

# CASE STUDY

## Improvement in Adolescent Idiopathic Scoliosis in a Patient Undergoing Upper Cervical Chiropractic Care: A Case Report

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### Abstract

**Objective:** To report on improvement in Adolescent Idiopathic Scoliosis (AIS) in a female undergoing upper cervical chiropractic care to correct vertebral subluxations.

**Clinical Features:** The patient is a fifteen year old female with a history of scoliosis, vertigo, lumbar pain, and lack of vitality. Objective indicators of vertebral subluxation were identified through palpation, National Upper Cervical Chiropractic Association (NUCCA) protocol, and radiographs. She had scoliosis with a Cobb angle of 44 degrees.

**Interventions and Outcomes:** NUCCA chiropractic adjusting directed at reducing vertebral subluxations in the upper cervical region was performed. Post upper cervical X-rays revealed a reduction of the Atlas subluxation. After 5 months of care, the Cobb angle was reduced to 32-degrees.

**Conclusion:** The case of a 15-year-old female with AIS is presented. After one adjustment to correct the Atlas subluxation and 5 months of check-ups, the Cobb angle was reduced. Further investigation is needed to study the relationship between the correction of the Atlas subluxation and the reduction of the Cobb angle in adolescent idiopathic scoliosis patients.

**Key Words:** *Adolescent Idiopathic Scoliosis, Atlas, Upper Cervical, NUCCA, subluxation*

### Introduction

Adolescent Idiopathic Scoliosis (AIS), is defined as a structural lateral curvature of the spine that develops from age 10 until skeletal maturity,<sup>1,2</sup> being more prevalent in girls than boys (6:1) with curves above 21° Cobb's angle.<sup>3,4</sup> In the United States, scoliosis screenings are mandatory in 26 states.<sup>5,6</sup> If one fails the screening evaluation, the school is responsible for referring the student for proper care.

Yawn et al. completed a retrospective cohort study to determine the effectiveness of a community based school scoliosis screening program. Children who attended a public or private school in the city were included and data were recorded from kindergarten or first grade and followed up until the age of 19. Based on the results from the school screenings, 92 children were referred for treatment of idiopathic scoliosis.

By the age of 19, sixty-eight children had received follow up care for scoliosis, while the other 24 did not. Of the 68 who sought care, 41 were deemed to have no scoliosis. Of the remaining 27, eleven had curves that measured 11-19 degrees,

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thus not meeting AIS criteria; while there were 10 who measured 20-39° and 6 greater than or equal to 40 degrees.<sup>5</sup>

Standard treatments for AIS include (a) observation for curves Between 0-20°, (b) bracing for 20 to 40°, and (c) spinal surgery for curvatures over 40°. In 2008, Weiss et al.<sup>8</sup> concluded that evidence for conservative treatment including exercise and bracing were limited, and case controlled studies did not exist supporting surgery. Support for bracing was mixed, mainly due to low compliance,<sup>9-17</sup> due to several factors: (a) the need to wear the braces up to 23 hours a day,<sup>11-13</sup> (b) psychological reasons related to embarrassment at school and poor body image,<sup>14,15</sup> (c) back pain,<sup>14,17</sup> and (d) lowered level of quality of life.<sup>16</sup>

Additionally, O'Brien et al.<sup>18</sup> published that an AIS patient, in 2007, could spend more than \$500,000 for 4 surgeries over a 40-year span. Danielsson et al.<sup>19</sup> concluded that AIS patients experienced more lumbar back pain along with decreased spinal mobility and muscle endurance after 20 years of bracing or surgery than a control group.

Since the general public prefers conservative treatment over costly and intrusive surgical interventions for AIS treatment,<sup>20</sup> we present the results from a conservative chiropractic intervention using the NUCCA technique. The primary goal of NUCCA chiropractic care is to restore the spine to its normal biomechanical balance and to bring all structures back to the vertical axis.<sup>21,22</sup> This is achieved by returning the skull and the cervical spine back to orthogonal balance by correcting the mal-alignment of the Atlas vertebrae. Other chiropractic techniques that share this premise are Atlas Orthogonal, Advanced Atlas Orthogonal, Orthospinology, and Grostic, to name a few.

Evidence for the effectiveness of chiropractic treatment and other non-surgical treatments for scoliosis is limited to a few case studies and one pilot study.<sup>23-29</sup> Chen and Chui<sup>26</sup> described a case of a 15 year old female with AIS whose Cobb angle measured 46 degrees. After 18 months of chiropractic spinal manipulation the Cobb angle was reduced to 30 degrees. A retrospective case series by Morningstar et al.<sup>28</sup> revealed an average of 17 degree Cobb angle reduction on 19 scoliosis patients after 4-6 weeks of combined spinal manipulation and postural therapy. However, Lantz et al.<sup>30</sup> conducted a forty-two subject scoliosis study and concluded that full-spine diversified chiropractic technique and heel lifts were ineffective in reducing the curves.

This is a presentation of care provided by an upper cervical chiropractor that applied the NUCCA technique to a 15-year-old female with adolescent idiopathic scoliosis measuring 44°.

## Case Report

### *Clinical Features*

A fifteen-year-old female sought chiropractic care between August 2003 and November 2007. At the initial visit, her primary complaint was pain due to scoliosis that had persisted for two years. She also had complaints of occasional vertigo, occasional lumbar pain, and lack of vitality.

### *Chiropractic Examination*

The practitioner performed an initial exam as per NUCCA protocol.<sup>21,22</sup> According to one of the tenets of NUCCA, a supine leg check revealing a one-inch leg length inequality (right leg < left leg) is indicative of an Atlas misalignment.<sup>1</sup> Knutson concluded both that leg-length inequality of greater than ¾ inch to be clinically significant<sup>31</sup> and may be of value to determine if an atlas adjustment is needed.<sup>32</sup> The supine leg check has demonstrated inter-examiner reliability<sup>33</sup> and clinical validity as a stand alone test for chronic low back pain.<sup>34</sup>

The patient's posture was measured with a Benesh Anatomometer (Benesh Corp., Monroe, MI) and showed her right side pelvic girdle was rotated 4° in the frontal plane with a translation of her pelvis to the right 3°. Seemann<sup>35</sup> demonstrated high inter-examiner and intra-examiner for both frontal and transverse pelvic plane analysis with the Anatomometer.

Full spine radiographs of the patient were taken and revealed a 44° Cobb angle on the right from the 11th dorsal to the 4th lumbar. (See Figure 1a) Lateral, nasium, and vertex radiographs were also taken and analyzed to determine the Atlas' misalignment and orientation in three dimensions. Upper cervical x-ray analysis to determine Atlas misalignment has been documented in the literature as having very good reliability.<sup>36-39</sup>

The lateral film properly displayed the posterior arch of Atlas. (See Figure 2) The nasium film revealed a left head tilt of 4°, Atlas was 2° left of the central skull line, and Axis was rotated 5½° to the right. (See Figure 3a) The vertex film revealed Atlas had rotated anterior 1½° on the left side. (See Figure 4a) These findings confirmed a Type II Atlas misalignment: the patient's central skull line and lower cervical line created acute angles on the same side relative to the Atlas Plane line.

### *Intervention and Outcomes*

The patient had a total of 35 visits over a 4 year and 2 1/2 months period, with only 5 visits requiring an Atlas adjustment. To determine if the patient needed an adjustment, the practitioner put the patient through a series of tests similar to the initial exam but without retaking x-rays. The existence of a supine leg length inequality and postural deviation confirms an Atlas misalignment according to NUCCA's premise.<sup>21</sup> During the 30 visits that did not involve an adjustment, the patient exhibited even supine leg checks, no leg length inequality existed, and postural deviations were within normal limits. On those 30 visits, the patient was released from the office without any intervention.

The patient was adjusted lying with her left side up on a side-posture table with her head on a raised stationary headpiece. Since the Atlas was rotated anterior, the practitioner stood in front of the patient. The practitioner contacted the left transverse process of Atlas with his left pisiform. In order to control the precise movement of the adjustment, the practitioner clasped his right hand over his left wrist firmly, contracted his triceps simultaneously and converged the subtle forces through his pisiform. The uniqueness of the NUCCA

correction does not involve a thrust.<sup>21</sup>

Following the NUCCA correction, the patient underwent a post-adjustment reassessment involving supine leg and postural checks with the anatometer. The patient exhibited an improved posture with legs evenly aligned as by a supine leg length check and the correction of the lateral translation and pelvic rotation.

Immediately after the first adjustment for the correction, a set of post x-rays, full spine, nasium and vertex, were taken to compare the results with the pre x-rays. The full spine film, taken only five months after the initial exam, revealed the patient's Cobb angle had reduced from 44° to 32°. The post-nasium film revealed the Atlas was in nearly ideal alignment. The post-vertex film revealed a reduction in the Atlas rotation from 1 1/2° to 1/2°. (See Figure 2b, 3b & 4b)

The patient returned for weekly check-ups for the next 5 weeks, then every other week for the next 2 months, and then once every 1-2 months for the rest of the first year of care, totaling 15 check-ups. A week after the first adjustment, the patient reported that her neck "feels straighter". Atlas was found to be in proper alignment on every check-up for 51 weeks after her initial visit.

The second Atlas adjustment was delivered in August 2004 and the third delivered 3 months and a week later following two "in alignment" check-ups, which required no adjustment. During the second visit, she reported, "everything is still doing well," and by the third check-up, all her symptoms showed improvement with normal anatometer readings.

The fourth adjustment was after 28 months with 8 "in alignment" check-ups in between. During this visit, she reported she was no longer experiencing any vertigo or lumbar pain. She had noticed more vitality and better facial color.

The fifth and last adjustment was conducted 8 months later in November 2007. Since the patient's symptoms had resolved and the Cobb angle had reduced, she was released from care. At this point, she was no longer a surgical candidate for scoliosis.

## Discussion

This case study presented positive results about a female patient with AIS and the reduction of adolescent idiopathic scoliosis from 44° to 32° over a 5-month period under conservative upper cervical chiropractic care supporting some of the limited current literature.<sup>23-29</sup> The patient's parent gave the authors permission to publish her personal health information without any personal identifiers.

If left alone, the natural progression of lumbar curves greater than 30 degrees in idiopathic scoliosis patients could progress an average of 16.2 degrees after skeletal maturity according to Wienstein et al.<sup>40</sup> Tan et al,<sup>41</sup> suggests using an initial finding of 25 degrees Cobb angle an "important threshold magnitude for long-term curve progression."

Since the Atlas is predominately held in place by ligaments and muscles, it is more prone to being misaligned than any

other vertebra.<sup>22,42-44</sup> As the brainstem exits the skull through the foramen magnum and occupies the neural canal at the superior aspect of the Atlas, a slight mal-alignment of the Atlas' position may lead to neurological compromise at the brain stem level.<sup>22,44</sup> In fact, Rosenberg et al.<sup>45</sup> concluded that instability as far down as the third cervical vertebra may result in brain stem dysfunction. Others have discovered 42% of AIS patients had their cerebellar tonsillar tip below the basion-opsithion line of 1 mm<sup>46</sup> especially in those with greater than 40-degree Cobb's angle.<sup>47,48</sup> This finding was significantly lower than control groups leading us to look at the brain stem.

The neuro-anatomy of the brain stem is important to note. The lateral vestibular nucleus fibers run to the anterior horn cells, via the vestibulospinal tract in the brain stem, to coordinate spinal motor activities like head position and postural stability.<sup>41,42,49,50</sup> It is at the brain stem level that some studies have found a correlation between brain stem dysfunction<sup>51-53</sup> and paraspinal muscular imbalance with scoliosis.<sup>54,55</sup>

Barrios et al.<sup>51</sup> induced kyphoscoliosis in 25% of Wistar albino rats after damaging the gracilis nucleus, the superior colliculus, and the lateral vestibular nucleus in their brain stems. This resulted in paraspinal muscle imbalance and increased muscle activity on the convex side of the scoliosis. In human adolescents, Yamamoto et al.<sup>52</sup> discovered a positive correlation between spinal curvature progression and brain stem dysfunction and concluded that the postural regulating system at the brain stem should be assessed to predict spinal curve progression in AIS patients. Byl et al.<sup>56</sup> also suggested that AIS patients may have problems with postural righting reflexes.

This may explain why the young woman in this study presented with a short right leg during the supine leg check. The Atlas subluxation produced a dysfunction at the brain stem that specifically affected the vestibulospinal tracts. This resulted in the increased contracture on her spinal muscles on the side of convexity, the right side of her scoliotic curve, pulling up her right ilium to cause a 1 inch right short leg. Once the adjustment was delivered to correct the Atlas mal-alignment, the Atlas was returned to its anatomical norm, her postural-righting reflex returned, and her spinal balance immediately corrected, which resulted in even leg lengths. As the spinal muscles on her right side started to relax, the rest of her spine adapted to the new "straighter" position and reduced her spinal curves.

Although the patient experienced one Atlas mal-alignment correction and underwent 5 months of check-ups without subsequent corrections, psychosomatic placebo could affect the patient during the 12 non-adjustment visits. Bias on the part of the practitioner is more difficult to account for as the NUCCA practitioner was the only one who took and analyzed the pre- and post-NUCCA series of x-ray films and also the pre- and post-intervention full spine x-rays.

Unfortunately the lack of another full-spine film taken after the post-intervention at 5 months of care to follow up at one year and at four years of care could have provided useful information on the progression of the patient's spinal curves. Having a thorough meaningful history, anthropomorphic data,

Roland Morris form for functional disability, pre and post quality of life questionnaires and objective neuromuscular examination findings would have made this case study stronger.

It is also important to note that the NUCCA technique is practiced by a small group of specially trained chiropractors. The NUCCA practitioner in this study has been in practice for over 50 years.

### Conclusion

We presented the upper cervical chiropractic care, NUCCA, of a 15-year-old female patient with 44° Cobb's angle AIS. After one adjustment to correct her Atlas mal-alignment and 5 months of check-ups, the patient's Cobb angle was reduced to 32° on a post full spine x-ray. The patient was adjusted an additional 4 times over a span of four years and two months.

Further investigation is needed to study the relationship between the correction of the Atlas mal-alignment and the reduction of the Cobb angle in adolescent idiopathic scoliosis patients.

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## Radiography

Full spine, Lateral cervical, nasium, and vertex radiographs were taken and revealed the following: The pre full spine x-ray revealed a Cobb's angle of  $44^{\circ}$  on the right from the T11 to L4. The lateral cervical x-ray was unremarkable and properly displayed the posterior arch of Atlas. The Nasium x-ray revealed a head tilt to the left of  $4^{\circ}$ , Atlas is measuring  $2^{\circ}$  to the left of the central skull line, and Axis has rotated  $5\frac{1}{2}^{\circ}$  to the right. The vertex film revealed anterior Atlas rotation of  $1\frac{1}{2}^{\circ}$  on the left side. (See Figure 1a, 2, 3a & 4a)

Follow-up radiographs revealed an improvement in Cobb's angle, which reduced to  $32^{\circ}$  on the full spine x-ray. The post-nasium film revealed the Atlas was in nearly ideal alignment. The post-vertex film revealed a reduction in the Atlas rotation from  $1\frac{1}{2}^{\circ}$  to  $1/2^{\circ}$ . (See Figure 1b, 3b & 4b) The patient experienced complete resolution of her primary complaints and was no longer a candidate for surgical intervention for the scoliosis.

**Figure 1a – Pre Full Spine X-ray**



**Figure 1b – Post Full Spine X-ray**



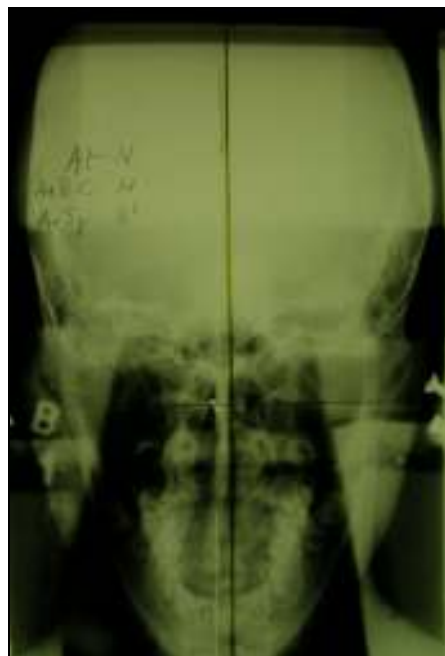
**Figure 2 – Lateral Cervical X-ray**



**Figure 3a – Pre Nasium X-ray**



**Figure 3b – Post Nasium X-ray**



**Figure 4a – Pre Vertex X-ray**



**Figure 4b – Post Vertex X-ray**

