CASE STUDY

Reduction in Scoliosis in a 10 Year-Old Female Undergoing Upper Cervical Chiropractic Care: A Case Report

Jonathan Chung, D.C.[1] & Bryan Salminen, D.C[2]

Abstract

Objective: To provide a detailed report of a patient with idiopathic scoliosis under upper cervical chiropractic care.

Clinical Features: A 10 year old female presented to a private chiropractic practice with a chief complaint of migraine headache and a 35 degree thoracolumbar scoliosis.

Intervention and Outcomes: Six upper cervical adjustments were delivered over a period of 11 visits and 25 weeks. A 10 degree reduction in scoliotic curve was found and confirmed by an independent medical radiologist.

Conclusion: The upper cervical subluxation may be a contributing factor to idiopathic scoliosis. Reduction of the subluxation with specific vectored correction may help reduce curvatures in the thoracic and lumbar spine. More research is warranted investigating the effects of upper cervical care and idiopathic scoliosis.

Key Words: *Scoliosis, upper cervical, subluxation, orthogonal, NUCCA, Grostic, Orthospinology, Atlas Orthogonal*

Introduction

Idiopathic scoliosis, as defined by the Scoliosis Research Society, is a lateral curvature of the spine measuring 10 degrees or greater by the Cobb-Lippman method on a standing radiograph. Scoliosis is estimated to affect 2-4% of adolescents between the ages of 10-16 years.[1] Scoliotic curves are generally considered to be a cosmetic problem with an occasional cause of minor back pain within the medical paradigm.[2] However, it has been documented in the literature that scoliosis can be associated with psychological distress[3] and decreased respiratory function[4] in subjects with curves beyond 10 degrees.

Medical management of the scoliosis patient has focused on watchful monitoring, orthopedic bracing, and surgical fusion depending on the severity and potential for progression of the lateral curve. Although bracing has documented success in

1. Private Practice of Chiropractic - Coral Springs, FL
2. Private Practice of Chiropractic - Alpharetta, GA

preventing curve progression and reduction in the need for surgical intervention,[5] the psychological impact of a full-time bracing system have shown to decrease compliance among female subjects.[6] An analysis of postoperative complications from spinal fusion surgeries revealed that 14.9% of pediatric patients and 25.1% of adult patients experienced symptoms that related to pulmonary, hemorrhagic, renal, cardiac, and neurologic complications.[7]

Historically, chiropractic has had a role in managing scoliosis due to its nature of intervening at the level of the spine. However the results of traditional spinal manipulation (high velocity, low amplitude thrusts) have been equivocal.[8] There has been a growing body of case studies published by Morningstar et al. discussing the effectiveness of spinal manipulation in conjunction with the Pettibon Spinal Rehabilitation System in reducing large curvatures in the spine.[9, 10] In the literature, there has only been one case study published that examines the role of the upper cervical subluxation on the progression of scoliotic curves.[11] This paper will describe the potential role that specific upper cervical correction of the atlas subluxation has on idiopathic scoliosis.

Criteria for Chiropractic Care

Upper cervical chiropractic is a technique and analysis focused on the alignment of the atlas vertebra in relation to the skull and the axis. Patients are accepted for upper cervical care based on exam procedures that indicate disrupted function of the nervous system. This includes postural assessment,[12] supine leg length inequality,[13,14] cervical static/motion palpation, [15] aberrant paraspinal thermography,[16] and aberrant paraspinal sEMG[17] findings to indicate the presence of the atlas subluxation complex.

If an atlas subluxation is indicated by the chiropractic exam, then a lateral cervical, vertex, and nasium radiographs are taken. These upper cervical specific radiographs are used to measure the direction and magnitude of atlas laterality, atlas/axis rotation relative to the skull, atlas alignment to axis, and condylar/axial surface. The nasium view is used to derive vectors in height and laterality while the vertex is used to determine the vector to correct atlas rotation.[18] The x-ray analysis of these films has been demonstrated to have a good to excellent level of inter-examiner reliability for those trained in Grostic/Orthospinology methods in 3 studies in the peer reviewed literature.[19,20,21]

Upper cervical adjustments are delivered in the side lying position on a head piece with mastoid support. The height and rotation vectors are measured in inches and a resultant vector is revealed to determine the stance and line of drive in which the adjustment is delivered. The correction is performed with a low force adjustment with an excursion ranging from 1/16 to 1/8 of an inch in depth. Following the adjustment a postural reassessment, leg length evaluation, and static palpation of the cervical spine are performed again to confirm a reduction in the atlas subluxation.

A post x-ray is taken immediately following the first adjustment. The new radiographs are analyzed to determine if a quantitative reduction in the atlas misalignment has occurred with an optimal relationship resulting in a measurement of 0 degrees for laterality, rotation, and height. If a significant reduction is made, then the listing is used for future visits. Previous studies on upper cervical chiropractic have shown that a reduction in atlas laterality correlates with improved outcomes in neck pain and non-migraine headache.[22, 23]

A frequent criticism of upper cervical chiropractic care is the risk of radiation exposure from the additional radiographs used for analysis. A study by Rochester found that the use of pre and post x-rays led to a total risk of 0.7905%.[22] Based on this figure and an analysis of previous studies, he found that the elevated risk of thyroid cancer from upper cervical x-rays to be zero or insignificant. Dosage is further reduced in the practice through the use of lead filters to remove any structures not necessary to the film's use. One study found that dosage can be reduced by an average of 65% with a 97% reduction to the skull and eyes through the use of lead filters.[24]

The following is a detailed case report of one patient with a 35 degree scoliosis with an independent confirmation of scoliotic curve reduction following reduction of the atlas subluxation complex.

Case Report

History and Exam

A 10-year old female presented to a chiropractic clinic with a chief complaint of migraine headaches. The headaches were described as a pounding pain in the front of the forehead around the right eye. The headaches occur 2-3 times per week and are occasionally accompanied by dizziness and vomiting. She reports that Tylenol and rest helps. The patient has had her eyes checked by a medical doctor, but the exam was unremarkable. Additional complaints include difficulty straightening her back with flexibility loss, shoulder tightness, and ringing in the ears while reading.

Further questioning revealed that at 1 year of age, the patient fell down the stairs backwards. She has no history of previous surgeries or previous chiropractic care. A diagnosis of a 35° juvenile idiopathic scoliosis was made on 11/8/2004 by a children's orthopedic center with a recommendation to monitor the progression of the curvature. (Figure 1)

Cervical range of motion was measured at 45° in flexion, 55° extension, 25° left lateral flexion, 40° right lateral flexion, 70° left rotation, and 60° right rotation. Lumbar range of motion was measured at 90° in flexion, 30° extension, 20° left lateral flexion, and 35° right lateral flexion. Static palpation showed severe muscle hypertonicity at right occiput, and right side C1. Moderate hypertonicity was noted at C2-C4 on the right, T3-T11 on the right, and L1 – Sacrum on the left. There was also a positive Adam's test for a functional scoliosis.

Diagnostic Imaging

A-P x-rays were taken on the thoracic and lumbopelvic spine. A lateral curvature from T5-T11 was noted. The Cobb-Lippman method was used, and a measurement of 35° indicating a moderate scoliosis was noted. Upper cervical radiographs were indicated and a lateral cervical, nasium, and

vertex x-ray were taken.

Chiropractic Analysis

Posture Analysis revealed a right head tilt, left neck tilt, right high shoulder, right anterior shoulder rotation, and right high ilium. A functional leg length deficiency of ¼" was noted on the left leg. Tenderness upon palpation was noted from C2 to C4 on the right side. Upper cervical radiographs were analyzed and a listing of right laterality, high 2 1/8°, anterior 1/2° was determined. The patient was given her first upper cervical adjustment and post x-rays were taken. The post adjustment radiograph showed a complete reduction in atlas rotation and head tilt, while the lower angle and central skull line were brought in line with the vertical axis line. The results indicated a significant reduction in misalignment, and the listing was kept for future visits. (Figures 3-8)

Outcomes

Each visit involves a postural assessment, leg length assessment, and static palpation to determine the presence of an atlas subluxation. Following each adjustment, posture, leg length, and static palpation was performed once more to determine if the misalignment was corrected.

The patient made 11 visits in a 25-week period. In that time, six adjustments were performed. Seven months after the initial diagnosis of juvenile idiopathic scoliosis, the patient returned to the orthopedist for a new radiograph to monitor the progression of the scoliosis. The medical radiologist measured a 25-degree scoliosis indicating a 10 degree reduction from her first x-ray and gave a recommendation to continue conservative care. (Figure 2)

A chiropractic re-exam was performed along with a stability report a month after the visit to the orthopedist. Lumbar and thoracic x-rays were taken to monitor the progression of the scoliotic curve. The patient reported experiencing less frequency in headaches and a 75% improvement in symptomatic relief. The x-rays revealed a 24° curve confirming the reduction observed by the orthopedic center's radiologist. (Figure 2) A postural exam found neutral head tilt, neck tilt, anterior shoulder rotation, and a level ilium. Cervical range of motion in left lateral flexion and right rotation increased to 40° and 70° respectively. Lumbar ranges of motion in left lateral flexion increased to 30° while right lateral flexion decreased to 25°. A static palpation exam of the cervical and lumbar spine revealed an absence of tenderness and hypertonicity.

Discussion

The case described the reduction of idiopathic scoliosis in a 10 year old female presenting with migraine headache. The patient showed improvement in her chief complaint while showing improvement in postural findings throughout her care. A follow up x-ray with the children's orthopedist showed a 10 degree improvement in scoliosis which was consistent with the improved posture.

The etiology of idiopathic scoliosis has been heavily studied but remains elusive. Pertinent theories for chiropractic have ranged from cortical asymmetry,[25] pelvic imbalance,[26] and disrupted sensory input.[27] Though these theories provide a basis for approaches that utilize functional restoration and full spine chiropractic approach, it does little to explain how upper cervical practitioners have seen improvements in thoracic and lumbar curves while only adjusting the atlas. The following will discuss the literature on the role of the brainstem in postural control, and how the atlas subluxation complex may create abnormal postural findings.

CNS Lesions and Scoliosis

The role of CNS lesions in the presentation of scoliotic curves has been studied extensively. With the advent of magnetic resonance imaging, patients previously diagnosed with idiopathic scoliosis were found to have primary CNS lesions that include low cerebellar tonsils, syringomyelia, and Chiari malformations.[28, 29, 30] Because of this link, it is recommended that an MRI screen is recommended for any patient with scoliosis that is considering a brace or surgical intervention.[30, 31]

Animal models have shown that the midbrain and descending tracts of the spinal cord contribute a significant amount to postural control. Lesions placed in cats and rabbits in the anterior spinal cord and brainstem have produced significant balance disruption and postural alterations while sectioning of the cortex had less effect.[32, 33, 34] Of particular significance to the upper cervical chiropractor is the fact that "balance requires the integration of vestibular, visual, and proprioceptive information which is known to occur in the brain stem and cerebellum."[33]

The atlas subluxation, cord distortion, and scoliosis

The dentate ligament/cord distortion hypothesis is a model proposed by Grostic to explain the neurological manifestations associated with the misalignment of the atlas vertebra.[13] It states that the strength of the dural attachments to the upper cervical region can create torsion of the brainstem and spinal cord when the atlas is moving abnormally. The spinocerebellar and spinothalamic tracts of the cord can become mechanically irritated with 0.75 degrees of lateral misalignment creating muscle tone imbalance, leg length inequality, and pain. Grostic further notes that the traction of the cord by the dentate ligaments may cause stasis of blood and ischemia in the cord creating an indirect irritation to the various spinal cord tracts.

Among these tracts is the spinocerebellar tract, to which Grostic credits as the source of pelvic imbalance and leg length inequality. Pelvic imbalance resulting in leg length inequality is frequently cited as the cause of postural distortions resulting from the atlas subluxation, but the theory has some limitations. The use of heel lifts to correct leg length inequality paired with spinal manipulation showed no effect on scoliotic curves.[8] Additionally leg length inequality cannot fully explain the global changes in posture and axial paraspinal muscle tone found immediately after an upper cervical adjustment.

The implications of the cord distortion hypothesis as a neurological cause of postural imbalance as it relates to

scoliosis can be found in a study by Geissele et al. In the study 26 patients with adolescent idiopathic scoliosis were studied. 27% of the patients had asymmetry in the ventral pons/medulla oblongata while only 9% of the control group had the asymmetry as determined by MRI.[35] Geissele further notes that these asymmetries disrupt the integration and transmission of impulses responsible for posture, proprioception, and equilibrium which are found within tracts in the brainstem (corticospinal, reticulospinal, rubrospinal, and vestibulospinal).

It is suggested by the authors of the current study that the atlas misalignment may create asymmetries in the brainstem due to the strength of the dural attachments at the atlas and the dura's connection to the cord via the dentate ligament. This mechanism provides a rationale for the immediate changes in observable posture and axial muscle tonicity that upper cervical practitioners find after an adjustment, and provides further support for scoliosis to be linked to problems in the central nervous system.

The study's limitations include the fact that it is retrospective and it lacks a control group due to its practice based nature. More studies are warranted including a more focused study on adolescent idiopathic scoliosis as well as imaging studies to see if correction of the atlas subluxation does in fact change structure of the brainstem and spinal cord.

Conclusion

The results of this study suggest that vectored correction of an atlas misalignment using an orthogonally-based analysis may improve outcomes in patients with mild to moderate scoliosis. The authors suggest that cord deformation especially at the level of the brain stem may be an aggravating factor in the etiology of idiopathic scoliosis, and provides a rationale for improvements in postural findings following an upper cervical adjustment. Further studies on the effects of upper cervical chiropractic on scoliosis and brainstem deformation are recommended.

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Figure1- Pre Treatment Radiology Report -- A diagnosis of a 35° juvenile idiopathic scoliosis was made with a recommendation to monitor the progression of the curvature

CC: Scoliosis.

HPI: This is a 9-year 10-month-old premenarchal young lady who comes in today for an evaluation of a curve. This was picked up by mom while at cheerleading practice when she thought she saw some rotation in her spine. She was subsequently evaluated by her pediatrician and radiographs were obtained. Courtney has no complaints of pain in her back. She is up and around without particular difficulty. She participates in sports without limitation. She denies numbness or paresthesia in the upper or lower extremities. She denies bowel or bladder complaints as well.

OH: Past medical history, medications and allergies, social history, family history and review of systems are documented in the chart.

PE: On examination she is 4'6" tall and weighs 62 pounds. She has a heart rate of 80. When standing she stands with a level shoulder and level pelvis and has minimal coronal plane deformity of her spine. On forward bending she has minimal rotatory deformity. She gets her fingertips to her toes without difficulty. She can laterally bend 35 degrees either way and extends without pain. There is full symmetrical range of motion of the hips, knees and ankles. There is no significant limb length discrepancy. Motor strength in the shoulder girdle is intact. Biceps, triceps, wrist dorsiflexor, volar flexor, radial and ulnar deviator strength is intact. In the lower extremities, hip flexor and extensor strength is intact. Hamstring, quadriceps, ankle dorsiflexor, plantar flexor, inverter and everter strength is 5/5. Extensor hallucis longus strength is 5/5. Sensation to light touch is intact in the upper and lower extremities. Biceps, patellar and Achilles reflexes are 2+ bilaterally. There is less than three beats of clonus bilaterally. Toes are down going bilaterally and abdominal reflexes are symmetrical and normal. The straight leg raise is negative at 90 degrees. Capillary refill is normal.

X-RAY: Radiographs AP of her thoracolumbar spine demonstrates a convex right T5-T11 curve measuring 35 degrees. She is Risser 0. There is very minimal if any rotation and no evidence of congenital malformation.

IMP: Juvenile idiopathic scoliosis.

PLAN: Given that this is her first presentation and her curve is atypical and there is no significant rotation and she appears clinically much better than her x-rays would suggest we will continue with observation. We will see her back in four months for a clinical recheck with a standing PA of her thoracolumbar spine at that time.

Figure 2 - Radiology Report 7 months later showed a 10 degree reduction in the scoliosis with a recommendation to continue conservative care.

CC: Juvenile scoliosis.

HPI: This is a 10-year 6-month-old young lady who comes in today for a clinical recheck. At our last visit my impression is that her radiographic curve was much greater than her clinical curve and we elected to see her again in four months. She comes in today without any complaint and mom states that her headaches have gotten much better as well as her back pain.

PE: On examination today she is a thin young lady who moves around the room without any apparent difficulty. On forward bending she has minimal if any rotatory asymmetry. When standing she has a minimal deformity in the coronal plane. She stands with a level shoulder and level pelvis. She can forward bend and touch her toes without difficulty. She can laterally bend 35 degrees either way and extend without pain. Motor strength in the upper and lower extremities remains intact.

X-RAY: AP of her thoracolumbar spine demonstrates a convex right T5 to L1 curve measuring 25 degrees. She remains Risser 0.

IMP: Juvenile idiopathic scoliosis.

PLAN: Given that this represents a significant decrease from her previous film we will continue with observation. I would like to see her in four months for a clinical recheck with a standing PA of her thoracolumbar spine at that time.

Figure 3 – Pre adjustment A-P thoracic and lumbopelvic radiograph revealed lateral curvature from T5-T11, measuring 35°, indicating a moderate scoliosis.

Figure 4 – Post adjustment A-P thoracic and lumbopelvic radiograph revealed a 10° reduction in the lateral curvature.

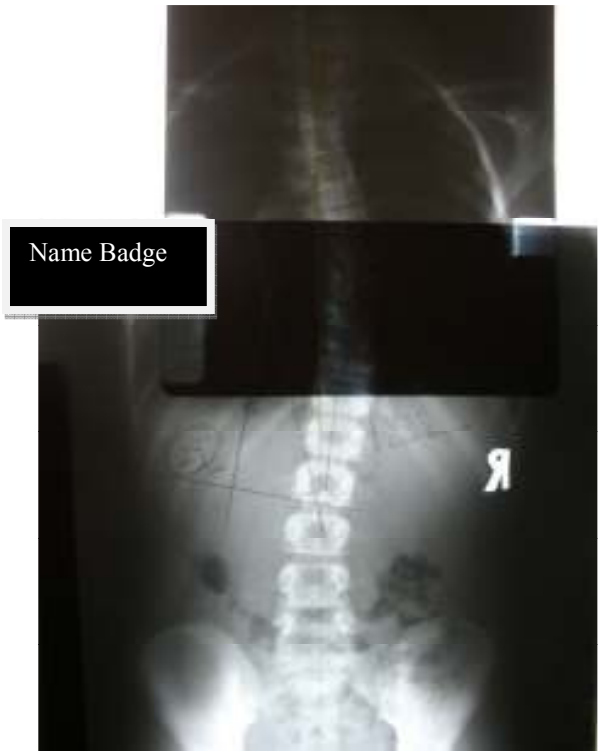

Figure 5 – Pre adjustment nasium radiograph used to derive vectors in height and laterality. A listing of right laterality, high 2 1/8°, anterior 1/2° was determined.

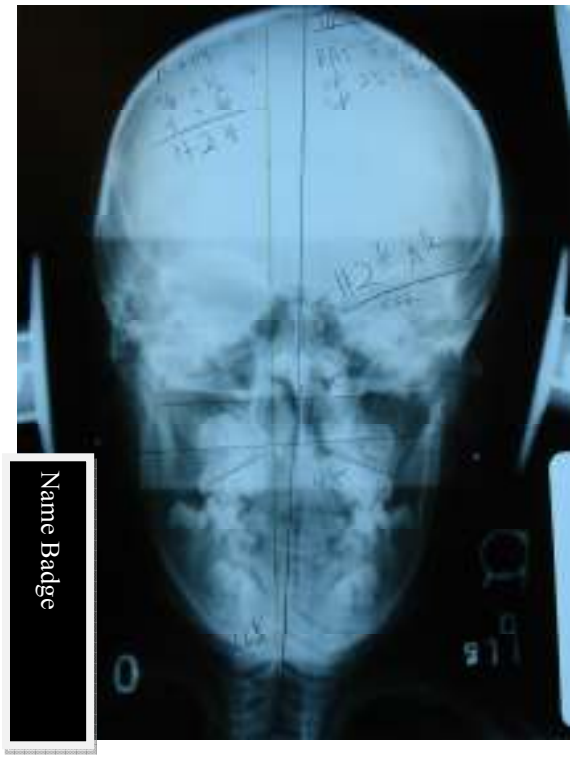

Figure 7 – Post adjustment nasium radiograph showed a complete reduction in atlas rotation and head tilt.

Figure 6 – Pre adjustment vertex radiograph is used to determine the vector to correct atlas rotation.

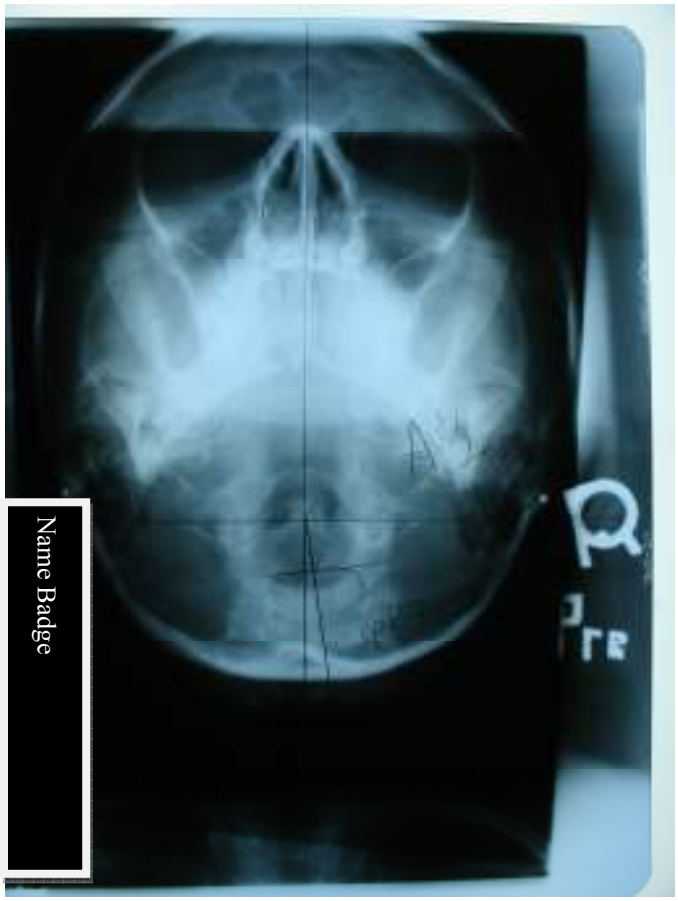

Figure 8 – Post adjustment vertex radiograph demonstrated the lower angle and central skull line were brought in line with the vertical axis line.