CASE STUDY

Improvement in Blood Pressure Following Specific Upper Cervical Chiropractic Care: A Case Study & Review of Literature

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ABSTRACT

Objective: To evaluate and discuss the effects of upper cervical chiropractic care, specifically NUCCA (The National Upper Cervical Chiropractic Association) technique adjustments administered on a patient with a previous diagnosis of hypertension. This paper aims to support previously published research suggesting upper cervical chiropractic care can improve blood pressure in patients with hypertension.

Clinical Features: The patient is a 77-year-old female that presented with hypertension, a previously diagnosed condition in which she has been prescribed Clopidogrel to treat. The patient's exam revealed positive palpation findings, postural changes, uneven weight distribution, indicative anatometer measurements and x-ray findings qualifying the patient for specific upper cervical chiropractic care to the first cervical vertebra utilizing the NUCCA chiropractic technique analysis.

Intervention and Outcomes: Specific, low force upper cervical chiropractic adjustments (NUCCA) were administered to the upper cervical spine. During the course of the patient's care, improvements were observed in all charted objective indicators including a correction in x-ray findings and a decrease in the patient's blood pressure readings.

Conclusion: The patient experienced improvements in her blood pressure and all additional objective indicators following specific chiropractic adjustments to the first cervical vertebra. The goal of this paper is to assist in exploring the role of chiropractic care in the co-management of conditions other than neck pain, back pain and headaches.

Key Words: *Chiropractic, vertebral subluxation, upper cervical, NUCCA, hypertension, blood pressure, adjustment, spinal manipulation*

Introduction

Hypertension is the most common primary diagnosis in the United States[1] and a major risk factor for cardiovascular disease.[2] Approximately 77.9 million people, or 1 out of every 3 people have high blood pressure in the U.S.[3] Hypertension is a condition of elevated blood pressure above the normal ranges of systolic levels of <120 mm Hg and diastolic levels of <80 mm Hg. Hypertension affects millions of people in the United States and can contribute to numerous adverse health effects such as myocardial infarction, heart failure, stroke and kidney disease.[1] Recent trends show that approximately 50 million individuals in the U.S. and approximately 1 billion individuals worldwide suffer from hypertension, and these numbers are expected to grow along with the aging population.[1]

The estimated direct and indirect costs of high blood pressure in the U.S. as of 2009 was $51 billion[3] which can be expected to increase along with the growing population of individuals

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with obesity. Annual hypertension treatment visits increased from 56.9 million in 1997 to 70.9 million visits by 2012 and angiotensin receptor blocker medication utilization increased substantially from 3% of treatment visits in 1997 to 18% by 2012.[4]

Stage 1 hypertension is defined for adults 18 and older as systolic measurements 140-159 mm Hg, and diastolic measurements of 90-99 mm Hg,[1] while stage 2 hypertension is defined as systolic measurements of ≥160 mmHg and diastolic measurements of ≥100 mm Hg.[1] Because of the serious health consequences of this condition, the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (The JNC 7 Report) developed a classification of prehypertension defined as systolic levels of 120-139 mm Hg and diastolic measurements of 80-89 mm Hg, to recognize this relationship and signal the need for increased education of health care providers and the public to decrease the blood pressure levels and prevent the development of hypertension in the general population.[1]

Prevalence of hypertension is on the rise in the United States. Increasing age and increasing body mass index have been shown to relate to higher rates of hypertension.[2] In addition to obesity, some other causes of hypertension include excess alcohol intake, drug induced hypertension, excess sodium intake, volume retention from kidney disease and thyroid and parathyroid diseases.[1]

For individuals between the ages of 40-70 years old, each increasing increment of 20 mm Hg in systolic blood pressure or 10 mm Hg in diastolic blood pressure doubles the risk of cardiovascular disease across the entire blood pressure range from 115/75 to 185/115 mm Hg.[5] The ultimate goals of antihypertensive therapy is the reduction of cardiovascular and renal morbidity and mortality.[1] The JNC 7 Report states that while most patients can achieve affective blood pressure control, the majority will require 2 or more antihypertensive drugs. More importantly, if physicians fail to prescribe lifestyle modifications along with medication, inadequate blood pressure control may result.[1]

For these hypertensive patients, modifications in lifestyle habits are critical to the prevention of high blood pressure as well as the management. The major lifestyle modifications suggested by the JNC 7 Report include weight reduction, adopting a diet rich in fruits, vegetables, and low-fat dairy products, dietary sodium reduction, physical activity, and moderation of alcohol consumption.[1]

Patients experiencing high blood pressure have in one way or another exhausted their natural internal controls. The human body has regulatory mechanisms in place to control blood pressure ensuring proper blood flow to all organs and tissues. Under healthy conditions, the nervous system responds to arterial pressure changes or blood gas levels at cardiovascular centers of the autonomic nervous system. These centers, once sensing a shift in pressure, adjust cardiac output and peripheral resistance to maintain appropriate blood flow.[6]

The vasomotor center of the medulla oblongata contains two populations of neurons; a large group that is responsible for widespread vasoconstriction and a smaller group responsible for vasodilation of arterioles in the skeletal muscles and the brain.[6] The vasomotor center exerts its effects by controlling the activity of sympathetic motor neurons.[6] An alteration in the function of these internal controls, just like obesity, high alcohol intake, and stress can contribute to a hypertensive state.

Case Report

Patient History

The patient is a 77-year-old retired female who presented with previously diagnosed hypertension for which she was taking Clopidogrel antihypertensive medication to treat. She denied having an exercise regimen and had been on anti-hypertension medications for the past five years and continued to have difficulties controlling her blood pressure.

She was also on medication for a hypo-active thyroid condition that she described as a pharmacist made mixture. She was involved in an auto accident 25 years ago where she was not hospitalized and denied any major injuries. She stated she had polio and spinal meningitis in 1952 and a full hysterectomy in 1990. She described some mild right shoulder pain when reaching and right foot pain that she attributed to a collapsed arch.

Chiropractic Examination

The assessment was conducted adhering to NUCCA technique protocols to determine if there was evidence of a vertebral subluxation at the C1 vertebra. The assessment consisted of several components including postural analysis, manual palpation, leg length measurements, anatometer measurements, spinal weight distribution and x-ray analysis. The patient presented with a short right leg known as a leg length inequality (LLI) of ½ inch when assessed in the supine position. The postural analysis indicated left head tilt, 1" high left shoulder and mild right head rotation.

Manual palpation revealed soft tissue inflammatory indicators bilaterally at the C1 vertebral level with a slight increase in hypertonicity inferior to the right C1 transverse process. Her anatometer measurements indicated a 4 degree right rotational displacement when measured from the fixed point. Spinal weight distribution of the patient was 75 pounds on the left and 95 pounds on the right. Her blood pressure measured 190/78 mm Hg on the left and 165/65 mm Hg on the right, a significant difference was noted when compered bilaterally.

Leg length inequality (LLI) is an assessment commonly used in the chiropractic profession that serves to indicate signs of vertebral misalignment and neuromuscular dysfunction. Studies have shown moderate reliability in examiners ability to assess LLI at 1/8 inch increments. One randomized study involving 50 volunteers showed that examiners agreed on a LLI within 1/8 of an inch 80% of the time.[7]

It has been suggested that unloaded LLI is a completely different phenomenon from anatomical LLI and might be due to hypertonic supra-pelvic muscles. An anatomical abnormality should be determined before using the LLI

assessment results as indications of vertebral misalignment and any asymmetry contributed to muscular hyper-tonicity should be resolved before treatment is initiated for an anatomical LLI abnormality.[8]

The Anatometer is a tool that NUCCA practitioners use to measure transverse and frontal plane pelvic displacement, the angulation of the fixed point from the vertical axis, and the percent weight differential. The data from the anatometer is recorded and referenced as the patient's baseline. Research results from the anatometer have established the basic NUCCA hypothesis that C1 subluxations can cause neuromusculature problems that yield body distortions. By using the data produced by the anatometer a pattern can be developed for each patient that indicates a C1 adjustment is necessary without overexposing the patient to radiation.[9]

Cervical x-rays were attained and analyzed according to the protocols established by the National Upper Cervical Chiropractic Association.[9] NUCCA technique protocol requires a specific set of radiographic views to be taken to establish the right to adjust the patient and determine the listing to be corrected. The views required include the lateral cervical view, nasium view, and vertex view. The lateral cervical view (Figure 1) is used to determine the angle of the atlas that is then used to determine the S Line. The S Line is referenced by the examiner to determine the x-ray tube angle required to take the nasium view. This patient's S Line was determined to be an S3 requiring the x-ray tube to be angled and directed through the bottom of the orbital socket. The nasium view (Figure 2) is used to determine head tilt and atlas laterality. This patient had a head tilt of 1 º to the left with a left atlas laterality of 4 º. The vertex view (Figure 3) is used to determine the rotation of atlas and was measured at 2º posterior on the left in this patient.

Chiropractic Intervention

Over two months the patient presented to the clinic seven times to be evaluated for the presence of vertebral subluxation and received a NUCCA chiropractic adjustment on two of the visits. The first adjustment was delivered on the initial visit following the patient's exam and the second adjustment was delivered on the sixth visit following an evaluation determining the presence of vertebral subluxation. The evaluation for the presence of vertebral subluxation consists of a postural analysis, manual palpation of the upper cervical region, leg length measurements, anatometer measurements, and spinal weight distribution.

The patient was adjusted, and the subluxation was reduced utilizing a specific and unique low force move adhering to the NUCCA technique protocols. NUCCA technique utilizes the C1 transverse process as a contact for the examiner's pisiform. Following the calculated angle, the examiner introduces a vectored low sustained force into the patient at the contact point generated by a gentle triceps pull.[10] This unique force when delivered correctly will restore proper alignment between the upper cervical spine, specifically the relationship between the occiput and atlas. Restoration of the alignment in the upper cervical spine removes nervous system interference, restores spinal alignment and improves biomechanical integrity of the patient's entire structure.[9,10]

The nature of this patient's subluxation required that the adjustment be delivered by contacting the left C1 transverse process posterior and inferior to the palpable tip of the mastoid process with counterclockwise torque. To determine the exact location of the contact point the C1 transverse process on the side of laterality was located by observing the relationship of three marked structures on the lateral x-ray view. After the contact point is determined on film the examiner locates the contact point on the patient with a combination of information derived from the films and manual palpation. After each visit where an NUCCA adjustment was delivered post findings were evaluated by a postural analysis, manual palpation of the upper cervical region, leg length measurements, anatometer measurements, and spinal weight distribution.

Outcome

The patient's blood pressure (BP) was monitored and recorded every visit in addition to the patient maintaining her own BP journal in which she tracked her BP twice a day (Table 1). On the initial visit her blood pressure was found to be 190/78 mm Hg when tested on the left and 166/66 mm Hg when tested on the right. A significant difference in BP compared side to side was noted in addition to some apparent swelling in the left arm. The patient was instructed to speak with her general practitioner (GP) about the swelling where she was told to only take blood pressure on one side until the swelling subsided.

At the second visit, her swelling was visibly decreased in the left arm and her BP was 165/55 mm Hg on the right, she was not adjusted this visit. Over the course of her treatment the swelling in the left arm was resolved and a 12% reduction in systolic BP and 13% reduction in diastolic BP on the left was observed. Systolic BP was reduced by 8% on the right accompanied by a 12% reduction in diastolic BP on the same side. Post x-rays were taken after the initial adjustment and revealed complete resolution of all atlas rotation and a significant decrease in head tilt. A slight increase in atlas plane line was noted on post examination. The patient is currently under care and continues to maintain a lowered BP and has removed herself from one of her BP medications. She is evaluated every five weeks for vertebral subluxation and adjusted accordingly.

Discussion

Evidence within the chiropractic literature supports the positive effects of the chiropractic adjustment on hypertension.[11-14] One such study investigating atlas vertebra realignment resulted in achievement of arterial pressure goals in hypertensive patients using NUCCA technique.[11] This double blind, placebo-controlled design involved 50 patients with stage 1 hypertension who were randomly selected to receive a NUCCA procedure or a sham adjustment. After the 8th and final week of the trial, there was a difference in systolic pressure of -17 ± 9 mm Hg in the NUCCA group versus a difference of -3 ± 1 mm Hg in the placebo group, and difference of diastolic -10 ± 11 mm Hg in the NUCCA group versus -2 ± 7 mm Hg in the placebo group.[11]

A case study evaluating blood pressure in a hypertensive patient before and after the start of upper cervical chiropractic

care, also using NUCCA technique, found a reduction in blood pressure and discontinuation of hypertensive medications following 16 adjustments.[12] Two studies conducted by Knutson and Dimmick et al. also found significant changes in systolic measurements following chiropractic adjustments.[13,14] However, unlike Knutson and the above studies, Dimmick et al. used a method of full spine adjustments that were not isolated to the atlas vertebra alone and as a result, did not find significant changes in diastolic measurements.[14]

In the literature, other examples exists of re-alignment of the atlas vertebra reducing blood pressure.[15-17] A case study involving a 55-year-old patient with a 25 year history of hypertension showed a sustained reduction in blood pressure after a single chiropractic upper cervical adjustmet.[15] The patient received one adjustment to his atlas vertebra, and over the course of the next seven months, his blood pressure continuously lowered down to normal values.

Without changes to lifestyle, or any additional chiropractic adjustments or therapies, the patient's blood pressure went from 180/100 to 130/82.[15] In a prospective longitudinal cohort study by Torns, twenty participants with high arterial blood pressure were divided into a therapeutic group and a control group.[16] The therapeutic group received an adjustment to their atlas vertebra using Atlas Orthogonal Technique. Pre and post measurements of blood pressure were taken in addition to readings at week 1, 2, 3, 4 and week 6 post adjustment.[16]

The results of this cohort study included a significant decrease on both systolic and diastolic values for the therapeutic group with a sustained decrease in systolic values after six weeks.[16] Another study shows the resolution of atrial fibrillation and hypertension in a 68-year-old female after just upper cervical chiropractic adjustments.[17]

The six studies above that address the atlas vertebra only, suggest that anatomical abnormalities at this level are associated with relative ischemia of the brainstem circulation and increased blood pressure[11] possibly supporting the neurovascular compression mechanism of Akimura et al, and Nicholas et al.[18,19] As explained by Bakris et. al, the atlas is unlike any other vertebrae in that it does not interlock to the next to ensure it's alignment. The atlas vertebra maintains its place solely from soft tissue attachments of muscles and ligaments.[11] As a result, the atlas is extremely vulnerable to misalignment. According to these authors, misalignment of the atlas can contribute to circulatory abnormalities around the vertebra and the posterior fossa of the brain.[11,12]

Proposed Neurophysiological Mechanisms

A neurogenic component to hypertension has become well established.[20] Neurogenic hypertension, defined as high blood pressure with sympathetic overdrive and loss of parasympathetically mediated cardiac variability.[20] The brainstem is the principal regulatory site for central sympathetic outflow with sympathetic pre-ganglionic neurons located in the intermediolateral cell column of the spinal cord receiving strong excitatory drive from pre-sympathetic motoneurons of the rostral ventrolateral medulla (RVLM).[20]

It has been postulated that pulsatile compression of this vasomotor center of the medulla, induces a chronic overstimulation of the sympathetic nervous system and thus sustains elevated systemic arterial blood pressure through effects on the heart, kidney, and peripheral vasculature.[19]

The vasomotor center of the medulla oblongata has been the subject of studies investigating its relationship with hypertension.[18,19] Two medical studies looking at neurovascular compression of the ventrolateral medulla oblongata in patients with essential hypertension using MRI each found such correlation.[18,19] The first study was conducted on 32 patients with essential hypertension and 6 patients with secondary hypertension. The researchers evaluated the relationships between the upper ventrolateral medulla and the vertebral arteries and branches identified by their flow-related hyperintensities in each group.

Using MR imaging, it was found that 90.6% of the essential hypertension group showed neurovascular compression as well as 1 of the 6 subjects in the secondary hypertension group. Overall, it was determined that a close correlation existed between essential hypertension and neurovascular compression at the ventrolateral medulla oblongata, found more on the left than right.[18]

The second study investigated pulsatile arterial compression in the retro-olivary sulcus along the surface of the ventrolateral medulla as the possible mechanism in both essential hypertension and diabetes.[19] While studying 147 patients being treated for neurological conditions requiring MRI of the posterior cranial fossa, presence of arterial compression was determined by blinded review of these images. The results showed that 60 of these subjects were hypertensive and 42% of these were found to have neurovascular compression, suggesting that arterial compression of the retro-olivary sulcus may be an independent risk factor, and neural mechanism for essential hypertension.[19]

It has also been postulated that catecholaminergic C1 cells of the RVLM are sympathoexcitatory and play a role in tonic and reflex control of blood pressure.[21,22] A study conducted by the National Institute of Health determined that activation of P2Y1-receptors in the RVLM of anesthetized adult rats mimicked effects of peripheral chemoreceptor activation, therefore hypothesizing that P2Y1-receptors expressed by C1 neurons in the RVLM contribute to peripheral chemoreceptor control of breathing, sympathetic activity and blood pressure.[21]

The C1 cell group has shown also to play a role in the arterial baroreceptor reflex, inhibiting their excitatory neurons that result in the withdrawal of excitatory input to preganglionic sympathetic neurons and the fall of arterial pressure, as well as the pressor response of somatosympathetic reflexes to peripheral nerve stimulation.[22]

Knutson proposes an additional possible mechanism for atlas vertebra misalignment contributing to hypertension. After his study which found a significant decrease in systolic blood pressure in a group of patients using specific, vectored adjustments to the atlas vertebra,[13] Kutson suggests that activation of the cervicosympathetic reflex as well as a reduction of the pressor reflexes could explain how

chiropractic manipulation could produce these results.[13] The cervicosympathetic reflex responds to signals from the muscle spindles and golgi tendon organs of the suboccipital spine to counteract the vestibulosympathetic reflex. The vestibulosympathetic reflex acts to increase blood pressure and heart rate to offset the effects of postural hypotension.[13] By re-positioning the atlas vertebra which is held in place by suboccipital muscles, these muscles are activated, thus stimulating the cervicosympathetic reflex.

The pressor reflex is initiated by muscle contraction, and causes compression of intramuscular arteries, increasing the need for oxygen, nutrients, and waste removal.[13] The body responds to this reflex by increasing blood pressure in order to accommodate this change in condition. Because joint dysfunction of the atlas vertebra can result in hypertonicity of surrounding musculature, the pressor reflex could be firing unnecessarily contributing to an unwanted response of increasing blood pressure.

Limitations

A limitation of the case presented in this paper and the Bakris study, is the lack of long-term data of months or even years, as well as the lack of information on the ability of the approach to lower blood pressure throughout daily-life conditions.[23] Blood pressure naturally fluctuates throughout the days as the body responds to different physiological and environmental stresses.

To ensure that regulatory mechanisms can properly respond to fluctuations in stress, it would be ideal to have a constant blood pressure monitor on a patient at all times continuously recording measurements. Although this method of data collection may be difficult, large-scale randomized controlled trials are still needed to further support the existing evidence for chiropractic care reducing blood pressure in hypertensive patients.

Conclusion

Hypertension is an increasingly serious problem all over the world, and especially here in the United States. The growing population of obese children and adults, as well as the aging population, are becoming prone to hypertension and the very serious consequences including cardiovascular disease and stroke. Lifestyle modifications are paramount in achieving blood pressure goals, and with evidence showing a neurovascular or neurogenic component to hypertension, there is a place for further research into these mechanisms for treatment options as well.

Although research exists supporting the rationale for the concept that aberrant stimulation of spinal or paraspinal structures may lead to responses of the autonomic nervous system, which may in turn affect visceral function,[24] there are still questions surrounding how a misaligned atlas vertebra can contribute to hypertension, and how specific upper cervical chiropractic adjustments can reduce blood pressure.

The case presented in this paper offers a method using a reproducible technique, measurable objectives, and positive outcomes. The 77-year-old patient who experienced such a dramatic decrease in her blood pressure is a powerful example of how hypertensive patients could benefit from chiropractic care.

This case also represents the need for further research surrounding specific upper cervical chiropractic adjustments in reducing blood pressure, and a neurovascular or neurogenic component of hypertension as it relates to the atlas vertebra area of the spine.

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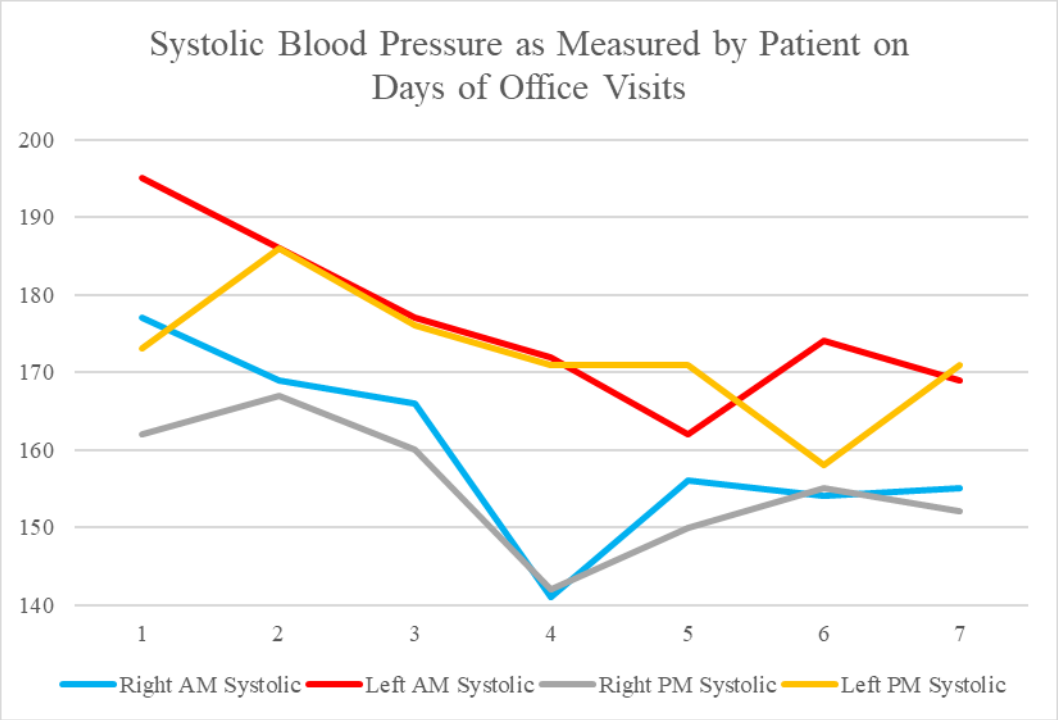
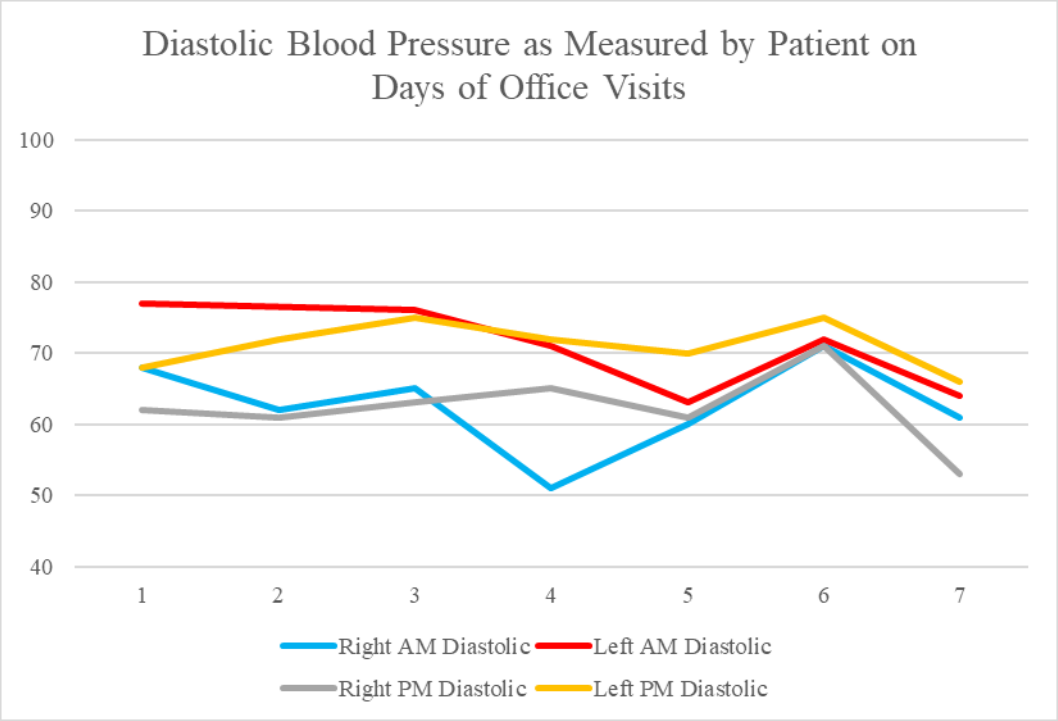
Appendix

Table 1. Blood Pressure as Measured by Patient Twice Daily on Days of Office Visits.

	Right Arm AM Measurement	Left Arm AM Measurement	Right Arm PM Measurement	Left Arm PM Measurement
Day of Initial Visit & 1st Adjustment	177/68 mm Hg	195/77 mm Hg	162/62 mm Hg	173/68 mm Hg
Day of 2nd Visit	169/62 mm Hg	Did not take	167/61 mm Hg	186/72 mm Hg
Day of 3rd Visit	166/65 mm Hg	177/76 mm Hg	160/63 mm Hg	176/75 mm Hg
Day of 4th Visit	141/51 mm Hg	172/71 mm Hg	142/65 mm Hg	171/72 mm Hg
Day of 5th Visit	156/60 mm Hg	162/63 mm Hg	150/61 mm Hg	171/70 mm Hg
Day of 6th Visit & 2nd Adjustment	154/71 mm Hg	174/72 mm Hg	155/71 mm Hg	158/75 mm Hg
Day of 7th Visit	155/61 mm Hg	169/64 mm Hg	152/53 mm Hg	171/66 mm Hg

Graphs.





Figures

Figure 1. Lateral Cervical View

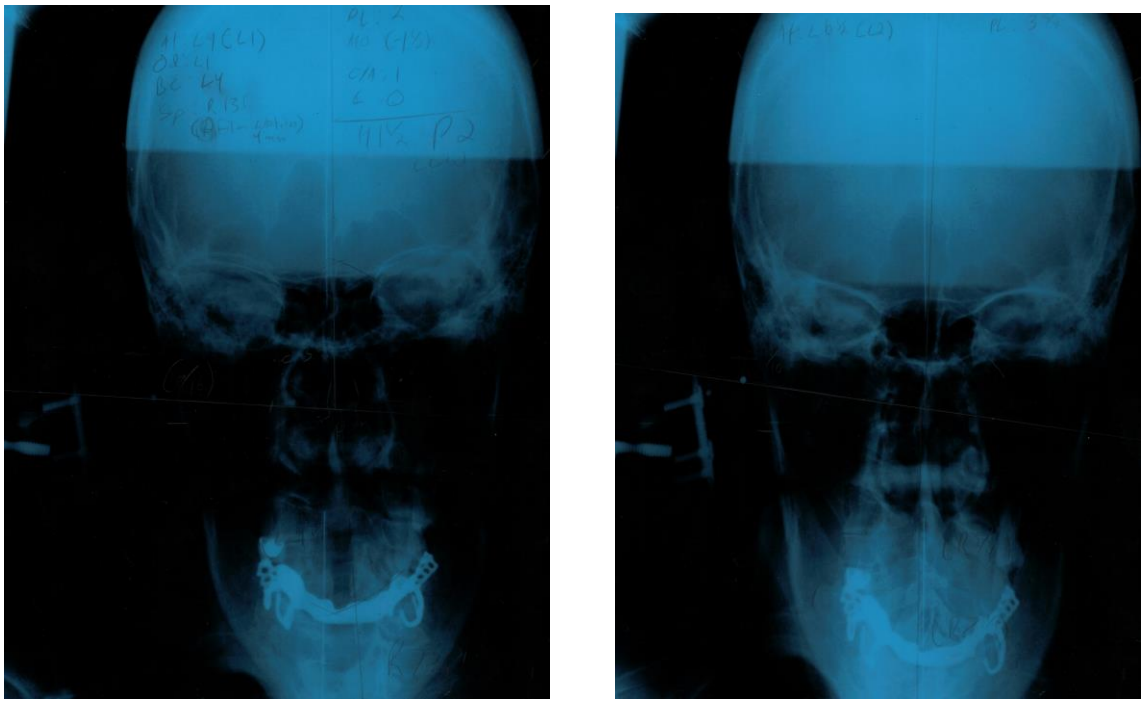


Figure 2. Nasium Views Pre and Post Initial Visit

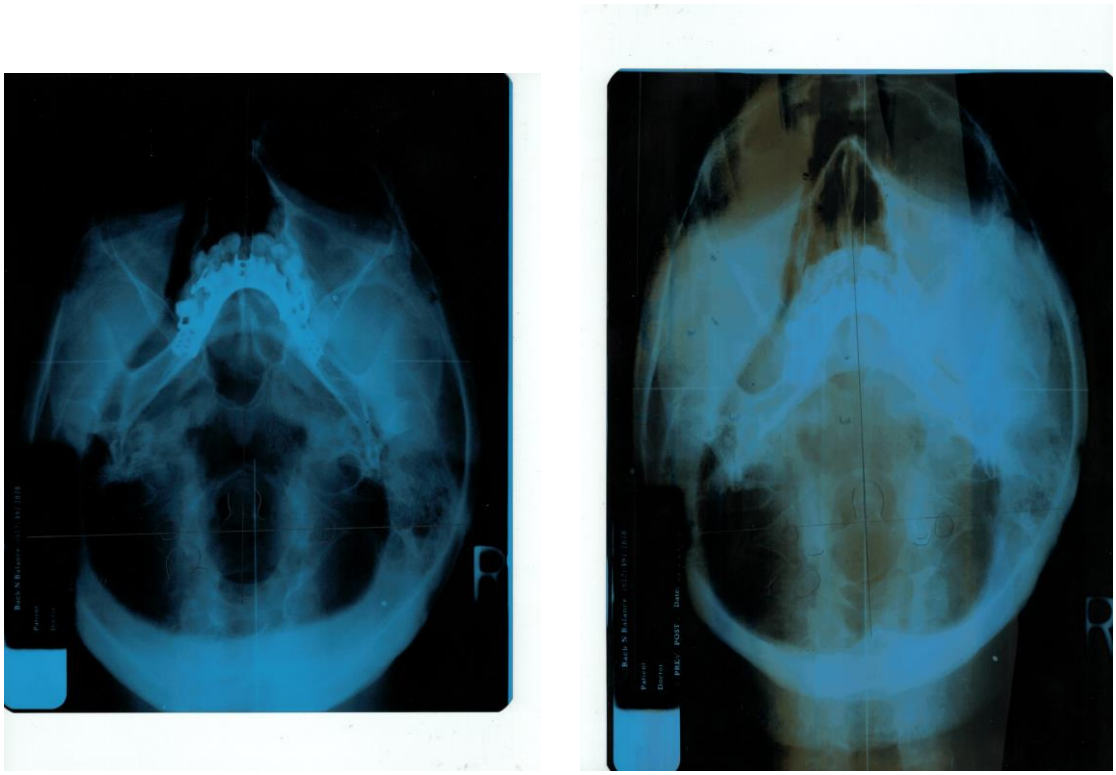


Figure 3. Vertex Views Pre and Post Initial Visit