
CASE STUDY

Resolution of Facial Neuralgia Following Reduction of Atlas Subluxation Complex: A Case Study

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ABSTRACT

Objective: The purpose of this case study is to provide a detailed report on the symptomatic improvement of a patient diagnosed with both trigeminal and glossopharyngeal neuralgia undergoing upper cervical chiropractic care using the NUCCA protocol.

Clinical Features: A ten-year-old male presented with a previous diagnosis of trigeminal neuralgia (TN) from a pediatric neurologist. The patient's mother took him to a chiropractor as a last resort. His history shows that he suffered for nearly 4 months with intense bouts of headaches, earaches, neck pain and extreme facial pain. He was prescribed medications by a neurologist with no overall relief. He was further diagnosed by the chiropractor with glossopharyngeal neuralgia (GPN).

Interventions and Outcome: The chiropractic care consisted of upper cervical care through the technique of the National Upper Cervical Chiropractic Association (NUCCA). During the patient's initial phase of care, the upper cervical subluxation as well as his symptoms improved significantly. After 7 months the patient reported complete resolution of his main complaint, as well as significant reduction in the associated symptoms. Follow up appointments done 1.5 years after the initial exam show that the patient was still symptom free.

Conclusion: This case demonstrates the reduction and eventual resolution of trigeminal and glossopharyngeal neuralgia associated symptoms following the reduction of the Atlas Subluxation Complex. This case adds further evidence to the literature demonstrating the effectiveness of upper cervical chiropractic care for facial neuralgias. Cohort studies and clinical trials should be performed to study the impact that upper cervical chiropractic may have on facial neuralgias.

Key Words: *chiropractic, subluxation, pediatric, trigeminal neuralgia, glossopharyngeal neuralgia, NUCCA, upper cervical*

Introduction

Neuralgia is described as a form of neuropathic pain, characterized by spasmodic shock-like sensations that follow a specific nerve distribution pattern; usually with a benign stimulus. It should be noted that a refractory period after each

attack occurs, and usually shortens in duration as the neuralgia advances over time.¹ Two specific types of neuralgias that share similar characteristics and are often misdiagnosed as the other, are glossopharyngeal neuralgia and trigeminal neuralgia.²

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Trigeminal neuralgia (TN), also known as Tic Douloureux, is the most common of all the facial neuralgias, having a prevalence of 0.1 to 0.2 per 1000. The incidence rate is roughly 4-5 per 100,000 per year, and up to 20 per 100,000 per year after the age of 60. There is a female to male proportion of three to two.³⁻⁴ Among the first to describe trigeminal neuralgia was Aretaeus of Cappadocia in the second century AD, who described it as when “spasm and distortion of the countenance take place.”⁵

There are two types of trigeminal neuralgia- primary, due to a blood vessel compressing the trigeminal nerve root, and secondary (AKA classic), due to a mass compression of the nerve, or even multiple sclerosis.⁶ It is defined as a neurological disorder which involves episodes of spontaneous sharp electric shock-like pain in specific regions of the face. It typically affects the right side, and it is known to affect the face, eyes, sinuses, and mouth. It typically involves only the maxillary and/or mandibular divisions of the nerve, and very rarely does the ophthalmic branch get affected.⁷

While it is known that the trigeminal nerve is affected, the exact pathophysiology is unclear. It may be triggered by specific touch or even sounds, and is usually unilateral in nature. It has been known to be triggered by activities such as eating, drinking, brushing teeth, chewing, shaving and light touch to the face.^{8,9} In fact, the effects can be so debilitating that up to half of those individuals with TN for 3 years committed suicide.⁸ There are no specific tests that result in a clear-cut diagnosis of TN, however a standard history and physical exam consisting of cranial nerve testing should be performed.

If there exists no history of trauma, Magnetic Resonance Imaging (MRI) should be performed to evaluate any sort of lesion, demyelination or any other possible causes. Magnetic Resonance Angiography (MRA) can establish an even more detailed image of the relationship between a vessel compressing the nerve.⁷ Standard medical treatment typically yields a pharmacological approach, as anticonvulsant medications (Tegretol) is the most common pharmacological treatment. It must be noted that two thirds of the patients who have used Tegretol have reported improved symptoms.⁸

Glossopharyngeal neuralgia (GPN) is an extremely rare disease, with an incidence of 0.7 per 100,000 per year, and it is typically seen with patients 60 years of age and older. The characteristic clinical presentation of GPN is severe attacks of sharp, stabbing pain in the oropharynx that travel up toward the ear, and can be felt deep within the throat or ear region. The paroxysms associated with GPN tend to last up to a minute in duration, and the regions affected include the pre or post auricular zone, throat, neck, and external auditory canal of the ear.

Attacks may be triggered by swallowing, chewing, coughing, sneezing, speaking, yawning, certain tastes, and touching of the neck or external auditory canal.¹ Epidemiologically it has been shown in studies to be less severe in nature than earlier believed as mild bouts are fairly common. The average annual recurrence rate is fairly low at only 3.6 percent.^{1,4} The diagnosis and treatment of GPN is the same as mentioned earlier for TN. Diagnosis of GPN is made through the use of a

standard physical exam including cranial nerve evaluation. MRI/MRA is used to further evaluate any lesions or demyelination of the involved nerve, and standard medical treatment similarly consists of anticonvulsant medications like Tegretol, with the option for surgery in the case that there is no relief.⁷

There is an increasing desire within the facial neuralgia population to pursue alternative healthcare options. This is especially true in cases where treatments rely heavily on the use of medications and surgery. The literature on upper cervical care and trigeminal neuralgia/glossopharyngeal neuralgia is limited, however positive outcomes resulting in the reduction or remission in symptoms associated exist in several chiropractic case reports.^{5,8,9,18-20} The following case describes a 10 year old child with facial neuralgia that achieves complete resolution following the correction of the atlas subluxation complex.

Case Report

Patient History

A 10 year-old boy with a diagnosis of trigeminal neuralgia presented to a chiropractic clinic. His symptoms include spontaneous bouts of extreme facial, ear, neck, and chest pain which began 4 months prior to his chiropractic visit. He also had symptoms of dysgraphia, headaches, and constipation. Windy environments and rapid changes in elevation from uphill/downhill driving aggravated his condition.. The boy was prescribed Tegretol and Indocin by his neurologist, but there was no change in his symptomatic outlook. The patient also had a history of medication usage including Ceftin for sinusitis, as well as Fluticasone, Omnicef, Benzocaine, Augmentin, Trileptal, and Ativan, none of which produced temporary relief or a remission of symptoms. An MRI revealed a blood vessel compressing the left trigeminal nerve, but was dismissed because the boy had right-sided symptomatology. At the time of visit to the chiropractor, the patient was further diagnosed with Glossopharyngeal neuralgia due to the complaints of ear, neck and chest pain.

Examination

The patient’s objective findings upon examination included a supine leg check that showed leg length inequality of a quarter of an inch on the right. Leg-length inequalities point out possible Atlas (C1) misalignments, which become evident when the patient lies in a supine position on the table and heel superiority or inferiority comparisons are made. Next, the patient is instructed to turn his/her head to the left or right, and as a result the heel position relationship can be altered. Heels that remain equivalent to one another or remain in their original position during head turning demonstrate that there may not be a subluxation present.⁸ A 2011 study tested the interexaminer reliability of a standardized supine leg check showed moderate reliability in assessing inequality increments within 1/8”, and good reliability in determining the presence of inequality.¹⁰

An instrument called an Anatometer was also used during the examination and throughout the patient’s care. The anatometer

is an instrument used by NUCCA practitioners to measure postural distortion due to the atlas subluxation complex. Besides radiographic analysis, it is used as the primary basis in this case to determine the presence of Atlas subluxation on a visit to visit basis. It showed measurements of postural distortions from the first visit, and on subsequent visits the device was utilized and measurements were recorded. The anatometer features left and right weight bearing scales and provides clinical measures how the body compensates around the subluxation in a weight bearing position. These platforms are fixed to transducers with numerical values reported in the form of digital readouts. The anatometer is not an FDA listed instrument, however as mentioned earlier, it is the only instrument approved by the upper cervical research foundation.^{11,12}

Surface electromyography (SEMG) was utilized on a progressive basis, in order to evaluate and record muscle activity as it relates to the sum of electric potentials throughout a given region of musculature; in this case the paraspinal musculature.¹³ The SEMG is able to detect asymmetric muscle activity throughout the scanned region. This was done via a hand held device called a Myovision, which uses electrodes placed at predetermined segmental levels of the spine between the occiput and sacrum. SEMG helps to quantify myopathology as a component of vertebral subluxation described by Kent.¹⁴ Electromyographic scanning, such as SEMG, have been shown to have good to excellent reliability.¹⁵

Additionally, palpation of the cervical spine revealed tenderness to touch throughout the patient's neck, mostly in the upper cervical spine. Active range of motion demonstrated decreased right rotation of the upper cervical vertebrae, and surface electromyography revealed several areas along the spine of abnormal tonicity.

Radiographic Results

X-Rays were taken before and after the initial chiropractic adjustment. The radiographs were taken of the cervical region in three views; which included a lateral cervical view, a nasium frontal skull view, and a vertex view that displays the crown of the skull and the neural canal. Lines are drawn based on the protocols outlined by the National Upper Cervical Chiropractic Association. Clinically meaningful measurements are made of atlas side slip (laterality) in the coronal plane, atlas rotation in the transverse plane, head tilt in the coronal plane, and angular rotation in the coronal plane. The physiological angles are measured on each view with a protractor, so that the orientation and misalignment of Atlas can better be seen and appreciated in three dimensions.¹⁶

The pre adjustment x-ray exam had demonstrated an Atlas laterality measurement of 5 degrees, and the post adjustment x-ray measurements showed a misalignment of 3.75 degrees, with an overall improvement of 1.25 degrees in laterality. Atlas rotation reduced from 2.25 degrees to 2 degrees. Head tilt reduced from 1 degree to 0.75 degrees. Anatometer readings were then used on each visit, along with leg length analysis, to determine necessity for chiropractic adjustment.

Intervention

The patient was seen initially 2 visits per week with progressive evaluations performed each month. On visits that showed Atlas misalignment through instrumentation and supine leg length inequalities, he received chiropractic adjustments at the level of C1 by the NUCCA protocol. The leg length inequality was shown in a study to always be present when the nasium radiographic view showed Atlas laterality to be three fourths of a degree or greater, and thus this analysis is the main tool used by NUCCA practitioners to determine subluxation of the atlas.¹⁷

Doctors who utilize NUCCA protocol primarily focus on finding and correcting subluxation of the first cervical vertebra. The NUCCA adjustment is based off of a calculated vector that is determined by the measurements in the nasium and vertex x-ray. A height vector and rotation vector are measured from the point of the atlas transverse process on the side of laterality. The horizontal resultant is measured as the hypotenuse of a triangle using the initial measurements. The resultant provides a number in which an angle is calculated for pelvic and shoulder angulation during the adjustment. An 8-phase process is used to create a base of support which leads to a triceps-pull that delivers the force into the cervical spine. The force is applied over the span of 2-3 seconds, and is usually performed 4-7 times.

Outcome

Progressive evaluations were performed throughout the care plan to note the patient's symptomatic state, as well as surface electromyography tests which were performed to detect any neuromuscular changes that had occurred over the period of care. The mother of the patient also maintained a weekly blog of the patient's pain scale (<http://georgepaulstory.wordpress.com/>), signs and symptoms, and other associated findings related to the patient's case. It was noted that five days after initial care via chiropractic upper cervical NUCCA adjustments, the patient was pain free and did not experience any symptoms he had been experiencing previously.

The patient continued on a care plan of 2 to 3 visits a week with the NUCCA upper cervical adjustments given when misalignment was noted via Anatometer and leg check. The patient's pre and post adjustment measurements were taken using the Anatometer, each of which had balanced out to 0 degrees misalignment. It was noted that sixteen days after the first visit that the patient's eye pain was 100 percent better, and the neck pain was 50 percent better. The patient also reported improvement in his bowel problems. The complaints of headaches and sensory integration disorder did not show improvement at this point. At the progressive evaluation performed 6 months later, the ear pain was reported to have resolved, and all other associated symptoms had improved significantly. The patient was seen 33 times between May and November. During that span, he required an adjustment on 7 visits. A year and a half after care started the mother stated that the patient has been symptom free since the start of the NUCCA chiropractic care.

Discussion

Facial neuralgias continue to be a rare but significant cause of chronic pain that leaves many people searching for solutions beyond conventional treatment. While some forms of facial neuralgia can be attributed to vascular compression or MS, many forms of facial neuralgia leave no pathological lesions to make a treatable diagnosis. The current case describes one such case compression by vascular structure is identified, but vascular decompression surgery was ruled out because of the symptomatology in the opposite nerve. In cases like these, patients struggle to find minimally invasive solutions when anti-convulsant medications fail to control pain. Surgical procedures can damage the nerve to shut off pain sensation, but may cause facial numbness from the nerve damage.

Several case studies describe improvement and resolution in trigeminal neuralgia through chiropractic care.^{5,8,9,18-20} Most of the case studies available featured improvement under the care of an upper cervical technique to correct upper cervical subluxations. While exact mechanisms remain unknown, a focus is being made to study the impact that the upper cervical subluxation has on the function of the brainstem and upper spinal cord.

Grostick introduces the role that an upper cervical vertebrae subluxation plays on the stress of the spinal cord and nervous system as a whole, by means of the dentate ligament-cord distortion hypothesis. He states that a mechanism of direct nerve compression or irritation by the upper cervical vertebrae would be highly unlikely, due to the diameter of the canal in that region and the space between the cord and the wall of the canal. The dentate ligaments of the spine are responsible for holding the spinal cord in the anterior portion of the spinal canal. The dentate ligament cord distortion hypothesis suggests that upper cervical subluxation will create axial tension on the cord through dural structures. He goes on to state that Atlas misalignment in the cervical spine can put traction on the sensory nucleus of the trigeminal nerve at the level of the first and second cervical vertebra.¹⁸

Bodguk in his study determined that the trigeminocervical nucleus exists as cells in the upper three cervical segments, C1, C2 and C3, which receive both a trigeminal and a cervical input.²¹ It is recognized that “the sensory innervation of the ear is complex, including general somatic afferent contributions from cranial nerves V3, VII, IX, and X, in addition to the upper cervical nerve roots, C2 and C3.”²² As a result, it can be suggested that structures innervated by the nerves arising from these three segments can affect the trigeminocervical nucleus. The trigeminocervical nucleus acts as the hub for nociceptive input from the upper neck, head, and throat. Under the right circumstances, nociception in the neck may get interpreted as pain in the trigeminal nerve.

A search of the chiropractic literature reveals a single case study of chiropractic care improving glossopharyngeal neuralgia. Burcon and Pero reported on an 82 year old woman with a 10-year history of glossopharyngeal neuralgia who underwent upper cervical care. After the first adjustment her pain was reduced from severe to mild. After six weeks of care, the patient presented symptom free.²³

In addition to this case, there is also some resourceful information on the general distinguishable traits of the disease. For example, what is known to be a “diagnostic trigger” for glossopharyngeal neuralgia serves as an important distinguishing feature to differentiate it from a similar type of otalgia, known as nervus intermedius.²⁴ Another clinical feature of glossopharyngeal neuralgia is that while it is much less likely that children develop the condition, they usually suffer from both short term and constant pain episodes.²⁵

It must also be noted that it may be difficult to differentiate between glossopharyngeal neuralgia and trigeminal neuralgia of the mandibular division, as the location of symptoms can be very similar as well.²⁶ The similarities do not, however, end with symptomatology. Both the trigeminal and glossopharyngeal nerves share a similar origination site in close proximity within the brainstem. The trigeminal nerve originates from the trigeminal ganglion within the pons, whereas the glossopharyngeal nerve exits from the medulla.²⁷ Both the pons and the medulla share a connection with the brainstem, and it is stated in Gray’s Anatomy that the somatic sensory fibers of the glossopharyngeal nerve joint the same spinal tract of the trigeminal nerve.²⁸

Saladin states that “pain signals from the head travel to the brainstem by way of four cranial nerves; mainly the trigeminal, but also the facial, glossopharyngeal, and vagus nerves. Trigeminal fibers enter the pons and descend to synapses in the medulla. Pain fibers of the other three cranial nerves end here.”²⁹ What affects the trigeminocervical nucleus would then have an effect on not only the trigeminal nerve, but possibly the glossopharyngeal nerve as well.

In the current case, because there was no evidence of direct pressure on the trigeminal or glossopharyngeal nerve through MRI or MRA, it is likely that the upper cervical subluxation created cord distortion and dysafferentation into the trigeminocervical nucleus. Abnormal motion of the upper cervical spine may have caused increased nociceptive input from the upper cervical nerve roots into the trigeminocervical nucleus. Increased nociception into this nucleus can cause pain sensation into both the trigeminal nerve or glossopharyngeal nerve. It may also cause abnormal myogenous tone as measured from the sEMG, and affect postural control as measured by the Anometer. Correction of the Atlas Subluxation Complex may restore normal biomechanics of the upper cervical spine and restore normal afferentation into the trigeminocervical nucleus.

This case is also uniquely positioned to discuss the maintenance of an upper cervical correction. The patient was checked 33 times during the course of the case and required an adjustment on 7 visits. By NUCCA protocols, a patient is maintaining their correction when there is an absence of leg length inequality, and postural findings are measured below $\frac{3}{4}$ of a degree in the frontal plane measurements of the head, shoulders, and pelvis. The patient showed gradual improvement in symptomatology as he showed more stability in his correction as measured by his leg length and postural findings. More work must be done to provide a testable operational definition of subluxation to differentiate between subluxation correction and ‘holding’ of an adjustment, versus the use of spinal manipulative therapy.

Limitations

Because this study is a case report, no causal relationships can be formed between upper cervical correction and improvement of the patient's symptoms. Although a number of case studies have documented chiropractic's impact on trigeminal neuralgia, clinical trials should be performed to determine a causal relationship.

Conclusion

The patient in this case has been pain free for over a year and a half since being under NUCCA care. This was a case where the patient, who was diagnosed with both trigeminal and glossopharyngeal neuralgia, reported initial relief of symptoms associated with the disease, and soon after, complete remission.

There is a need for more studies on chiropractic's role in the management of both trigeminal and glossopharyngeal neuralgia. Though several case studies about trigeminal neuralgia have been documented in the chiropractic literature, cohort studies and randomized clinical trials should be performed to determine a causal relationship between subluxation correction and improvement in either trigeminal or glossopharyngeal neuralgia.

References

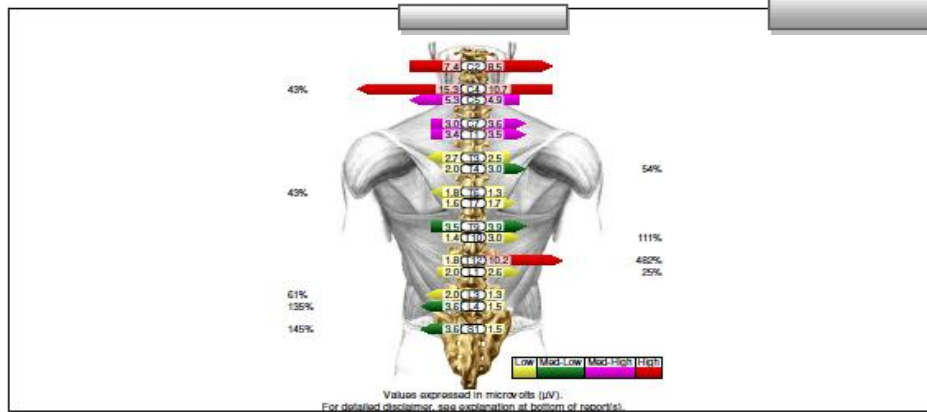
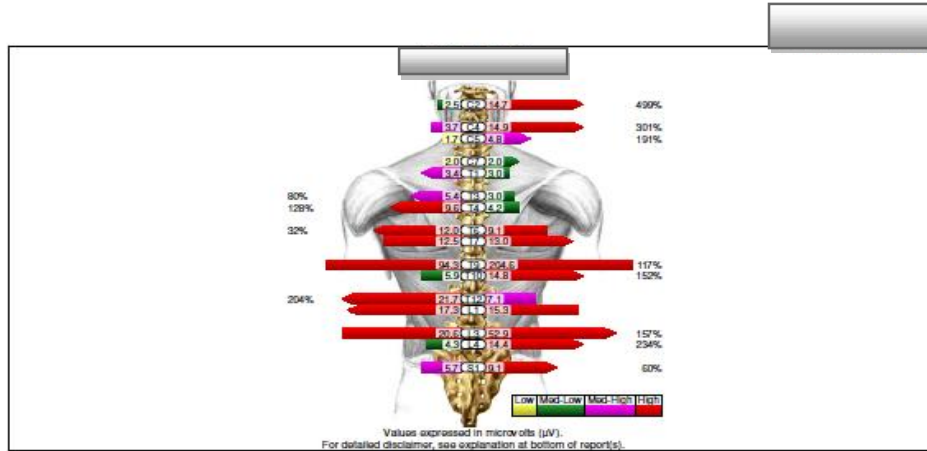
1. Dorsch J. Neurologic Syndromes of the Head and Neck. Primary Care: Clinics in Office Practice. 2014; 41 (1): 133-149.
2. Nakano N, Fukawa N, Nakagawa N, Nakanishi K, Tsuji K, Yabuuchi T, Iwakura N, Kato A. Endovascular Microcatheter Provocation Test for the Diagnosis of Glossopharyngeal Neuralgia. Journal of Neurological Surgery Part A: Central European Neurosurgery. 2014; (EFirst).
3. Popovici F, Mergeani A, Popescu D, Antochi F. Review on the Causes of Trigeminal Neuralgia Symptomatic to Other Diseases. Romanian Journal of Neurology. 2011;10 (2).
4. Manzoni G, Torelli P. Epidemiology of typical and atypical craniofacial neuralgias. Neurological Sciences. 2005; 26 (2): 65-67.
5. Zielinski E, Acanfora M. Resolution of Trigeminal Neuralgia Following Subluxation Based Chiropractic Care: A Case Study & Review of Literature. A. Vertebral Subluxation Res. 2013: 33-45.
6. Peker S, Usseli I, Pamir N. Trigeminal Neuralgia Due To Brainstem Vascular Malformations: Report of Two Cases and Review of The Literature. Journal of Neurological Sciences (Turkish). 2012; 29 (3): 594-597.
7. Rozen T. Trigeminal neuralgia and glossopharyngeal neuralgia. Neurol Clin N Am. 2004; 22: 185-206. [Accessed 28 Jan 2014].
8. Grochowski J. Resolution of Trigeminal Neuralgia Following Upper Cervical Chiropractic Care: A Case Study. J Upper Cervical Chiropr Research. 2013: 20-24. [Accessed 28 Jan 2014].

9. Sweat M, Wallace S. Resolution of Trigeminal Neuralgia in a Patient Undergoing Atlas Orthogonal Chiropractic Care: A Case Report. J Upper Cervical Chiropr Research. 2012: 46-54. [Accessed 28 Jan 2014].
10. Woodfield HC, Gerstman BB, Olaisen RH, Johnson DF. Interexaminer reliability of supine leg checks for discriminating leg-length inequality. J Manipulative Physiol Ther, 2011 May; 34(4): 239-46.
11. Bibliography: Ucrf.org. Anatometer | NuCCA. [Online] Available from: <http://ucrf.org/anatometer> [Accessed 28 Jan 2014].
12. NuCCA.org. NUCCA - National Upper Cervical Chiropractic Association. [Online] Available from: <http://www.nucca.org/patients.php> [Accessed 28 Jan 2014].
13. Cooper M, Herda T, Vardiman J, Gallagher P, Fry A. Relationships between skinfold thickness and electromyographic and mechanomyographic amplitude recorded during voluntary and non-voluntary muscle actions. Journal of Electromyography and Kinesiology. 2014
14. Kent C. Models of Vertebral Subluxation. J. Vertebral Subluxation Res. 1(1). August 1996.
15. Spector B. Surface electromyography as a model for the development of standardized procedures and reliability testing. J Manipulative Physiol Ther. 1979; 2(4): 214.
16. Bakris G, Dickholtz M, Meyer P, Kravitz G, Avery E, Miller M, Brown J, Woodfield C, Bell B. Atlas vertebra realignment and achievement of arterial pressure goal in hypertensive patients: a pilot study. Journal of human hypertension. 2007; 21 (5): 347-352.
17. Palmer J, Dickholtz M. Improvement in radiographic measurements, posture, pain & quality of life in nonmigraine headache patients undergoing upper cervical chiropractic care: A retrospective practice based study. J Vert Sublux Res. 2009 Jun;4:1-11.
18. Grostic JD. Dentate ligament-cord distortion hypothesis. Chiro Research J 1988; 1(1): 47-55.
19. Kessinger R, Matthews A. Resolution of Trigeminal Neuralgia in a 14 Year Old Following Upper Cervical Chiropractic Care to Reduce Vertebral Subluxation: A Case Study. J. Upper Cervical Chiropractic Res. 2012: 77-84. [Accessed 28 Jan 2014].
20. Rodine R, Aker P. Trigeminal neuralgia and chiropractic care: a case report. The Journal of the Canadian Chiropractic Association. 2010; 54 (3): 177-186.
21. Bogduk N. The cervical-cranial connection. J. Manipulative Physiol Ther 1992; 15(1): 67-70.
22. Rosenberg W, Salame K, Shumrick K, Tew Jr J. Compression of the upper cervical spinal cord causing symptoms of brainstem compromise: A case report. Spine. 1998; 23 (13): 1497-1500.
23. Burcon, M. and Pero, J. 2014. Resolution of Glossopharyngeal Neuralgia & Spastic Dystonia Following Chiropractic Care to Reduce Upper Cervical Vertebral Subluxation: A Case Study. Journal of Upper Cervical Chiropractic Research, pp. 7-13.
24. Smith J, Robertson C, Garza I, Cutrer F. Triggerless neuralgia: A case series and systematic literature review. Cephalalgia. 2013; 915-923.

25. Yue W, Zhang Y. Peripheral glycerol injection: An alternative treatment of children with glossopharyngeal neuralgia. *International journal of pediatric otorhinolaryngology*. 2013
26. Iasp-pain.org. Relatively Localized Syndromes of the Head and Neck. [Online] Available from: <http://www.iasppain.org/AM/Template.cfm?Section=Publications&Template=/M/ContentDisplay.cfm&ContentID=16276> [Accessed 28 Jan 2014].
27. Moore K, Dalley A, Agur A. *Clinically Oriented Anatomy*. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2010.
28. Gray, Henry. *Anatomy of the Human Body*. Philadelphia: Lea & Febiger, 1918; Bartleby.com, 2000. www.bartleby.com/107/.
29. Saladin K. *Anatomy & Physiology: The Unity of Form and Function*. 5th ed. Columbus: McGraw-Hill; 2010.

Figures

MyoVision MultiScan Report



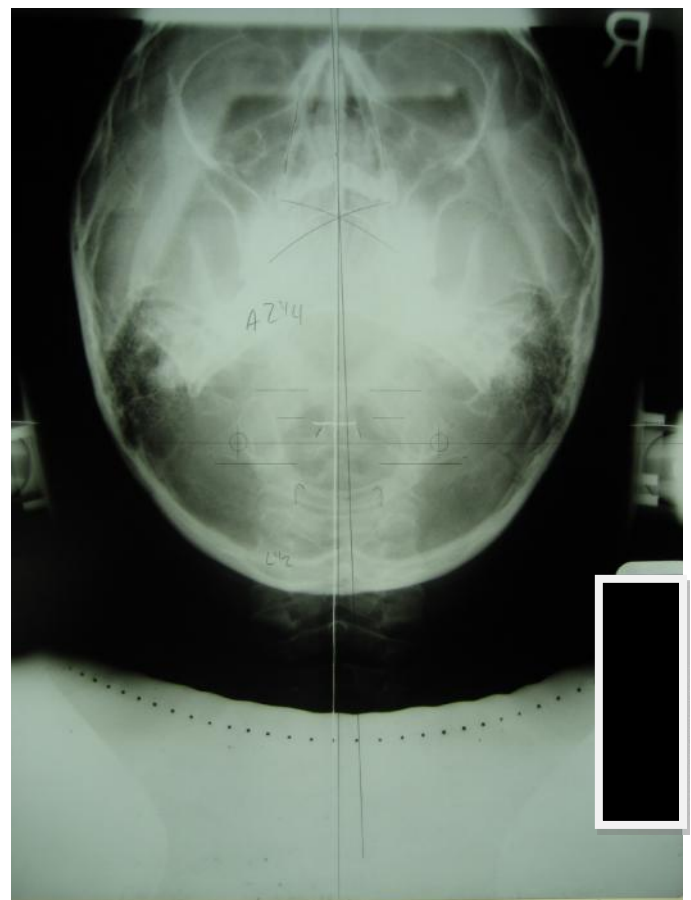
Surface Electromyography Scans Pre and Post Treatment



Lateral Cervical X-ray



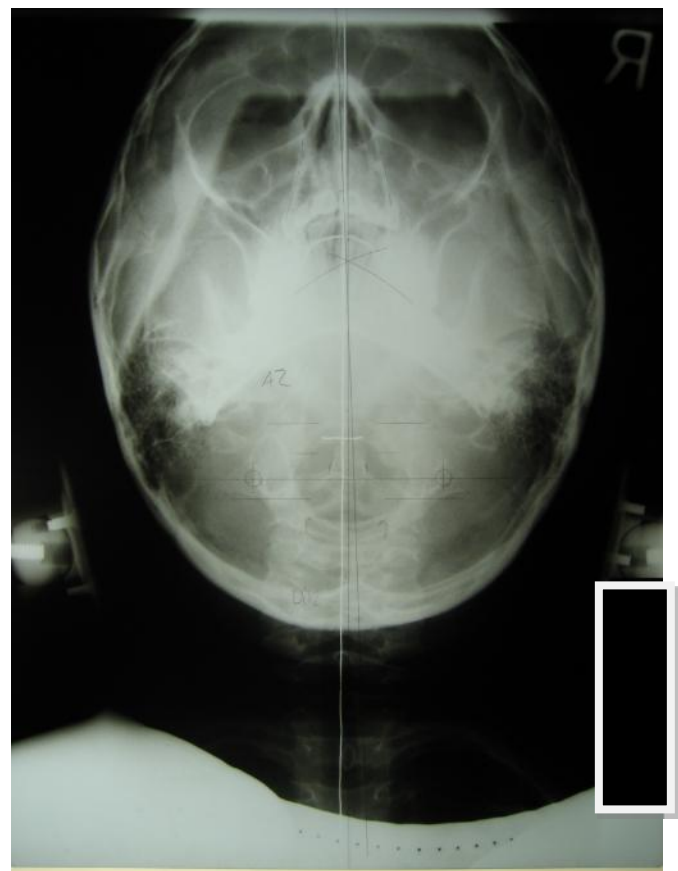
Nasium Frontal Skull X-ray Pre Adjustment



Vertex X-ray Pre Adjustment



Nasium Frontal Skull X-ray Post Adjustment



Vertex X-ray Post Adjustment