CASE STUDY

Resolution of Essential Tremors in a Female Patient Undergoing Upper Cervical Chiropractic Care: A Case Report & Review of the Literature

Nathan Berner D.C.[1]

ABSTRACT

Objective: The objective of this case study is to present the chiropractic case management and improvement of a patient with diagnosed essential tremors and an upper cervical subluxation.

Clinical Features: A 58-year-old female presented to a private practice with a 40-year history of diagnosed essential tremors without relief. She additionally suffered from headaches, mid and low back pain, hip pain, sciatic pain, brain fog, difficulty concentrating and challenges with self-motivation.

Intervention and Outcomes: The patient was assessed for vertebral subluxation utilizing the Orthospinology analysis including a supine leg length check, hip calipers, cervical scanning palpation, and x-rays. Upon examination, a cervical vertebral subluxation complex was found. The patient was seen 12 times over 4 months of care and received 4 Orthospinology atlas adjustments. On post-adjustment X-rays, the atlas misalignment was reduced by all factors, and the patient's symptoms improved dramatically.

Conclusions: This case study demonstrated the upper cervical chiropractic management of a patient diagnosed with essential tremors. The patient found immediate relief of symptomatology and extended improvement in quality of life. This case highlights the need for more research on the link between upper cervical subluxation and essential tremors.

Key Words: *Chiropractic, vertebral subluxation, essential tremor, orthospinology, adjustment*

Introduction

Essential tremor (ET) is one of the most common movement disorders with a worldwide prevalence of 0.4% to 3.9% in the general population.[1] It is estimated to be 20 times more prevalent than Parkinson's. In the United States it is estimated that seven million individuals, and 1 in 25 adults over the age of 40 suffer from ET.[2]

The condition is usually progressive and normally mild but can also be debilitating, preventing many individuals from joining or continuing in the workforce. For such a common condition with potentially debilitating effects, one study found that public knowledge of its existence and characteristics was overall poor.[2]

Tremor is a rhythmic, mechanical oscillation of at least one body region. Essential tremor refers to a condition where there

1. Private Practice of Chiropractic, Marietta, GA

is either a persistent bilateral tremor of the upper extremities or an isolated tremor of the head, without abnormal posturing, and there is no other known cause.[1] The tremor itself is a 4-12Hz action tremor that can be postural or kinetic in nature.

These action tremors can occur in the upper limbs (95% of cases), head (34%), voice (12%), face (5%), or legs (20%). If the head tremor is not accompanied by hand tremors, it is generally diagnosed as cervical dystonia.[3] ET can be inherited with an autosomal dominant pattern, but about 40% of people with ET have no family history of it.[1] Neurologically speaking, the tremor in ET begins by the rhythmic activation of the affected muscles, which is originally caused by pathological oscillations most likely found in the cerebello-thalamocortical pathways to spinal motorneurons.

The central mechanism mediating ET is still up for debate but a recent study performed on the phase difference between neural drives to antagonistic muscles of ET found that the phase difference was determined by the relative strength of supraspinal tremor input and spinal afferents due to passive stretch of the affected muscles. Therefore, much of the mediation appears to be determined by supraspinal input and spinal afferents.[4] Recent studies have used molecular imaging to gain even deeper understandings of ET. One such study utilized positron emission tomography, and found that with ET, there is cerebellar hypermetabolism and abnormal GABAergic function in premotor cortices, dentate nuclei and ventral thalami.[5]

Associated Conditions

Essential tremor commonly interferes with physical activities such as exercise; fine motor activities such as handwriting or typing; and daily activities such as dressing or eating.[1] Although ET is considered an action tremor, non-parkinsonian resting tremors are present in 20-30% of patients.[4] Many patients also find the constant shaking embarrassing and can suffer from social anxiety or social phobia.[2] Some experts even suggest that ET is not just a motor issue but a multi-dimensional phenotype of symptomatology.

One study performed on ET patients observed quantifiable data to suggest that ET patients experience significant levels of apathy, trait anxiety, and cognitive impairment, suggesting the presence of a non-motor phenotype in these patients.[6] A resting-state fMRI study performed on ET patients found increased connectivity in the frontoparietal networks leading to decreased cognitive performance and depressive symptoms, as well as decreased connectivity in the cerebellum and visual networks leading to decreased visuospatial ability.[7]

Medical Interventions

Medical interventions for ET have been limited, mainly due to the lack of understanding of the condition on the molecular level. Currently, no drug has been designed specifically for ET, but several have been shown to improve tremors. Medications that increase the opening time of GABA-A receptors show the most consistent association with tremor reduction.[8]

Propanolol has received high clinical scores, but may lead to hypotension and depression. Primidone may improve hand tremors in the short term but is also associated with depression and cognitive and behavioral problems.[1] Deep brain stimulation (DBS) surgery has become an established ET therapy that is believed to benefit the patient by modulating brain circuitry. Diffusion MRI tractography is also being used in conjunction with DBS to help visualize white matter pathways and allow for direct targeting of these pathways. This method is still in its infancy, but has great potential to aid in administration of DBS.[9]

Chiropractic Intervention

The main focus of chiropractic is to locate, analyze, and correct vertebral subluxation. Chiropractors work with the patient's nervous system by way of osseous structures located in the spine. All models of vertebral subluxation include two main components, a biomechanical component and a neurological component. The biomechanical component can be measured by X-ray, Videofluoroscopy, MRI, CT, and range of motion instrument. The neurological component can be measured by somatosensory evoked potentials, dermatomal evoked potentials, visual and auditory evoked potentials, paraspinal thermal scanning, surface electromyography, heart rate variability, algometry, and computerized muscle testing.[10]

Chiropractors work with patients who have all sorts of conditions and symptoms, but the focus of care is the management of vertebral subluxation. Berner and Kustarz had a patient who presented with a 15-year history of ET. After the patient's first adjustment, they noticed immediate improvements in symptomatology. After four and a half months of care the patient reported 75% improvement in arm tremors, 90% improvement in head tremors, and overall improvements in quality of life.[11] Hubbard and Kane had a patient who presented with constant ET and migraines. After 4 months of upper cervical care, the patient's ET episodes dropped down to 1 to 2 per week, and her migraines went from 2 to 3 per week to 1 per month.[12]

A case study by Carvalho et al. showed an instance where cervical manipulation technique was applied to an ET patient resulting in improved surface electromyographic readings and motor control.[13] While not chiropractic, another case study outlined the temporary treatment of a patient with ET utilizing acupuncture. The patient underwent weekly acupuncture treatments for 12 months. The patient felt immediate relief after the first treatment and reported a 75% improvement after 10 weeks.[14]

Case Report

History

A 58-year-old female presented for chiropractic care with a chief complaint of tremors in her upper extremities bilaterally. The patient stated that the tremors started 40 years ago and were diagnosed as essential tremors. The mechanism of onset was not known, however a year later the patient was diagnosed with thyroid cancer and shortly after underwent a successful thyroidectomy.

The patient stated that about 20 years ago, the tremors worsened, and that the tremors were progressively getting worse with the right hand being affected more than the left. The patient also complained of numbness, tingling, and weakness in the right arm with pain into the right wrist and hand. It is unclear if this symptom is related to the tremors, but may be associated with the worsening of the tremors on the right side. The patient stated that the tremors were constant and were currently 8/10 on a 0-10 scale, with 0 being no symptoms and 10 being unbearable symptoms. The patient stated that the tremors made cooking and putting on makeup very difficult. It also completely prevented her from knitting, which she was wanting to start. The right wrist pain with associated numbness, tingling, and weakness was, on average, 8/10 and made it difficult to hold a pen or open a jar.

The patient also complained of headaches, back pain and 'brain fog'. The headaches were described as stabbing and were located at the back of her skull and associated with numbness and neck pain. These symptoms began 1 year ago and occurred once per week. The back pain was located in her mid and low back and associated with hip pain and occasionally sciatic pain. This pain was described as a dull ache with associated numbness and tingling, and occurred daily for the past 3 years. The patient had a history of knee surgery and foot surgeries. The 'brain fog' was described as difficulty with concentration and lack of motivation.

Chiropractic Examination

The chiropractic examination was performed utilizing Othospinology protocol. Chiropractic findings included unbalanced hip calipers, leg length inequality, and neck tenderness upon scanning palpation. Hip calipers measure and compare the height of the hips, looking for the hips to be even and parallel with the horizon. The patient's hip calipers showed moderately low on the left. A supine leg length was taken looking for functional pelvic distortion and was found to be 1/8” short on the right.

These findings show functional instability as you would expect to see a lower right hip with an anatomically short right foot. Note that bowling shoes are worn during both procedures to prevent false readings due to wear and tear of footwear. Initial X-rays were taken and included lateral cervical, nasium, and vertex views of the cervical spine (Figures 1, 2, 4). These radiographic views were used to analyze for pathology and to determine if a misalignment of the upper cervical spine was present.

The lateral cervical film showed some degeneration in the mid-cervical region between C3 and C6. The vertex view showed a rotational misalignment of atlas of 1.5 degrees anterior with respect to the skull on the left. The nasium view showed a pretty significant misalignment of atlas revealing a left atlas laterality with an upper angle measuring 3.8 degrees. The lower angle, which essentially measures lateral head displacement, was also significant, measuring 4.5 degrees on the right. With the lower and upper angles being on opposite sides, this is known as a Type 1 misalignment in Orthospinology. The nasium view also revealed left head tilt and a rotated C2 spinous to the left.

Intervention

The patient presented to the office 12 times over 4 months. Of these 12 visits, the chiropractic assessment, which included assessments of hip calipers, supine leg length and scanning palpation, indicated a presence of vertebral subluxation on 4 occasions and on those occasions, an atlas adjustment was performed with the intent to reduce vertebral subluxation. The atlas adjustment was performed using the Laney Table-Mounted Torque instrument. The patient was placed on the table in a right side-lying position so that the left atlas transverse process could be contacted with the instrument. The table's head piece is mobile and was positioned low and flat. The instrument was set with a height factor of 5.25, anterior rotation of 1.5, and resultant angle of 16 with moderate inferior torque applied during the adjustment.

Outcome

After the initial adjustment, hip calipers balanced, scanning palpation tenderness was cleared, and the patient's short leg went slightly long, all showing positive indicators supporting a restoration of normal muscular tone and reduction of neurological interference. Post x-ray analysis showed a reduction of the overall misalignment of the upper cervical region as the upper cervical region was moved toward orthogonal position after the initial adjustment.

The post vertex film was reduced from 1.5 to 0.8 degrees of anterior rotation on the left (Figure 5). The nasium also showed reduction of the upper angle from 3.8 to 2.2 degrees on the left, as well as reduction of the lower angle from 4.5 to 2.0 degrees on the right. Left head tilt and left C2 spinous rotation were also reduced (Figure 3). Table 1 shows the specific factors and the respective percent correction for each factor (Table 1).

The patient noticed an improvement in her bilateral tremors immediately after the adjustment and within 24 hours reported an 80% improvement in frequency and intensity of the hand tremors. At the 4-month mark of care, after only 4 atlas adjustments, the patient reported a 95% improvement in the frequency and intensity of her tremors. The patient also stated that the numbness, tingling, and weakness in the right arm was completely gone and that her wrist and hand pain was reduced by 80%. With these improvements, the patient was able to cook and put makeup on without difficulty. She no longer found holding a pen or opening a jar particularly difficult and was able to take up knitting as a hobby.

In addition to improvements in the patient's chief complaint, she also saw the frequency and intensity of her headaches reduced by 95%. Her mid and low back pain improved by 80% with associated hip pain improving by 90% and a complete resolution of her sciatic pain. She also reported a 90% improvement in 'brain fog' with increased ability to concentrate and self-motivate.

Methods

Supine Leg Length Inequality

A patient's leg-length inequality is categorized as either anatomical or functional. An anatomical leg-length inequality would indicate an osseous asymmetry of the lower extremities. A functional inequality however, is hypothesized to indicate neurophysiological asymmetries of the body as a whole.[15] The procedure for measuring supine leg-length inequality requires precise instructions from the doctor. The patient stands directly at the foot of the table facing away from the table, sits straight down, slides back on the table without moving side to side, lays back supine with the occiput supported by a pillow or headpiece.

The doctor gently supports the patient feet by placing the first digit of each hand up the lateral malleolus, digits 2, 3 and 4 posterior to the patient's heel and the fifth digit on the patient's sole with slight superior pressure. The doctor will also take out any extreme foot flare to get an accurate reading. The measurement is taken and recorded to the closest 1/16 of an inch on the shorter side.[15] According to Eriksen, "Research has shown very high inter- (>0.9 intra-class correlation coefficient) and intra-examiner reliability for the supine leg check".[16]

One study on inter-examiner reliability of the supine leg check found 32% of ratings in perfect agreement, 58% within 1/8 inch of one another, 92% with 3/8 inch, and 100% within ½ inch.[15] Another study on supine leg checks found agreement on the side of the short leg 43.3% of the time.[17] The upper cervical subluxation can cause several forms of postural disturbance including functional leg-length inequality, head translation, head tilt, shoulder tilt, unequal weight distribution and pelvic distortion.

Therefore, a supine leg check is a neurological indicator for the presence of an upper cervical subluxation. When a doctor is performing a supine leg check on a patient without an anatomical leg-length inequality, what they are really measuring is muscular tone and its resultant pelvic distortion. Therefore, a more appropriate term is functional pelvic distrotion.[16] It is also interesting to note that evidence has been published correlating functional leg-length inequality to stress on the lumbar spine, hips and knees, low back pain, scoliosis, and bilateral weight deviations.[16]

Hip Calipers

The hip caliper is a non-FDA approved device that compares the heights of the iliac crests to determine if they are balanced. The doctor places the instrument on the patient's iliac crests with equal pressure, and the instrument measures whether the hips are aligned parallel with the horizon. The instrument utilizes a device similar to that of a carpenter's level to determine horizontality. The instrument includes a laser which, when compared to a horizontal line, shows the hip alignment precisely. The hip caliper check is similar to the supine leg check in that it is a neurological indicator that measures muscular tone and its resultant pelvic distortion. The main difference is that the hip calipers check for functional pelvic distortion under weight-bearing circumstances and the supine leg check is performed under non-weight-bearing circumstances.[16]

Scanning Palpation

Since the inception of chiropractic, static palpation procedures have been used to identify muscle spasms, trigger points, and sub occipital tenderness before and after an adjustment.[16] The change in muscular tone is often profound after an effective adjustment and provides valuable information to both doctor and patient as to its effectiveness.[16] In the upper cervical region, the first and second cervical dorsal rami are fairly large and exit above and below the posterior arch respectively.[18]

Due to the size and location of these rami, the doctor is able to apply palpatory pressure to both nerves, as well as the structures they innervate. Scanning palpation is performed by supporting the patient's forehead with one hand and gently applying pressure to the C1 spinal nerve and C2 spinal nerve ganglion with the other hand. It is performed bilaterally and given a subjective rating based on pain or tenderness felt by the patient as well as tautness or tenderness observed by the doctor.[16] A study on the inter-examiner reliability of upper cervical scanning palpation found 75% agreement between experienced practitioners.[18]

X-ray Analysis

The Orthospinology procedure is a continuation of Dr. Grostic's life work in analyzing and correcting the occipito-atlanto-axial complex through the use of specific X-rays and adjustments.[16] The X-ray analysis includes three radiographic views in order to determine the upper cervical region's three dimensional alignment. Several factors are measured to measure the severity of a misalignment and determine the appropriate vector to use in order to reduce or correct this misalignment. After the first adjustment, the views are generally taken again to determine if a reduction or correction was achieved.

The first film taken is a lateral cervical film, which is used to measure the angle of the atlas in the sagittal plane. This angle is used to determine the angle at which we take the nasium view. This nasium view is taken anterior to posterior along the sagittal plane angle of the atlas. The analysis of the nasium view contains the most important factors and begins with the atlas plane line, which is produced by drawing a line through the points where the lateral edge of the lateral mass meets the inferior portion of the posterior arch on both sides. This line is compared to the horizon.

The central skull line is determined by the shape of the skull in the parietal region of the skull and is drawn through the center of the skull. This central skull line is compared to the atlas plane line to determine the upper angle, which is also referred to as atlas laterality. Another line is drawn through the centers of C2 and C7, and again compared to the atlas plane line to provide the lower angle measurement.

There are also measurements to determine the size of a circle created by the occipital condyle surfaces and another for the superior axial surfaces. A calculation is made of the condylar circle over the axial circle. This calculation will determine the vector for an applied force that will change the upper and lower angles proportionately and will provide about 69% of the adjusting height factor. The final view is the vertex, which provides the rotational component of the atlas misalignment. This rotational component is determined by drawing a line through the atlas transverse foramen and bisecting it with a line drawn through the center of the ethmoid bone. The angle is then measured on the side of atlas laterality to determine anterior or posterior rotation.[16]

The purpose of the X-ray marking procedure is to give the doctor information on the misalignment present in the upper cervical region before an adjustment and to determine if the adjustment improved the alignment after the adjustment with a post X-ray. A study performed by Rochester concluded that all aspects of the upper cervical marking procedures are reliable.[19]

One study of inter-examiner reliability of the X-ray analysis found 96.1% agreement on the side of atlas laterality from the nasium view, with an ICC of 0.906 at 95% CI. The study also found 94.5% agreement on the side of atlas rotation from the vertex view, with an ICC of 0.850 at 95% CI.[20] The validity of the X-ray analysis has been challenged due to image distortion, image rotation, doctor marking, and the presence of osseous assymetries.[16] There have been studies to link the adjustment to the X-ray changes.

A study of 523 cases found that the mean deviation from 0 degrees of misalignment is 2.75 and 2.63 degrees for atlas rotation and laterality, respectively. These values improved after upper cervical adjustments by 48% for rotation and 47% for laterality. These figures were both significant and concluded that the adjustments were responsible for the improvements.[16] There have also been attempts to link X-ray changes to patient outcomes. One study of 458 patients found that patients on average had better symptomatic outcomes if their misalignment was reduced by at least 50% post-adjustment.[21]

Adjusting Instruments

Most Orthospinology practitioners either use the KH2 Handheld adjusting instrument or the Laney Table-Mounted Torque instrument. Both instruments were built before 1976 and grandfathered into FDA exemption. Both instruments use mechanical force in a specific vector determined by X-ray analysis as opposed to other instruments that use sound waves or vibrations.

The Laney Table-Mounted Torque instrument has the ability to provide torque, which is defined by Orthospinology as a second vector at the end of the thrust that is in either the caudal or cephalic direction. The KH2 Handheld does not have this function, but after several years of observation, Dr. Laney determined that 10 degrees of added height factor was enough leverage to make up for the lack of torque on certain adjustments.[16]

Discussion

In Kent's article *Models of Vertebral Subluxation*, he discusses the dysafferentation model of subluxation. This model of subluxation points out that the intervertebral motion segment is imbued with a dense accumulation of mechanoreceptors and nociceptors, which gather information about mechanical stimuli and pain respectively. It also says that, if a motion segment has biomechanical dysfunction, the afferent signals from these receptors will be aberrant. This aberrated afferent input could then lead to dysponesis. Kent describes this in other terms as "garbage in-garbage out".[22]

With respect to ET, it is generally accepted that the efferent input to the affected muscles of the arms most likely comes from pathological oscillations in the cerebello-thalamocortical pathways to spinal motor neurons. The central mechanisms of mediation however are widely debated. However, Gallego et al studied the neural drives of antagonist muscles in ET and found strong mediation by supraspinal and afferent input from mechanoreceptors.[4] With this information and by applying the dysafferentation model of subluxation, it is conceivable that this pathological afferent input is cause by a dysfunctional vertebral motion segment.

In the case of the 58-year-old female with ET, it can be theorized that her atlas misalignment resulted in a lack of motion in the upper cervical region, causing faulty reception by her mechanoreceptors. This lead to aberrant afferent input into the cerebello-thalamocortical pathways and to rhythmic activation of her upper extremities in the form of ET. Kent says that, "Correcting the specific vertebral subluxation cause is paramount to restoring normal afferent input to the CNS and allowing the body to correctly perceive itself and its environment".[22] When the patient's atlas misalignment was reduced, motion was restored to that area of the spine, leading to improved afferent input and the immediate relief of her ET symptoms.

Limitations

The outcomes of this case cannot be applied to the general population directly, as this is a case study of one particular case. The sample size of one is not nearly enough to extrapolate to the general public. The nature of ET is such that it can spontaneously improve as well, which further necessitates a larger sample of cases.

Conclusion

This case study summarizes the reduction of ET symptomatology and increase in quality of life following a chiropractic adjustment utilizing the Orthospinology protocol. The immediate relief as well as the continued improvements shown under upper cervical chiropractic care may indicate a link between atlas subluxation and ET symptomatology. The medical community has shown little success in the treatment of ET, and its treatments have some serious side effects such as depression. Utilizing conservative upper cervical chiropractic treatment can often be less expensive, less invasive, and may show better outcomes in the future. However, the breadth of research on this topic must be expanded.

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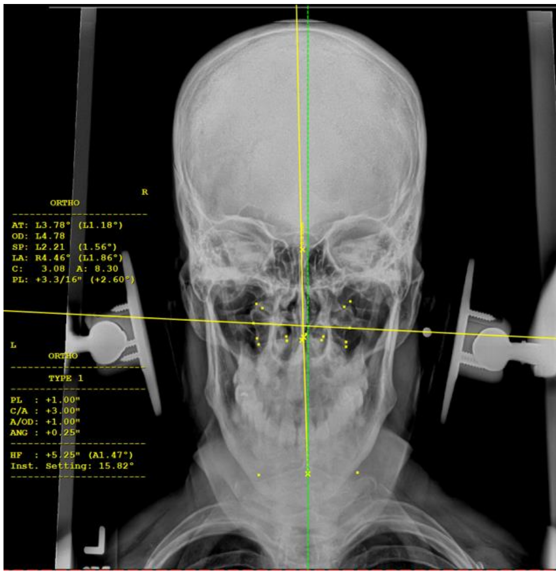
Appendix

Factor	Pre-treatment Measurment	Post-treatment Measurment	+/- Differential	% Correction
Upper Angle	L 3.78	L 2.21	-1.57	42%
Lower Angle	R 4.46	R 2.00	-2.46	55%
C1 Rotation	A 1.47	A 0.80	-0.67	46%
C2 Rotation	L 2.21	L 1.35	-0.86	39%
Head Tilt	L 1.18	L 0.43	-0.75	64%

Table 1 – Pre and Post Factors with Percentage Differentials
Note: 'L' and 'R' signifies right and left respectively, and 'A' signifies anterior. All measurements are in degrees unless labeled otherwise.

Figure 1 – Pre-treatment lateral cervical



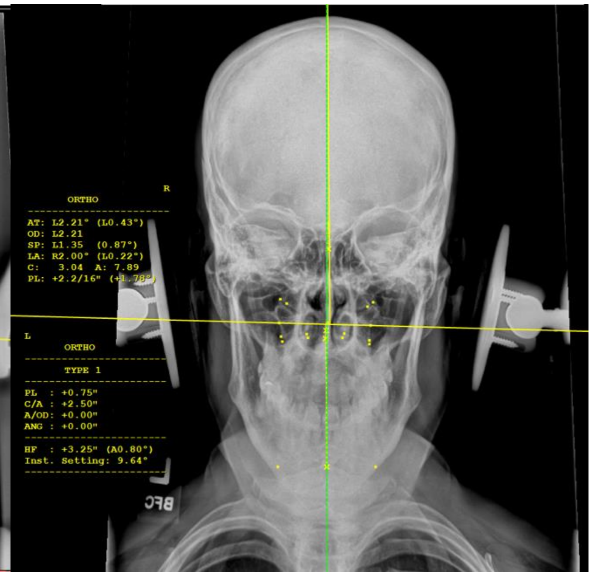


Figure 2 – Pre-treatment nasium

Figure 3 – Post-treatment nasium

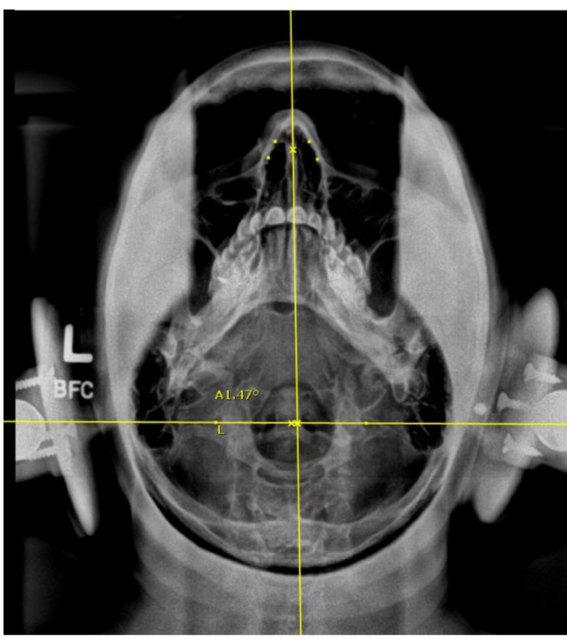


Figure 4 – Pre-treatment vertex

Figure 5 – Post-treatment vertex