches and two fixations for correction of curvatures.*

Cobb and SCA angles were measured [7] (Figure 2).

Figure 2: *The strategic points to measure SCA are: Two points are made at the extremes of the base of the sacrum, two more points are made in the upper clavicle encounters with the two second ribs.*

Five operated cases are reported using short, apical and multiple attachments (Figures 3 to 7).

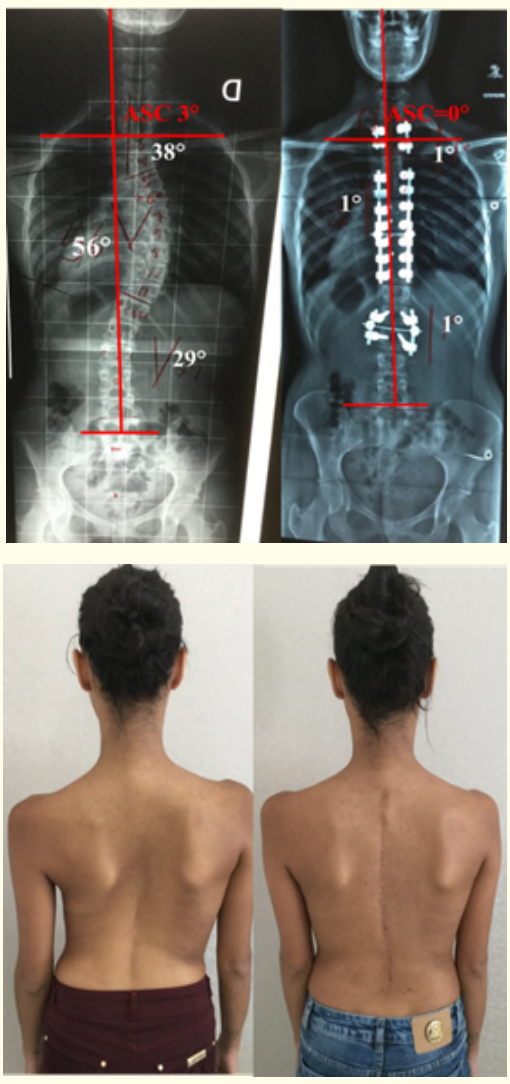

Figure 3: *A 17 year old female, operated by AIS, submitted to fixations, short, apical and multiple. The left image above shows the X-ray of the preoperative showing the angles measured by the Cobb and SCA method and the right image above demonstrates the correction of the referred angles. Below left is the preoperative photograph and the right photo is the postoperative result.*

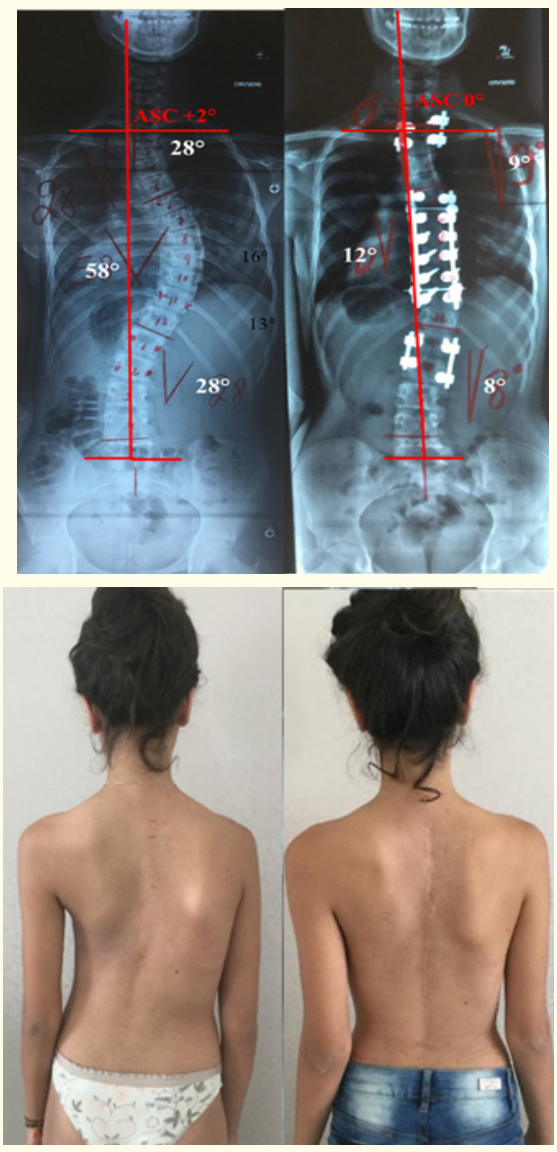

Figure 4: *Patient operated on AIS, female, 13 years old, presenting three curvatures, underwent three fixations. Image of X-Ray above left is the measurement of the Cobb and SCA angles in the preoperative and above right the postoperative control with correction of the angles. Photograph below left of preoperative and right postoperative.*

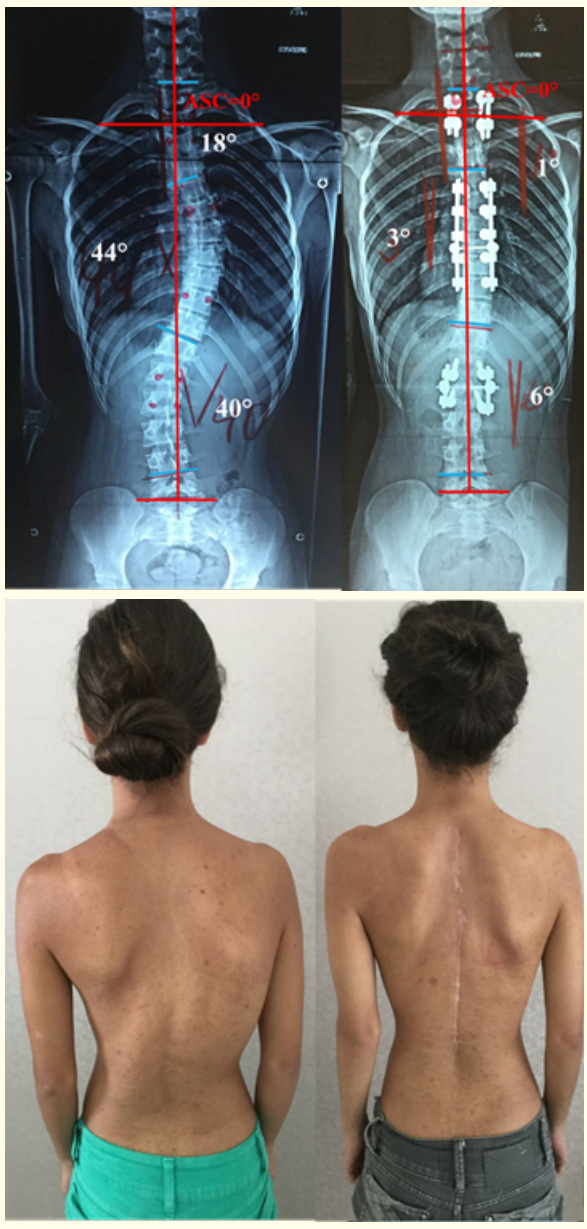

Figure 5: *Female, 15-year-old, operated on AIS, with the new fixation principle, short, apical and multiple. X-Ray image above left of the preoperative, with Cobb and SCA angles measured, and above right is an X-Ray image of the surgical postoperative, with correction of the curvatures. The photograph below left of the patient in the preoperative and right of the postoperative, showing the correction.*

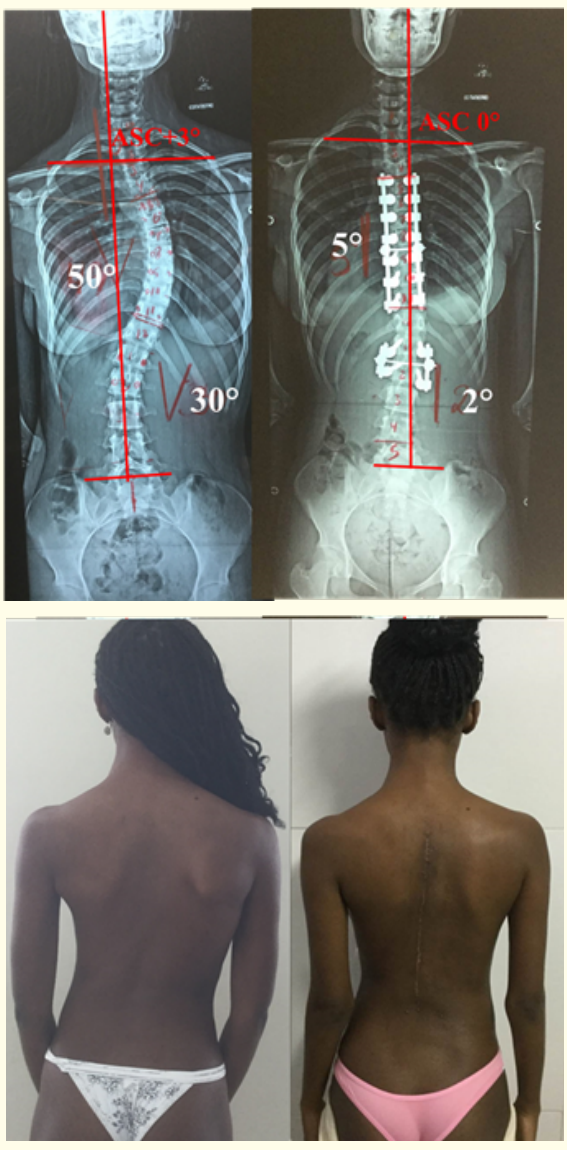

Figure 6: *Female, 14-year-old, operated on AIS, presenting two curves, underwent two fixations. X-Ray above left, showing the Cobb and SCA angles measured and the image above right showing the correction of the angles. Below left photo of the preoperative and the right the result of the correction.*

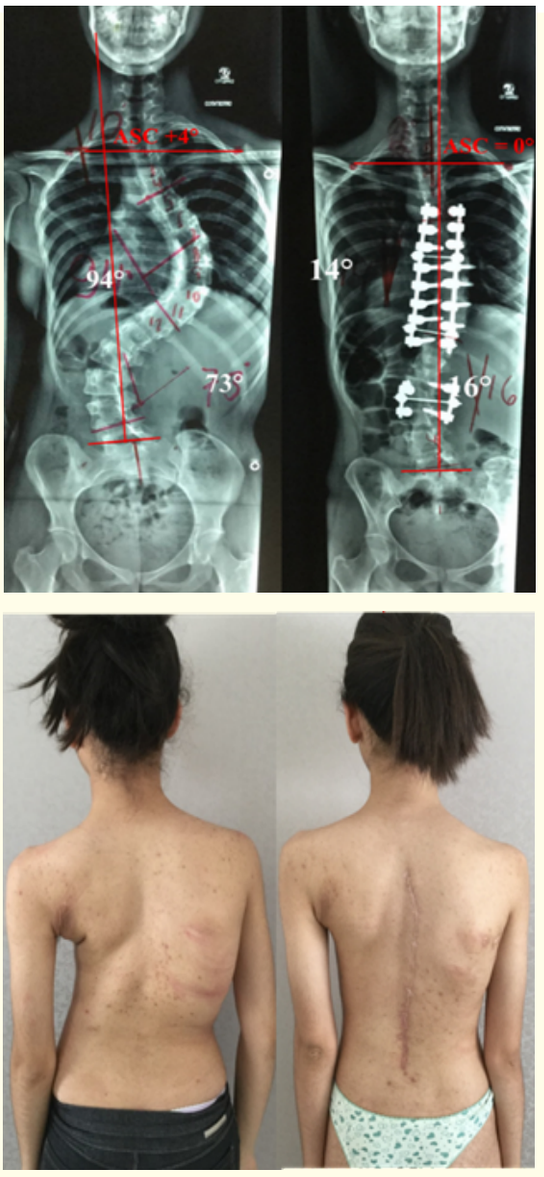

Figure 7: *A 17-year-old female patient, presenting severe AIS with two rigid curves, was submitted to anterior and posterior access, with multiple fixations. X-Ray image above left showing the Cobb and SCA angles and the right showing the satisfactory correction of the same. Below left the photograph of the preoperative and right, post-surgical correction.*

Discussion

The advances of the new types of instrumentation in AIS, allowed for major corrections of the deformities. In selective arthrodeses, in which only the main thoracic curve instrumentation is performed, the curves classified by King as type II and Lenke 2CN [8,9] obtained a smaller number of vertebrae in the arthrodesis, allowing a greater mobility, less surgical time and less surgical risk [9-11].

The purpose of curve correction was achieved with the use of 3rd generation instruments, but the presence of decompensation of the trunk was observed in several studies after a 1-year follow-up [11-14].

The patient with thoracic scoliosis may have a perfect balance between the head over the pelvis and no decompensation of the trunk [12]. However, if this same individual has a large thoracic curve, the trunk can be displaced significantly away from the midline of the pelvis, reflecting a remarkable decompensation in the position of the thorax on the pelvis [11,13].

At about 18 years of age, approaching AIS with short and selective fixations, trying to preserve vertebral mobility, patients with visible shoulder asymmetry could be observed with some frequency.

According to Literature [15-17], the 3rd Generation Quality Instrumental really was the differential in the treatment of AIS, however, selective instrumentation can bring about imbalance of the coronal plane, beginning when we do not approach the structured secondary curves, or when we interrupt instrumentation at the apex of these curves. Structured secondary curves are the cause of trunk imbalance, especially when the main curve is completely corrected.

This situation led the authors to think of solutions, beginning to plan the realization of the short, apical and multiple fixations, but since there was no support from the literature, the authors always gave up the project.

Only in early 2014 was a patient operated on for the first time with three curves, we made three accesses, three fixations, with excellent results, now with 40 months of follow-up.

The authors suggest AIS treatment, with short, apical and multiple fixations, with less dissection of the spine, less blood loss, cost reduction, less loss of vertebral mobility, seeking a better balance of the coronal plane.

The results of 67 cases already operated, without loss of correction and absence of imbalance in the intermediate levels not fixed, being considered neutral vertebrae. That is, in the point of view of the authors, the unnecessary fixation. These free intermediate segments result in greater preservation of spine mobility and better distribution of the overload.

Conclusion

It can be observed in the five reports that the new principle of instrumentation in the surgical treatment of AIS using short, apical, single or multiple fixations presented excellent correction of the Cobb and SCA angles.

Conflict of Interest

No conflict of interest.

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