

---

---

# CASE STUDY

---

---

## Resolution of Trigeminal Neuralgia in a 14 Year Old Following Upper Cervical Chiropractic Care to Reduce Vertebral Subluxation: A Case Study

Robert Kessinger DC<sup>1</sup> & Alicia Matthews DC<sup>2</sup>

---

---

### ABSTRACT

**Objective:** This paper reports on outcomes following chiropractic care for a 14 year old female with trigeminal neuralgia.

**Clinical Features:** 14-year old female presented with excruciating, intermittent left facial pain below the eye radiating into the jaw. Patient reported previous diagnosis of trigeminal neuralgia.

**Interventions and Outcomes:** Cervical radiographs, paraspinial digital infrared imaging, and pelvic balance leg length inequality were used to confirm upper cervical subluxation. A Knee Chest Upper Cervical Specific adjustment was administered to the C1 region of the spine. Patient's progress was monitored through pattern analysis of the subluxations, pelvic balance, leg length inequality, and observational reports from the mother and child. The patient demonstrated a complete remission of symptoms after one adjustment. One year later, the patient remains asymptomatic.

**Conclusion:** The chiropractic care of a patient suffering with trigeminal neuralgia is presented. Complete alleviation of symptoms was achieved. It is feasible that chiropractic care can affect trigeminal neuralgia. Further study is recommended.

**Key Terms:** *chiropractic, adolescent, trigeminal neuralgia, facial pain, upper cervical, vertebral subluxation, thermography, Knee Chest adjustment*

---

---

### Introduction

Trigeminal neuralgia (TN), also known as Tic Douloureux,<sup>1,2</sup> is classically characterized by episodes of recurrent pain that are described as lancinating, intense, stabbing, excruciating, unilateral, and sudden pain in the distribution of the 5<sup>th</sup> cranial nerve. Pain is intermittent lasting just a few seconds to two minutes.<sup>3</sup> Typically, attacks are triggered by talking, chewing, teeth brushing, shaving, light touch, vibrations from walking, applying makeup, face washing or cool wind.<sup>2,4</sup>

Brief attacks can occur a few times or hundreds of times per day.<sup>3</sup> Onset usually occurs in adults and elderly, but can occur in the young.<sup>5</sup> Although trigeminal neuralgia is more common in adults 40-60 years of age,<sup>6</sup> the youngest reported case is of a three year old girl.<sup>7,8</sup> The annual incidence of trigeminal neuralgia is 4.3 per 100,000 with it occurring slightly more often in women. The right side of the face with the maxillary branch of the trigeminal nerve is the most common site affected.<sup>2</sup> No statistical analysis of the prevalence of

---

1. Private Practice of Chiropractic – Cape Girardeau, MO  
2. Private Practice of Chiropractic – Kennesaw, GA

trigeminal neuralgia in children could be found in the literature.

Arateus first described trigeminal neuralgia in the 1<sup>st</sup> century AD.<sup>9</sup> In 1677, a medical physician described it and later in 1756 it became a definite clinical entity.<sup>10</sup> Although many centuries have passed since the discovery of trigeminal neuralgia, its pathophysiology still remains controversial. Yet, this condition requires immediate intervention due to its agonizing nature.<sup>11</sup> In his book, Thomasi describes his struggle with suicide due to the inability to want to live with such a debilitating disorder.<sup>12</sup>

Medical therapy is currently the primary treatment for trigeminal neuralgia.<sup>13</sup> Patients first go down a medical route, which first includes prescription drugs. If these fail to reduce symptoms, patients are offered surgical options based on age and concurrent conditions.<sup>14</sup> The current gold standard of pharmaceutical treatment is Carbamazepine.<sup>15-20</sup> Although some studies show carbamazepine to be effective in the pain control of trigeminal neuralgia,<sup>13</sup> there remains a number of side effects which include nausea, vomiting, giddiness, anorexia, dry mouth, headache, drowsiness, ataxia, confusion, acute retention of urine, haematuria, agranulocytosis, purpura, thrombocytopenia, urticarial or erythematous itching rashes, skin photosensitivity, and aplastic anemia.

Due to potential adverse effects, it is important that patients stop taking this medication slowly rather than abruptly.<sup>21</sup> According to a clinical review of trigeminal neuralgia and Cochrane systematic reviews, the small number of trials show that the evidence is weak.<sup>22</sup> Yet this medication is still used routinely for pain control and has been found to be successful in many patients.

If medication fails to effectively control pain, patients are offered numerous surgical options dependent on their age and concurrent conditions. Microvascular decompression is the gold standard of surgery options. This procedure surgically separates cranial nerve five from its adjacent blood vessels. There have been no randomized control studies to provide evidence of its effectiveness.<sup>16</sup> This procedure is performed under general anesthesia with the risk of mortality at about 1%.

Other complications included hearing loss, facial palsy, diplopia, wound infections, postoperative hematomas, and CSF leakages. Radiosurgery with the Gamma Knife is a less invasive, alternative procedure.<sup>23</sup> The procedure is performed using a focused beam of radiotherapy to trigeminal nerve at its proximal end, but its evidence is based solely on case studies.<sup>16</sup> Non-surgical, drug-free treatment options are needed in the management of trigeminal neuralgia.

## Case Report

### *Patient History*

Patient is a 14-year-old female. The patient's mother presented her to Kessinger Specific Chiropractic with facial pain that began four days prior. Patient recently had an accident, one month prior to her initial visit, where she landed on the back of her head, neck, and shoulder after doing a back flip on a

trampoline. Patient reports Neck stiffness for a couple days and looking up also caused pain in her lower neck region.

Facial pain is left sided and began four days prior to coming into the clinic. It was currently rated 10/10 on the visual analog scale. Pain is intermittent lasting approximately one minute with episodes occurring every twenty minutes. Pain is described as "excruciating". Pain is just below the eye and radiates down into the jaw. Pain is provoked by wind and s/t touching, but patient reports attacks being random as well. Nothing reduces pain. Patient has tried Tylenol with no results. Upon report of patient history, it was discovered that patient has a past medical history of four permanent teeth being removed 4.5 years ago. Menstruation began approximately two years prior to initial visit.

Patient has not received any previous care for facial pain. Two days prior she went to a dentist who ruled out TMJ and any dental reasons for her pain. He gave her a diagnosis of trigeminal neuralgia. The dentist recommended pain medication, which the patient did not take. Patient has no past history of this complaint and decided to seek chiropractic care for management of her facial pain.

### *Examination*

Blood pressure, pulse, temperature, pulse oximetry and weight were all measured and within normal limits. Examination also included paraspinal digital infrared imaging, pelvic balance leg length inequality assessment and cervical spine radiographs.

A skin temperature differential analysis (STDA) of the cervical spine was performed via paraspinal digital infrared imaging. The Duff pattern analysis method was employed.<sup>25,26,27</sup> The patient was found to display a distinct pattern indicating neurophysiological dysfunction in the upper cervical spine.

A pelvic balance leg length inequality (LLI) examination was performed in the prone position and revealed an 8 mm short right leg. Pelvic balance LLI has been commonly used as an assessment tool in various upper cervical chiropractic techniques for a number of years.<sup>28,29</sup>

Cervical radiographs were performed to evaluate the structural integrity of the cervical spine due to the aberrant STDA, pelvic imbalance, neck pain, and the diagnosis of TN. The spinographic examination included an APOM full cervical in stereo, neutral lateral, base posterior, and left and right Blair protracto views.<sup>30,31</sup> The APOM full cervical in stereo is viewed using a dual viewbox with mirrored prisms and gives the examiner a 3 dimensional view of the head position over the spine.<sup>32</sup> The APOM full cervical and neutral lateral views were primarily used to determine the upper cervical alignment. The Blair views confirmed the atlas listing. (Figure 3-7)

APOM full cervical demonstrated a right head tilt and a dens malformation deviated left in relation to the axis body. There was a moderately increased inter-odontoid atlas space on the left and the body laminar notch was moderately larger on the left side. The right Protracto view demonstrated a matched C0/C1 lateral margin and the left Protracto revealed a C1

lateral overlap relative to its respective condyle. The neutral lateral demonstrated an anterior weight bearing with a slight cervical curve reversal with slight to moderate fanning at the C3/C4, C4/C5 motor segment. Misalignment of C1 and C2 were defined as an ASL (anterior superior with left laterality of atlas relative to the condyles) and a PLI (posterior and inferior axis, relative to superior C3 facets, with left spinous process deviation).

### *Diagnosis and Management*

After examination, the patient's diagnosis of TN was confirmed using the guidelines published by the International Headache Society.<sup>33</sup> We found evidence of an atlas/axis misalignment and given the patient case history concluded a possible causative role in the patient's TN etiology. The goal of care was to correct the atlas misalignment and monitor the symptomatic progress related to TN. Recommendation for care included the correction of the atlas position through a chiropractic adjustment as determined by the X-ray findings, thermographic pattern analysis, and pelvic balance LLI examination.

### *Interventions and Outcomes*

A chiropractic adjustment was administered to the existing subluxation located at the C1 vertebra. The Knee Chest Upper Cervical Specific (KCUCS) technique was chosen as the method for subluxation removal. The KCUCS upper cervical adjustment has been described as a high velocity, low amplitude torque adjustment administered to the upper cervical spine.<sup>31</sup>

The adjustment is used to correct subluxations and nerve interference. This technique requires the chiropractor to follow a specific protocol. When evaluating a patient the examiner must perform paraspinal thermography to the cervical region of the spine, leg checks, and x-ray. Patient must also rest at least 45 minutes in the supine position after each adjustment.

A Knee Chest practitioner's goal is to remove the subluxation through a specific adjustment to the upper cervical spine. Speed is most important in removing the subluxation. For the ASL atlas misalignment, the adjustment is a 6 step procedure performed on a solid head piece knee chest table. Step one is doctor/patient position where the patient is instructed to kneel in front of the knee chest table and place their chest on the front portion of the table. For the ASL misalignment, the patient is instructed to turn their head maximally to the left. The doctor stands on the patient's left side and uses their left hand as the contact hand and the right hand as a supportive hand.

In step 2 the doctor contacts the left side of the C1 posterior arch with the tip of their right index finger. Step 3 is the tissue pull and is performed by the doctor's right middle digit lightly pulling tissue from the lateral margin of the C2 spinous process to the left posterior arch of atlas with a 3 to 12 sweep. In step 4 the left arched hand of the doctor rolls in contacting the C1 posterior arch with the hypothenar eminence.

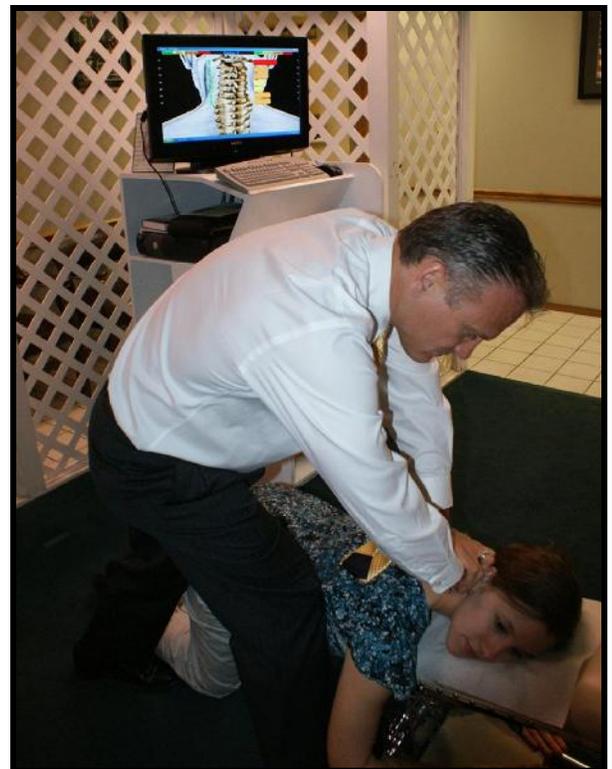
The purpose of step 5 is to firm up the contact point as well as

traction down the cervical spine to get the upper cervical spine to their endpoint of joint motion. It is accomplished primarily by the doctor's right hand thenar eminence contacting the back of the contact hand moving in a clockwise direction exerting pressure down onto the lower cervical upper thoracic spine. The 6<sup>th</sup> step is a body drop initiated by an abdominal contraction where the high velocity, low amplitude thrust is completed. It is characterized by a downward torquing arc with bilateral triceps contraction at the end point.

Following the KCUCS protocol the patient was instructed to rest supine with cervical pillow support and support pillows under the knees for a minimum of 45 minutes immediately post KCUCS adjustment. The patient was evaluated subsequent to this rest period and on each successive office visit to determine the progress of the upper cervical spine.



**Figure 1.** Depicts a Knee Chest Upper Cervical Specific Adjusting Table



**Figure 2.** Depicts a Knee Chest ASL adjustment.

A Knee Chest Upper Cervical Specific adjustment was administered to the C1 region of the spine. Patient's progress was monitored through "pattern analysis", leg length

inequality and observational reports from the mother and child. Palmer first used “pattern analysis” in the early 1920s.

Thermography reports are used to determine aberrations in skin temperature differentials that have remained constant or in “pattern”. This allows the doctor to determine if the patient has a subluxation and if the patient will be adjusted on the day of their visit.<sup>25</sup>

The patient returned the following day and then again 6 days after that. Each visit the patient did not need an adjustment. No adjustment was administered because the patient’s legs remained balanced and thermography pattern was not found. Patient reported no symptoms of trigeminal neuralgia. The patient demonstrated a complete remission of symptoms after the first adjustment. Approximately one month after presentation and almost one year later the mother reported that her daughter has not had any facial pain since her first adjustment.

## Discussion

A survey of literature on the connection between chiropractic More people are seeking natural health care options. Non-surgical, drug-free treatment options are needed in the management of trigeminal neuralgia. In this case study, the patient achieved complete alleviation of symptoms through the use of upper cervical specific chiropractic care.

## Literature

Perderick conducted a case report on a patient with a six-year history of trigeminal neuralgia with intermittent periods of remission and exacerbations. Prior to chiropractic treatment, the patient had experienced a 2-month period of continuous exacerbation with pain rated at 9.5 on the visual analogue scale. The patient received chiropractic care, which included cranial work and adjustments to the upper cervical spine, thoracic, and lumbar spine. After and 11-day period and 4 patient visits, the patient reported a decrease in pain rated at 0.5 on the visual analogue scale.<sup>26</sup>

Burcon conducted a case report on a 57-year-old female who presented with right side trigeminal neuralgia for duration of two years. Patient also had the concurrent conditions of high blood pressure, hypothyroidism, decreased hearing in the left ear, cervicgia, bilateral shoulder pain, right shin numbness, and allergies. Patient was adjusted at the level of C2 & C5. After one week of care, her facial pain decreased significantly. After eight weekly visits, the patient was completely out of pain and no longer taking pain medications. In addition, her need for blood pressure medication also decreased by 50 percent. The patient remained without pain during her two years of maintenance chiropractic care.<sup>8</sup>

In a case report of a 68-year old woman with seven and a half year history of head and neck pain diagnosed as trigeminal neuralgia, Rodine describes successful intervention with the use of chiropractic care. Beginning with the first treatment, the patient reported improvement of at a satisfactory level. Eighteen months of supportive care yielded positive results.<sup>27</sup>

A case of a 76-year-old male with a complain of trigeminal

neuralgia was reported by Tomasello and Guagliardo. Patient received specific upper cervical adjustments. Within 4 weeks, the patient was without pain and continued to be asymptomatic for six and a half weeks of care.<sup>28</sup> Prax conducted a review of pediatric upper cervical chiropractic literature and established “that the upper cervical spine should be recognized as a region that may have tremendous impact on the health of the pediatric patient”. Sports and interactive play can be one of the many avenues that subluxations to the spine can occur. These subluxations can negatively affect the function of the whole body.<sup>29</sup>

## *Knee Chest Upper Cervical Specific*

In this case study, the doctor utilized the KCUCS technique in the management of a patient with upper cervical subluxations and trigeminal neuralgia. Protocol for this technique includes aberrant digital infrared thermography readings, pelvic balance leg length inequality, and cervical radiographs revealing upper cervical subluxations. After positive objective findings have been confirmed in all three areas, a specific upper cervical knee chest adjustment to the upper cervical spine is administered to the patient who is positioned on a knee-chest table. The patient is then required to rest for at least 45 minutes in a supine position.<sup>24</sup>

Pelvic balance leg length inequality evaluation is utilized at each patient visit. This assessment is used because it is hypothesized that irritation of the spinal cord caused by the traction of the dentate ligament does so first in the spinocerebellar tracks. These tracks are located most lateral and are composed of the largest axons in the spinal cord. These tracks affect muscle tone and joint position of the lower extremities and pelvic girdle. Subluxations in the upper cervical spine thus produce hyper tonicity in these muscles producing a short leg.<sup>30</sup> Upon correction of the subluxation, the patient’s legs balance. Pelvic balance leg length inequality is assessed at each visit. Balanced legs are one of the positive indicators that the patient is holding their adjustment. If legs are unbalanced and an adjustment is administered, balanced legs are used as part of the confirmation that the adjustment was properly administered.

Paraspinal thermography is used to detect abnormal neurophysiological function. This has been shown to be a valid and reliable outcome assessment tool. It is used to manage vertebral subluxations. Pattern is established when a patient is no longer adapting to the environment and their thermal reading has become fixed in an asymmetrical pattern. The scan is valuable in determining to what degree the autonomic nervous system is abnormally functioning. Deviations from normal can indicate pathology.<sup>31</sup> Each patient is scanned at least three times to determine pattern on his or her first visit. This pattern is used to determine if the patient will need an adjustment on subsequent visits. After an adjustment and 45 minutes of resting in the supine position, the patient is scanned again using digital infrared thermography to confirm the reduction in the subluxation.

## *Dentate Ligament-Cord Distortion Hypothesis*

According to the dentate ligament-cord distortion hypothesis, mechanical distortions of the spinal cord can be produced

through misalignments of the upper cervical vertebrae. This is the only area of the spinal cord where the dentate ligament is perpendicular to the cord. Due to the unique attachment of the C1 and C2 vertebrae to the spinal cord through the dentate ligament, misalignments of these vertebrae can cause direct stress and deformity to the spinal cord. This in turn may create venous occlusion with stasis of blood thus developing anoxia in different areas of the upper cervical spinal cord.

Furthermore, this theory provides probable cause to an involvement of a vascular component where obstruction of the small radicular veins of the upper cervical cord could result in stasis of blood and ischemic reactions to the venous drainage portion of the cord due to the low level of pressure that they operate under.<sup>30</sup>

In regards to trigeminal neuralgia, it is hypothesized that the Dentate Ligament-Cord Distortion Hypothesis provides an explanation for the efficacy of correcting the upper cervical subluxation in relieving this disorders associated symptoms.

Grostick explains:

The paroxysmal nature of the pain indicates that it arises as a sudden discharge of neurons as a result of irritation of the trigeminal nerve or it could occur in the gasserian ganglion or in the spinal nucleus of the trigeminal nerve may extend downward as far as the 4<sup>th</sup> cervical vertebra. By combining anterior rotation of the atlas on the side to which the atlas has laterally deviated with the lateral traction it may be possible to put traction directly on the sensory nucleus of the trigeminal nerve at the level of the first and second cervical vertebrae.

This is one theory available to explain the successful improvement of a patient with trigeminal neuralgia.

Other studies support the idea that changes in cerebral circulation can occur with an atlas misalignment.<sup>38</sup> Jannetta has reported disturbances in cerebral circulation as being a causative feature in TN.<sup>14</sup>

## Conclusion

The chiropractic care of a 14-year-old patient suffering with trigeminal neuralgia is presented. Complete alleviation of symptoms was achieved. It is feasible that chiropractic care can affect trigeminal neuralgia, but further study is recommended. There are limitations to every case study, including this one. It is important to note that the origin of trigeminal neuralgia is still unknown.

Many patients recover spontaneously and have many asymptomatic months. This patient has remained asymptomatic for almost one year. It is important to take into consideration the natural and unknown course of this disease. Based on the results of this study, it is at the recommendation of the author that future studies be conducted. There is a need for more extensive research supporting the link between upper cervical subluxations and relief of trigeminal neuralgia symptoms. This case study may shed light on other options

for patients suffering with trigeminal neuralgia.

## References

1. Loeser JD. Tic douloureux. *Pain Res Manage.* 2001; 6(3):156-165.
2. Krafft RM. Trigeminal neuralgia. *Amer Acad Fam Phys.* 2008; 77(9):1291-6.
3. Zakizewska JM, Linskey ME. Trigeminal neuralgia. *Clin Evid.* Mar 12, 2009; pii:1207.
4. Zakrzewska JM, McMillian R. Trigeminal neuralgia: the diagnosis and management of this excruciating and poorly understood facial pain. *Postgrad Med J.* June 2011; 87(1028):410-6.
5. Love S, Coakham HB. Trigeminal neuralgia pathology and pathogenesis. *Brain.* 2001; 124:2347-2360.
6. Kabatas S, Albayrak SB, Cansever T, Hepgul KT. Microvascular decompression as a surgical management for trigeminal neuralgia: A critical review of the literature. *Neurol India.* 2009; 57:134-8.
7. Bloom R. "Emily Garland: A young girl's painful problem took more than a year to diagnose." *Arizona Daily Star,* 11.18.2004.
8. Burcon MT. Resolution of trigeminal neuralgia following chiropractic care to reduce cervical spine vertebral subluxations: a case study. *Vertebral Subluxation Res.* October 26, 2009, pp 1-7.
9. Stookey B, Ransohoff J. Trigeminal neuralgia, its history and treatment. Springfield, IL. Charles C Thomas, 1959:3-32.
10. Pearce JMS. Trigeminal neuralgia (Fothergill's disease) in the 17<sup>th</sup> and 18<sup>th</sup> centuries. *J Neurol Neurosurg Psychiatry.* 2003; 74: 1688.
11. Dewhurst K. A symposium on trigeminal neuralgia with contributions by Lock, Sydenham, and other eminent seventeenth century physicians' disease. *Ann J Hist Med Allied Sci.* 1957; 12: 21-36.
12. Katusic S, Beard CM, Bergstril E, Kurland LT. Incidence and clinical features of trigeminal neuralgia, Rochester, Minnesota, 1945-1984. *Ann Neurol.* 1990; 27:89-95.
13. Dandy, W. Concerning the cause of trigeminal neuralgia. *Am J of Surg.* 1934; 24: 447-55.
14. Jannetta PJ. Structural mechanisms of trigeminal neuralgia: arterial compression of the trigeminal nerve at the pons in patients with trigeminal neuralgia. *J Neurosurg.* 1967; 26: 159-62.
15. Miller JP, Acar FA, Burchiel KJ. Trigeminal neuralgia and vascular compression in patients with trigeminal schwannomas: case report. *Neurosurg.* 2008; 62(4): E974-E975.
16. De Simone R, Marano E, Brescia MV, et al. A clinical comparison of trigeminal neuralgic pain in patients with and without underlying multiple sclerosis. *Neurol Sci.* 2005; 26 Sup 2: S150-1.
17. Blom S. Trigeminal neuralgia: it's treatment with a new anticonvulsive drug (G-32883). *Lancet.* 1962; 1: 839-840.
18. Scheinberg MA, Saghar O. Medical management of trigeminal neuralgia. In: Burchiel KJ, ed. *Surgical Management of Pain.* New York: Thieme, 2002: 304-311.
19. Obermann M. Treatment options in trigeminal neuralgia. *Ther Adv Neurol Disord.* 2010; 3(2): 107-115.

20. Green MW, Selman JE. Review article: the medical management of trigeminal neuralgia. *Headache*. 1991; 31: 588-592.
21. Barker FG, 2nd, Jannetta PJ, Bissonette DJ, Larkins MV, Jho HD. The long-term outcome of microvascular decompression for trigeminal neuralgia. *N Engl J Med*. 1996; 334(17): 1077-1083.
22. Young RF, Vermeulen SS, Grimm P, Blasko J, Posewitz A. Gamma knife radiosurgery for treatment of trigeminal neuralgia. *Neurology*. 1997; 48: 608-614.
23. Gleberzon BJ. Chiropractic “name techniques”: a review of the literature. *J Can Chiropr Assoc*. 2001; 45(2): 86-89.
24. Eriksen K, Rochester RP, Hurwitz EL. Symptomatic reactions, clinical outcomes and patient satisfaction associated with upper cervical chiropractic care: a prospective, multicenter, cohort study. *BMC Musculoskelet Disord*. 2011; 12: 219.
25. Duff SA: Chiropractic clinical research, interpretations of spinal bilateral skin temperature differentials. San Francisco: Paragon Printing, 1976.
26. Palmer BJ. Chiropractic clinical controlled research. Hammond, Indiana: W.B. Conkey Co, 1951: 587.
27. McCoy M. Paraspinal thermography in the analysis and management of vertebral subluxation: a review of literature. *J Vert Sublux Res*. 2011; 57-66.
28. Hinson R, Brown SH. Supine leg length differential estimation: An inter- and intra-examiner reliability study. *CRJ*. 1998; 5(1): 17-22.
29. Woodfield HC, Gerstman BB, Olaisen RH, Johnson DF. Interexaminer reliability of supine leg checks for discriminating leg-length inequality. *J Manipulative Physiol Ther*. 2011; 34(4): 239-246.
30. Blair WG. A synopsis of the Blair upper cervical spinographic research. *sScience Review of Chiropractic (International Review of Chiropractic:Scientific Edition)*. 1:1-19 (Nov. 1964), p.2, 12.
31. Kessinger RC, Boneva DV. A new approach to the upper cervical specific, knee-chest adjusting procedure: part 1. *CRJ*. 2000; 8: 14-32.
32. Reimer, PA. The chiropractic stereoscope in modern technic and procedures. The Palmer School of Chiropractic. May 1936.
33. International Headache Society. The international classification of headache disorders, 2nd Edition. *Cephalalgia*. 2004; 24 (suppl 1): 1-160.
34. Rodine RJ. Trigeminal neuralgia and chiropractic care: a case report. *J Can Chiropr Assoc*. 2010; 54(3): 177-185.
35. Tomasello M, Guagliardo J. Chiropractic care in a case with chronic trigeminal neuralgia: a case report. *Journ Chiro Education*. 2010; 24(1): 143.
36. Prax JC. Upper cervical chiropractic care of the pediatric patient: a review of the literature. *J of Chiropractic Clin Pediatr*. 1999; 4: 257-263.
37. Grostic JD. Dentate ligament-cord distortion hypothesis. *CRJ*. 1988; 1: 47-55.
38. Bakris G, Dickholtz Sr M, Meyer PM, 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. *J Hum Hypertens*. 2007; 21: 347-352.

## Radiographs

Figures 3-7 represent the radiographs taken during the patient examination. The views of interest were APOM full cerv protracto views.

APOM full cervical demonstrated a right head tilt and a dens malformation deviated left in relation to the axis body. There was a moderately increased inter-odontoid atlas space on the left and the body laminar notch was moderately larger on the left side. The right Protracto view demonstrated a matched C0/C1 lateral margin and the left Protracto revealed a C1 lateral overlap relative to its respective condyle. The neutral lateral demonstrated an anterior weight bearing with a slight cervical curve reversal with slight to moderate fanning at the C3/C4, C4/C5 motor segment.



**Figure 3. APOM Left Stereo**



**Figure 4. APOM Right Stereo**



**Figure 5. Neutral Lateral Cervical**



**Figure 6. Left Protracto View**



**Figure 7. Right Protracto View**