CASE STUDY

Reduction of Adolescent Idiopathic Scoliosis & Improved Cervical Curve in a 12-Year-Old Female Undergoing Orthogonal Upper Cervical Chiropractic Care: A Case Report & Review of Literature

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ABSTRACT

Objective: To describe the effects of orthogonal upper cervical chiropractic care on the management of a 12-year-old female with adolescent idiopathic scoliosis.

Clinical Features: A 12-year-old female presented to a chiropractor with a chief complaint of headaches after a collision during a lacrosse game. Upon radiographic examination an S-shaped scoliosis of 15.4° in the thoracic spine and 16.2° in the lumbar spine was revealed.

Intervention and Outcomes: Three upper cervical adjustments were delivered over a period of five visits and 28 days. A reduction of 6.2° in the thoracic curvature and 8.7° in the lumbar curvature was found upon re-examination. The cervical curve also improved.

Conclusion: Subluxation of the atlas vertebra and the resulting neurological dysfunction may be a contributing factor in adolescent idiopathic scoliosis. Reduction of the subluxation with low-force, orthogonal upper cervical chiropractic adjustments may help reduce these lateral curvatures. Further research is needed to investigate the relationship between the atlas subluxation and idiopathic scoliosis.

Key Words: *Scoliosis, upper cervical, craniocervical junction, atlas, subluxation, adjustment, NUCCA, Grostic, Atlas Orthogonal, Advanced Orthogonal, Orthospinology*

Introduction

Scoliosis is defined as a lateral spinal curvature of at least 10° on standing radiographs, based on the Cobb method of analysis. Classification of scoliosis begins with identification of the cause of the abnormality. When structural malformations, neurological disorders, tumors and other known etiological factors have been ruled out, a classification of idiopathic scoliosis is applied.

This category is then delineated further based on the age of the patient at diagnosis. Between the age of 10 and the time a patient has reached full skeletal maturity, scoliosis without a known cause is termed Adolescent Idiopathic Scoliosis (AIS).[1]

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Scoliosis is found in 2-4% of children between the ages of 10 and 16 years old. With the infantile (<3 years of age) and juvenile (3-10 years old) forms accounting for less than 1% and 12-21% of all idiopathic scoliosis cases, AIS is the most common form of the disorder.[2] Traditional medical management for scoliosis in skeletally immature patients is based on the severity of the curve and its likelihood for progression. It is typically represented by a three-phase continuum monitoring for curves of <20°, bracing for curves between 20 and 40° and surgical intervention for curves >50°.

Most of the existing literature on chiropractic management of scoliosis focuses on direct intervention through full-spine segmental manipulation, postural exercises and traction. Morningstar et al. have produced multiple reports on benefits of the Pettibon system for scoliotic patients[3-5] while others have presented improvements under Diversified,[6,7] Chiropractic Biophysics,[7] Pierce,[8] and Thompson[9] techniques.

The authors of this report were able to identify three studies exploring the effects of upper cervical chiropractic on the condition. Eriksen published the first of these studies investigating the effects of primary upper cervical chiropractic care on a case of juvenile idiopathic scoliosis on a 9-year-old male, showing an 88% reduction in the patient's double rotatory scoliosis after 5 upper cervical adjustments over 13 visits.[10]

In 2010, Khauv and Dickhotlz presented a case featuring reduction of a 44° Cobb angle to 32° in a 15-year-old female with AIS following one atlas subluxation correction and 5 months of "check-ups".[11] The following year Chung and Salminen produced a case report showing a reduction of a thoracolumbar scoliosis in a female AIDS patient from 35° to 24° following six upper cervical adjustments over a 25 week period.[12] A fourth study[13] purporting the use of Hole-In-One (HIO) technique was initially considered as an example of an upper cervical study; however the report referenced no identifiable upper cervical protocol and listed a multiplicity of non-chiropractic interventions.

Criteria for Chiropractic Care

The orthogonal model of upper cervical chiropractic focuses on alignment of the occipito-atlanto-axial (C0-C1-C2) joint complex, increasingly referred to as the craniocervical junction (CCJ). This model assumes that the ideal position of these structures is a perpendicular relationship between both the sagittal plane of the skull or "central skull line" and the sagittal plane of the lower cervical spine (represented by "angular rotation" or "AR") with the transverse plane of the atlas ("atlas plane line").

Techniques within this model include Grostic, Orthospinology, Atlas Orthogonal, Advanced Orthogonal and NUCCA. This model exists in the upper cervical paradigm along with the articular model, which focuses on the relation of the atlanto-occipital and atlanto-axial articular surfaces rather than the relative position of the structures in space. Orthogonal techniques place force into the transverse process of the atlas, using the vertebra as a lever to gently reposition the skull over the lower cervical spine.[14]

Patients are considered candidates for care following a detailed history and physical examination. Examination begins with vital signs including height, weight, and blood pressure. Next paraspinal thermography and sEMG scans are performed to assess for signs of neurological dysfunction. Range of motion is then measured in the cervical and lumbar spine to assess for motion restrictions. Finally, the doctor performs a postural assessment, supine leg length analysis, and paraspinal static palpation. These three evaluations are used throughout a patient's care plan to assess for subluxation during regular office visits.

The doctor interprets the findings of the physical exam to decide if the patient qualifies to move on to the radiologic examination. Findings including aberrant paraspinal thermography and sEMG, supine leg length inequality, postural asymmetries and palpatory hypertonicity and tenderness indicate the presence of an atlas subluxation complex (ASC). If qualified, patients will have lateral cervical, vertex, and nasium radiographs taken and analyzed to confirm the presence of atlas misalignment.

The lateral cervical film is taken to view the state of the cervical lordosis, to locate the segmental contact point (atlas transverse process) and to act as a guide for producing a high quality nasium film using "S-lines". Analysis of the nasium, an anterior to posterior view of the upper cervical spine through the skull, reveals both the side of atlas laterality as well as, through calculation, the height vector that will be used during the adjustment.

Finally, the vertex provides a "top-down" view of the upper cervical spine and is used to determine the direction and degree of the rotatory component of the misalignment. From these radiographs a four-part listing is derived that the doctor will use when delivering adjustments. This listing includes the side of laterality of C1 (Left/Right), the height vector (High/Low and magnitude), rotation vector (Anterior/Posterior and magnitude) and torque (Superior/Inferior).[15]

Chiropractic Adjustment

With the patient in the side lying position, the doctor places the patient's head on a solid headpiece with support beneath the mastoid process. The headpiece is raised or lowered and the flexion and rotation of the patient's head are slightly altered to allow for maximum relaxation of the cervical musculature. Using the vectors derived from the x-ray analysis, the doctor measures a resultant to determine the line of correction for the adjustment. With this, the doctor can determine the proper stance, hand position (or the position of the instrument if recommended by the technique) and relative amount of force to use to deliver the optimal correction.

Post Analysis

Post-adjustment, the doctor uses the same postural assessment, supine leg length analysis, and paraspinal static palpation to assess for reduction of the atlas subluxation. A relative balancing of functional postural distortions, decrease in leg length inequality and relaxation of hypertonic cervical musculature serve as indicators that a correction has been made. Following a patient's first adjustment, a set of "post" films (vertex and nasium) is taken to confirm the accuracy of the listing via visible reduction of the misalignment. If a significant reduction is made, the listing is accepted and used for future adjustments. Unsatisfactory corrections lead the practitioner to a reevaluate the original films and may necessitate "post 2" vertex and nasium films following the second adjustment for verification.

The following is a detailed case report of a 12-year-old female patient with a 15.4° thoracic levoscoliosis and a 16.2° lumbar dextroscoliosis that was reduced following upper cervical chiropractic care.

Case Report

History

A 12-year-old female presented to the clinic with a chief complaint of headaches following a collision during a lacrosse match one and a half weeks prior. The collision included a blow to the head that resulted in loss of consciousness. The headaches occurred daily and were described as pulsating and localizing to the left ear. Additional complaints included difficulty concentrating, neck, low-back, shoulder and ankle pain, and stomach discomfort.

Further questioning revealed that at nine months of age the patient fell down a set of stairs. The patient had a surgical history of adenoidectomy and tonsillectomy. She had a previous history of chiropractic care, but details were not provided.

Physical Examination

Postural analysis revealed right head and neck tilt, right high shoulder and high ilium and left anterior shoulder rotation. Static palpation revealed severe palpatory tenderness and hypertonicity at C0-C3 on the right and at the right shoulder. Moderate hypertonicity without tenderness was noted at T1-T4 and L5-S2 on the right. The patient exhibited a functional supine leg length deficiency of 1/4" on the left. No positive Adam's Sign was recorded at the time of the physical exam.

Diagnostic Imaging and Analysis

Upper cervical radiographs were indicated based on an evaluation of the examination and chiropractic analysis data. Lateral cervical, vertex, and nasium radiographs were taken (Figures 2a, 3a, and 4a), followed by AP and lateral thoracic and lumbopelvic views. The AP thoracic and lumbopelvic films were then stitched together using 20/20 Imaging software to produce an AP full spine image (Figure 1a).

Using the Cobb-Lippman method, a left curvature of 15.4° from T4 to T12 and a right curvature of 16.2° from T12 to L4 were measured. The lateral cervical film revealed a decreased cervical lordosis. The nasium and vertex films were analyzed; with 3.55° of C1 laterality and 1.25° of anterior rotation, a listing of [R H0.22 A1.25 I] was determined.

Interventions and Outcomes

The patient had a total of five visits over a 28-day period during which three atlas adjustments were delivered. The patient received adjustments on the first, second, and fourth encounters after positive findings for postural distortions, leg length inequality and cervical palpatory tenderness were revealed. During the third encounter the patient showed balanced posture and leg length and was negative for cervical palpatory hypertonicity/tenderness, indicating that a correction was not necessary and no intervention was delivered. During the fifth encounter, an adjustment was delivered, but only after the reexamination, including an updated radiographic exam, had been performed.

During the three adjustments that were delivered the patient lied in the side-lying position with her right side up. The doctor measured the height and rotation vectors of 0.22" superior and 1.25" anterior, respectively, from the contact point as determined by the lateral cervical film. The doctor positioned himself in front of the patient with the resultant line of correction bisecting his stance and with his feet shoulder width apart, hinging at the waist, he clasped his left hand over his right wrist and contacted the patient's right transverse process with his right pisiform.

Minute contractions of the doctor's triceps produced thrusts with excursions of approximately 1/16th of an inch. Post films following the initial intervention revealed an unsatisfactory correction of the atlas misalignment (Figures 3b and 4b). A reevaluation of the original films followed, however no change was made to original listing. Post films following the second adjustment revealed a significant reduction in the laterality of the atlas misalignment (Figure 3c).

After 28 days, a chiropractic reexamination was performed that included AP and lateral views of the thoracic and lumbopelvic spine as well as a lateral cervical view. Using the same methods as for the initial full spine series, the AP thoracic and lumbopelvic views were stitched and analyzed to reveal a decrease in the severity of both lateral curvatures (Figure 1b). The thoracic levoscoliosis was reduced to 9.2°, a 40% reduction, while the lumbar dextroscoliosis was reduced to 7.5°, a 53.5% reduction. These findings indicate that both curves were reduced to a point beneath the standard 10° threshold for diagnosis of adolescent idiopathic scoliosis. The patient also experienced visual improvement in the lordosis of the cervical spine as seen on the lateral cervical view (Figure 2b).

Discussion

This case presented the reduction of adolescent idiopathic scoliosis in a 12-year-old female presenting with a chief complaint of headaches. Over a 28-day period, conservative chiropractic management led to improvement in chief complaint as well as incidental findings of scoliotic distortions.

As the name implies, experts have failed to conclusively determine the etiology of adolescent idiopathic scoliosis. Multiple pathophysiological processes have been proposed and are strongly indicated including genetics, asymmetrical spinal growth patterns, and even the innate mechanics of upright posture, but an inability to link a single causative factor to all cases has resulted in a multifactorial status.[16] While medical theorists steer research in the direction of genetic predisposition[2], chiropractors are uniquely positioned to address the neurological component of this condition.

Chiropractors managing cases of the disorder should not only be aware of the implications of biomechanical abnormalities for central nervous system dysfunction, but conversely, the impact of CNS dysfunction on spinal biomechanics as well.

CNS Dysfunction, Dysafferentation and Scoliosis

Neurological disorders are known to cause structural scoliosis.[16] Animal studies have shown lesions within the CNS, especially the brainstem, to be linked to balance disruption and postural abnormalities,[17-20] however many of these are conducted on quadrupedal animals with spinal biomechanics vastly different from those of humans.[16] In a 1981 study, Pincott and Taffs induced scoliosis in primates via injection of poliomyelitis into the spinal cord. The areas with the most significant damage caused by the virus prior to the development of the scoliosis were predominantly sensory in nature, suggesting that, “disturbance of the sensory input into the spinal cord can cause scoliosis,” and, “[t]he mechanism whereby scoliosis develops when afferent nerves to the spinal cord are disrupted appears to be asymmetric loss of proprioception… leading to muscular imbalance.”[21]

Although previous studies have relied on the Grostic Dentate Ligament theory to explain the link between upper cervical subluxation and idiopathic scoliosis,[10-12] Chung admits that “the theory has some limitations.” The application of dentate ligament theory to scoliosis is based around the spinocerebellar tract’s influence on leg length inequality and subsequently, pelvic imbalance[12], the same mechanism posited by many full spine practitioners. Pelvic imbalance corrected by heel lifts in conjunction with spinal manipulation has been shown to be ineffective in the correction of scoliotic curves.[22]

The authors of this study suggest that instead, the association between upper cervical subluxations and scoliosis instead is caused by dysafferentation, or an imbalance in the afferent input into the body[23] through dysfunction of the upper cervical spine. The cervical spine has the highest concentration of mechanoreceptors of any spinal region.[24] The authors suggest that when the upper cervical region of the spine, rich in mechanoreceptors, becomes dysfunctional, a significant amount of afferent input into the brain is decreased, thereby causing similar muscular imbalances to those reported by Pincott and Taffs in their primate study.

Limitations of this study include its retrospective nature, the lack of a control group for comparison and the absence of independent third-party verification of the results. More research is needed to investigate the relationship between the atlas subluxation complex, dysafferentation theory and adolescent idiopathic scoliosis.

Conclusion

After three adjustments, a 12-year-old female patient experienced a reduction of scoliotic curves in the thoracic and lumbar spine regions to below the level required for diagnosis of scoliosis. This study suggests that orthogonally-based correction of misalignments at the craniocervical junction and resulting neurological dysfunction may provide benefits to patients with mild scoliosis. The authors suggest that both brainstem deformation as well as detrimental alterations in sensory input may play a role in the etiology of adolescent idiopathic scoliosis. Further investigation is warranted to study the relationship between upper cervical dysfunction and scoliosis.

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Appendix

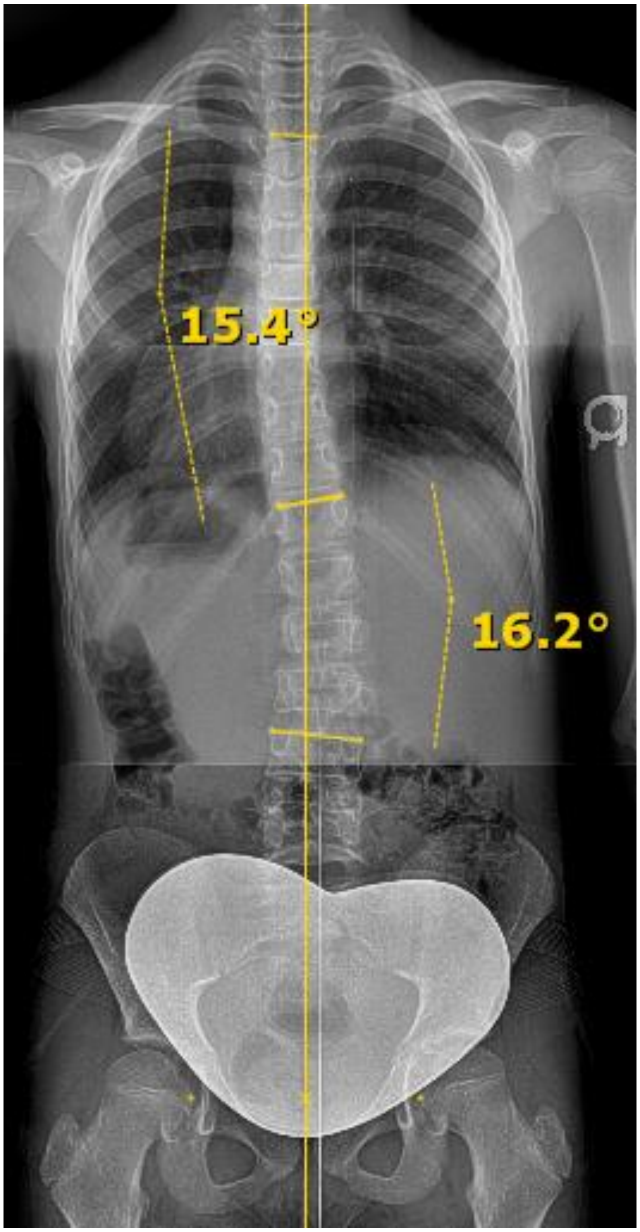

Figure 1a. Initial examination stitched AP thoracic and lumbopelvic full spine views with S-shaped scoliosis

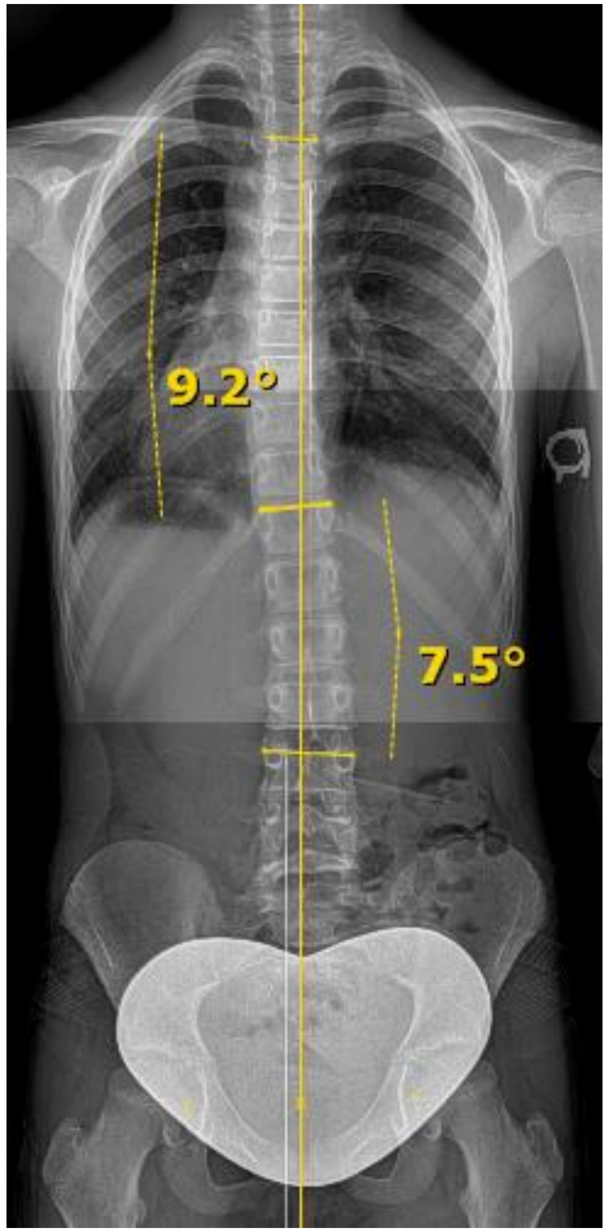

Figure 1b. Reexamination stitched thoracic and lumbopelvic full spine view with reduction in severity of thoracic and lumbar scoliosis

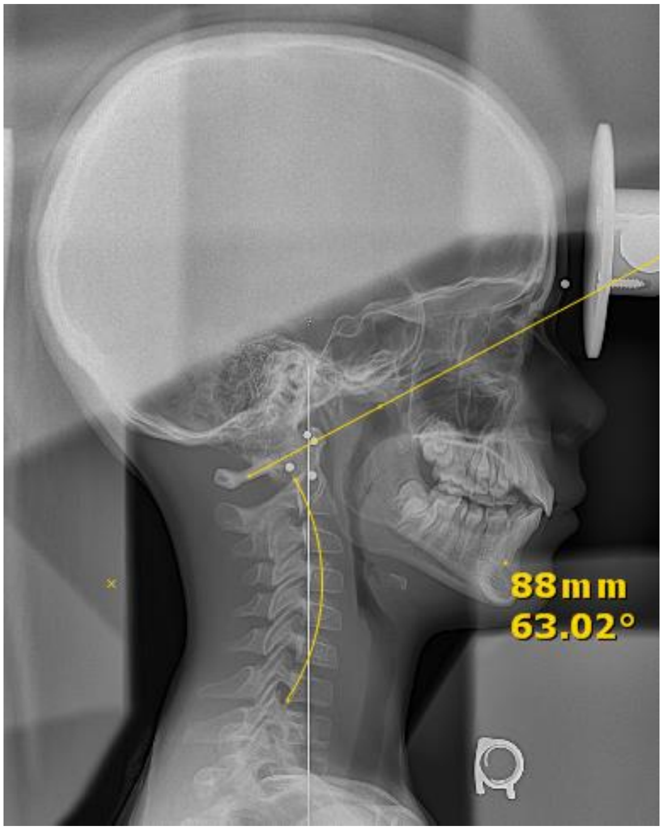

Figure 2a. Initial examination lateral cervical

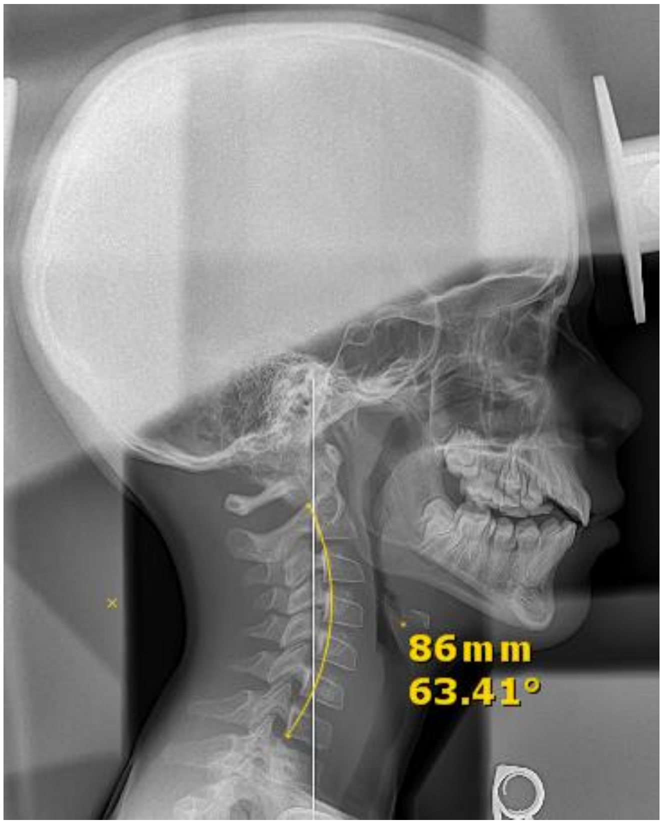

Figure 2b. Re-examination lateral cervical with improvement in cervical lordosis.

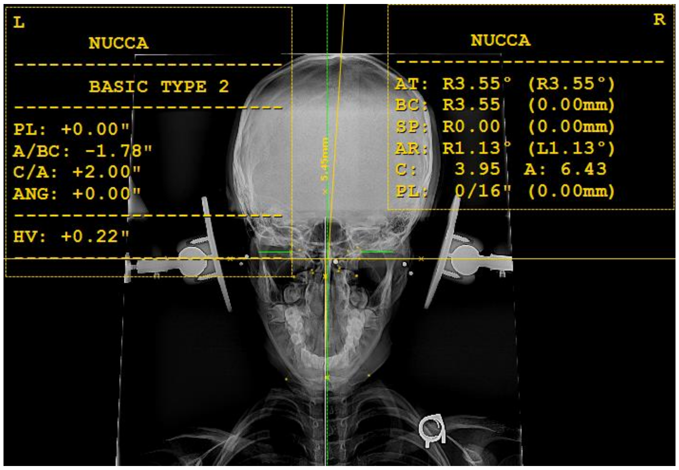

Figure 3a. Initial Exam Nasium View

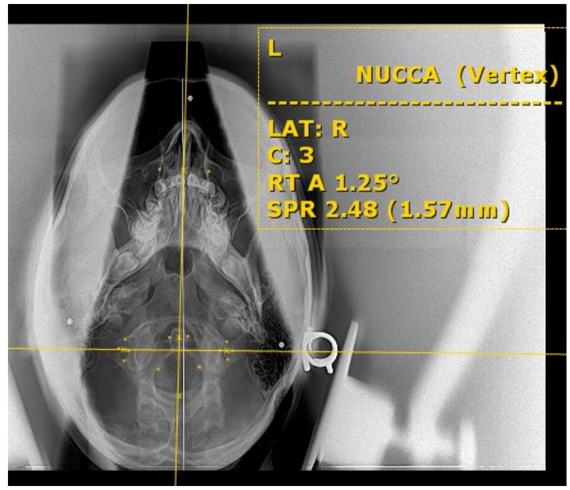

Figure 4a. Initial Exam Vertex View

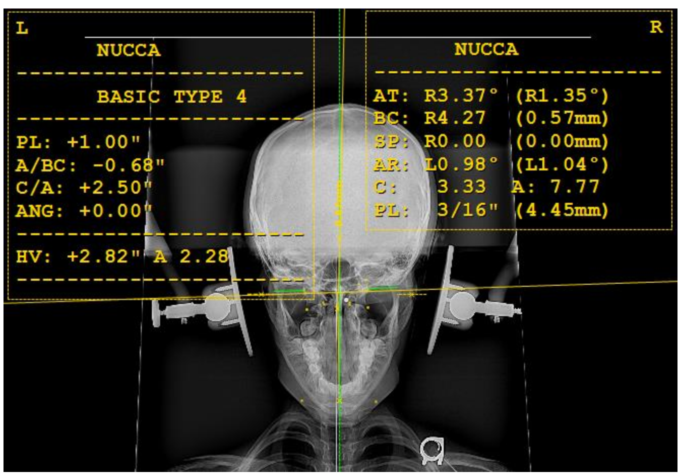

Figure 3b. “Post 1” Nasium View

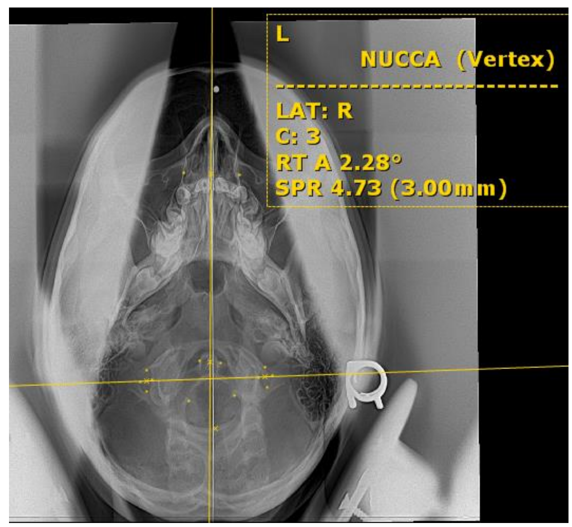

Figure 4b. “Post1” Vertex View

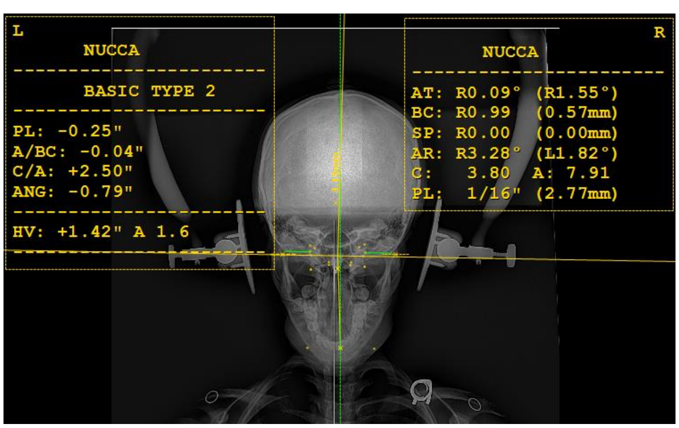

Figure 3c. “Post 2” Nasium View

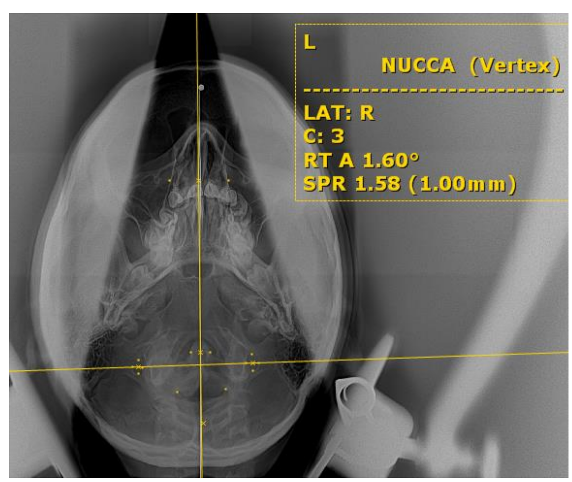

Figure 4c. “Post 2” Vertex View