

CASE STUDY

Resolution of Immunodeficiency in a Child Undergoing Chiropractic Care for the Management of Vertebral Subluxations: A Case Study & Review of the Literature

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Abstract

Objective: To report on the outcomes experienced by a child diagnosed as immune-deficient undergoing chiropractic care for the management of vertebral subluxations.

Clinical Features: A 5-year-old female child diagnosed as immuno-deficient with recurrent respiratory illnesses presented for chiropractic care with evidence of vertebral subluxation and loss of the normal cervical curve. The patient had a history of a premature birth, birth trauma, torticollis, constipation, frequent ear infections, tympanostomy tubes, tonsillectomy and adenoidectomy.

Intervention & Outcomes: Vertebral subluxations were addressed using the Activator Method and manual Full Spine adjustments. Radiographic analysis of the cervical spine was used to determine the specific characteristics of misalignment in the cervical spine. Through the course of care, the patient's mother reported a decrease in the frequency of respiratory illnesses and related symptoms with an increased ability to respond to infections more efficiently. The patient was able to stop all medication with only occasional use of an inhaler at night.

Conclusions: The clinical progress documented in this case reveals that chiropractic care may benefit children considered to be immuno-deficient. Further research on the benefits of addressing vertebral subluxation in those with a weakened immune system is warranted.

Key Words: *Chiropractic, Immuno-deficient, respiratory illness, subluxation, adjustment, pediatric, birth trauma, cervical spine, spinal manipulation, premature birth, birth trauma, torticollis, constipation, ear infections, tympanostomy tubes, tonsillectomy, adenoidectomy*

Introduction

It is understood that as we develop and throughout life our bodies will need to be overcome immune challenges. Every day we are exposed to innumerable microorganisms that have the potential to cause illness. The immune system is primarily responsible for keeping us well and for attacking microbial invaders when necessary. Getting infections when we are young primes our immune system to deal with future instances of infection more efficiently and more rapidly than the first time. However, there are instances wherein a pattern of frequent and recurring infections is abnormal and can indicate a compromised immune system. According to Boston

Children's Hospital, the incidence of primary immuno-deficiency is rare, with only 1 in 2,000 Americans having a primary immuno-deficiency disorder.¹ An immune disorder is predominantly diagnosed after discovering low levels of antibodies, immuno-globulins, and other immune system cells in the blood.

In children, a compromised immune system may manifest itself as recurring respiratory, sinus, ENT (ear/nose/throat) infections, etc. potentially in association with various mechanical imbalances. According to research by Resell &

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Rudy, allergies and ear infections represent the largest classification of health complaints affecting children, second only to “growing pains.”² Approximately one out of every five children has problems related to the lungs, asthma, and breathing.² In particular, girls in the toddler age group appear to have the most frequent occurrences of colds, episodes of rhinitis, “strep” throat, and tonsillitis.² Otitis media, which has been previously linked to immune system suppression, has also been reported to occur in one out of every four children as a toddler.² These statistics make it clear that although diagnostic rates of immuno-deficiency are low, maturation of the immune system may be impaired in a large majority of children.

Customarily, parents first try the traditional medical route to treat their children’s frequent illnesses. This usually results in multiple antibiotic prescriptions that may or may not provide relief. If these treatment options fail, many times they turn to Complementary and Alternative Medicine (CAM) therapies. Chiropractic, homeopathy, naturopathy, and acupuncture account for 84% of CAM use.³ Of these therapies, Spigelblatt noted that chiropractic was the most popular form of alternative medicine used for children with 36% of individuals choosing this route.⁴ In the United States, 68 million chiropractic office visits are child appointments with overall costs exceeding \$2 billion.^{3,5} Of particular importance is the fact that the most common pediatric conditions treated by chiropractors are ENT disorders, respiratory disorders, and musculoskeletal conditions.^{3,4} As mentioned, recurrent episodes of these types of conditions may reveal a dysfunctional immune system.

Chiropractors often contend that many adult conditions originate in the childhood years due to nervous system interference and resulting aberrations of physiology.² Previous research has identified chiropractic care as an effective treatment option for childhood conditions, including but not limited to respiratory illnesses, which are directly related to the functioning of the immune system. Thus, it is reasonable to conclude that chiropractic intervention has the potential to benefit cases of childhood immuno-deficiency.

Case Report

Patient History

The patient, a 5-year-old female, presented to the clinic with a chief complaint of recurrent respiratory illnesses related to dysfunction of the immune system. The mother of the child reported that, since birth, the patient has had repeated episodes of coughing every 2-4 weeks during the winter months with frequent pneumonia often three times in one year. She had been congested for approximately two weeks before presenting for her chiropractic examination. She had routinely been on antibiotics from the time of her birth. Before coming to the clinic, the patient underwent a full blood work-up and was determined to be borderline immuno-deficient with evolving bronchitis by a specialist in pediatric and adult allergy, asthma, and immunology (Table 1). She was prescribed a variety of medications, mainly antibiotics, to address these diagnoses in addition to other daily medications for allergies and asthma. The immunologist also advised her to consume yogurt with probiotics and to take 1,000 iu Vitamin

D3 per day.

In describing her labor and delivery, the mother revealed that the patient was premature by five weeks and that a forceful vacuum extraction was utilized during this traumatic birth. As a baby, the patient had frequent constipation and ear infections. She had undergone two myringotomies in which a small plastic tube was inserted into the eardrum in an effort to ventilate and equalize pressure in the middle ear. The patient had also already had her tonsils and adenoids removed.

Chiropractic Exam

A-P and lateral radiographs were taken of the patient’s cervical spine prior to treatment (Figure 1A & 2A). A severe decrease in cervical curve, a left lateral listing of the cervical spine, and an uneven shoulder level were noted. The cervical curve was measured at 5.4° with a C1 angle of 96°. The difference in shoulder height was measured to be 15mm with the left shoulder being lower than the right. The patient reported a complaint of pain and discomfort in the cervical, lumbar, and mid to upper thoracic spine. Asymmetry with postural deficits, loss of segmental range of motion, bilateral para-spinal musculature spasm, and a loss of global active range of motion were noted at the spinal levels: C1, C2, Occiput, C5, L5, L4, T2, and T3. No other abnormalities were noted upon evaluation. The patient was diagnosed with vertebral subluxation of the cervical, thoracic, and lumbar spine, muscle spasm of the back, and torticollis.

Chiropractic Care—Intervention

The patient was analyzed by inspection, static palpation, motion palpation, and leg length inequality on each visit.⁶ Postural analysis to determine areas of asymmetry, evaluation of segmental and global range of motion, and palpation of bony and soft tissue structures were used in conjunction with the analysis of the cervical radiographs to determine appropriate spinal listings. Palpation for pain and tenderness, motion palpation for active range of motion, prone and supine functional leg length inequality, and cervical x-ray line drawing analysis have all been found to be reliable assessments of subluxation according to Owens.⁶ Once the areas of segmental and somatic dysfunction were located, the patient was asked to lie prone on the adjusting table. To begin her initial treatment and for the first few adjustments, the Activator Method was utilized as the primary chiropractic adjusting technique. The Activator Method is a gentle, safe technique that utilizes a hand-held instrument to deliver a specific impulse into the spine.⁷ Three to four spinal regions were often adjusted per visit. Early on in treatment, the patient’s cranium was analyzed for dysfunction and immobility and was adjusted as necessary. Specifically, restrictions were addressed at the sphenoid bone and the parietal fissure.

Once the patient felt comfortable, she was transitioned to Full Spine technique to address spinal subluxations. Full Spine diversified adjustments are manual chiropractic adjustments that deliver a high velocity, low amplitude force into the spine.⁸ Side posture adjustments were used to address lumbar subluxations. Alternatively, the patient was asked to lie in the prone position for correction of thoracic subluxations and in

the prone and/or supine position for the correction of cervical subluxations. Both instrument-assisted and high velocity, low amplitude manual adjusting has been found to decrease pain and disability and increase cervical range of motion.⁸

The recommended frequency of care was initially three visits per week for three weeks. This was then reduced to two visits per week for five weeks and then finally to one visit per week for eight weeks. In addition to chiropractic care to reduce vertebral subluxations, it was recommended that the patient should modify her diet. The mother was advised to support the following nutritional goals: eliminate all dairy, drink less juice, and eat more natural fruits.^{9,10} These dietary changes were suggested at the initial visit following the completion of the history and physical examination. After about a month of care, these changes were again emphasized with a particular focus on the elimination of all dairy which has been linked to atopic symptoms and reduced lung function in asthmatic children.⁹ She was also advised to drink less juice because sweetened beverages dilute the intake of essential micronutrients such as calcium, phosphorus, folate, vitamin A, and vitamin C.¹⁰ The patient's mother noted that, at times, it was difficult to implement the diet modifications especially at breakfast and when she was at a relative's house. Gradually, throughout the course of care, the patient was more compliant with the nutritional recommendations.

Chiropractic Care—Outcome

A-P and lateral radiographs of the cervical spine were repeated approximately 4 months after beginning treatment (Figure 2A & Figure 2B). The patient's cervical lordotic curve had improved from severely decreased to only mildly decreased. After care, the cervical curve was measured at 31.6° compared to the initial measurement of 5.4°. The angle of C1 was initially measured to be 96° and this had been reduced to 87.4°. The general alignment of the cervical spine had improved and the shoulders had become nearly level. The left shoulder was only 5mm lower than the right, as compared to the initial difference of 15mm.

The mother reported that the patient remained symptom-free for the majority of her time under chiropractic care. This had been the longest times she had gone without getting sick since birth. She had one mild cough episode which resolved on its own with no medications and no antibiotics and she recovered much faster than usual. The patient was also able to get off all of her medications with the exception of her inhaler for allergies and asthma occasionally at nighttime. The mother reported that it was very rare for her to need her inhaler but on occasion she would use it when having trouble breathing. Additionally, the patient missed very few days of school, was able to concentrate more efficiently, and slept better following the introduction of chiropractic care. She was behaving better both at home and at school and reported an increase in energy levels. The patient's cervical, thoracic, and lumbar pain had all been reduced and her range of motion was documented to have improved. The patient remains under chiropractic care to continue to improve stability and address vertebral subluxation.

Discussion

Neurological Mechanisms of Vertebral Subluxation

In this individual case study, the practitioner utilized the Activator Methods Technique and then switched to the Full Spine Diversified Technique to address the patient's subluxations.^{7,8} Both of these techniques are based on the segmental model of subluxation. Kent notes that in this model, vertebral subluxations arise as a result of alterations in specific intervertebral motion segments.¹¹ This coincides with the Dysafferentation Model which asserts that these intervertebral motion segments have extensive nociceptive and mechanoreceptive networks. Nociceptors are sensory neurons responsible for the conscious awareness of pain and for the release of analgesic hormones. Mechanoreceptors are sensory receptors that perceive distortion and mechanical pressure, allowing for orientation in space.¹² When motion segments are disrupted, aberrant afferent input is projected to the Central Nervous System.¹¹ Misdirected neurophysiologic reactions and abnormal stimuli are produced, causing biomechanical dysfunction that may manifest itself as various symptomatology.

Furthermore, researchers have found that the immune system is partly regulated by the nervous system.¹¹ The Neurodystrophic Model proposes that when neural dysfunction is present as a result of vertebral subluxation, tissue resistance is decreased.⁶ This may lead to the over-activation of the sympathetic nervous system and the release of immuno-regulatory cells within the blood circulation.¹¹ This process alters immunological function at a cellular level which may then disrupt the functioning of internal organs.¹³ In sum, dysregulated spinal activity negatively impacts neuromusculoskeletal as well as visceral organ function.¹³ These conditions can increase one's susceptibility to a multitude of health disorders that require intervention, as was evident in this particular case study.

Review of Literature

There is very limited research on the topic of chiropractic care and its effects on pediatric immuno-deficiency. This is likely due to the low number of medical diagnoses of immuno-deficiency in children. However, in this case study, the patient presented with a primary complaint of recurrent respiratory illnesses as a manifestation of her weakened immune system.

Whittle-Davis & Czegus reported on a similar case wherein a 7-year-old male suffering from chronic colds, allergies, and asthma since five months of age presented for care.¹⁴ Similar to our case, Activator Methods Technique was used to correct any detected vertebral subluxations. Within two weeks, the patient's mother reported significant improvements in the boy's well-being and was able to discontinue the use of his allergy and asthma medications.¹⁴ In the subsequent five months since beginning care, the patient did not miss any days of school as was common prior to treatment.¹⁴

Likewise, Davis & Byrley documented the chiropractic care of a 2-year-old male suffering from chronic colds, asthma, and respiratory issues since birth.¹⁵ Activator Methods was again used as the primary technique to address areas of vertebral

subluxation. Within two weeks, the patient was responding very well to care. He experienced a reduction in his asthma symptoms and an increased ability to respond to colds and other respiratory illnesses.¹⁵

While the previously discussed cases predominantly used Activator Methods, there are a variety of case studies in which alternative chiropractic techniques were used to resolve respiratory symptoms in children.

Jaszewski & Willard recounted the successful chiropractic management of a 15-year-old male with asthma and headaches utilizing the Pierce Results System.¹³

Fedorchuk & Opitz described improvement in spinal structure and neurological function in a pediatric patient with allergies and asthma employing Chiropractic Biophysics (CBP) Technique.¹² The patient was able to discontinue all medication use and his cervical curve, posture, and lung function all normalized, effectively increasing quality of life.¹²

Rectenwald detailed improvements in a 19 month old patient diagnosed with severe chronic asthma following chiropractic care.¹⁶ The patient had been to the hospital emergency room on four different occasions for episodes of acute respiratory distress by the age of 18-months.¹⁶ Over a seven month period, with employment of the Orthospinology technique and a KH-4 electric instrument, cervical subluxations were addressed. No further episodes of respiratory distress were reported after nine weeks of care.¹⁶

Together, these cases clearly outline the positive effects of chiropractic care in pediatrics cases of respiratory illnesses. This data helps to confirm the assertion that vertebral subluxation causes mechanical and neurological dysfunction of surrounding tissue. When properly addressed with chiropractic adjustments, the balance between the parasympathetic and sympathetic activity in the body can be restored which allows for stability of the respiratory system.¹⁵

Another important component of our case study was the utilization of cranial work to address dysfunction of immobile sutures and fissures. In our case, restrictions were noted at the sphenoid bone and the parietal fissure. Laferriere reports a comparable case detailing the chiropractic care of a 6-year-old female suffering from migraine without aura, sleep bruxism, and chronic sinus congestion worse during the winter time.¹⁷ This patient's medical history was similar to ours in that the mother reported chronic otitis media, recurrent sinus congestion, and multiple rounds of prescribed antibiotics with no relief.¹⁷ In addition to receiving chiropractic spinal adjustments, the practitioner applied massage, sinus lymphatic drainage, and cranial work to the sphenoid bone. After 3 months of care, migraine intensity, triggers, and frequency were all reduced.¹⁷

Moreover, Erickson et. al., discusses the case of a young boy presenting with repeated episodes of otitis media and respiratory distress, likely asthmatic in nature.¹⁸ The practitioners employed a combination of chiropractic, craniosacral therapy, and nutritional guidance in an effort to increase respiratory function and eustachian tube drainage in the middle ear.¹⁸

In terms of nutritional guidance, the mother was advised to avoid consuming dairy products and to change from a milk-based formula to a soy-based formula.¹⁸ Our patient was also advised to avoid dairy products as part of her treatment plan because it is a known allergen that is correlated with reduced lung function and atopic symptoms in asthmatic children.⁹ Along with our case study, these examples open the discussion on the potential benefits of not only cervical adjustments but cranial work and diet modifications on helping the immune system.

As a final topic of discussion, we must address the latent negative consequences of birth trauma. It is virtually impossible to determine if our patient's weakened immune system and frequent illnesses were due to the trauma that she suffered upon forceful vacuum extraction during delivery. However, cases such as those reported by Spear & Alcantara allude to the possible connection between traumatic birth, vertebral subluxations, and negative health outcomes.¹⁹ Spear & Alcantara note that vacuum-assisted deliveries can cause severe neonatal injuries and the risk of such complications is estimated at 5%.¹⁹ The median peak forces for average vacuum extraction in the clinical setting were 225 N (range:115-436 N).¹⁹

In the case of a 6-week-old infant with a large hematoma on his skull as a result of vacuum extraction, chiropractic care was able to help him overcome the detrimental health consequences of such an experience. The boy was considered a "high needs baby" by the medical community and presented with infantile colic, acid reflux, restlessness, inability to relax and/or lay on his back, difficulty sleeping and general irritability.¹⁹ Beginning with the first and continuing after each subsequent adjustment, the infant's mother reported drastic improvements in the child's health and demeanor. The baby slept longer, had more regular bowel movements, had improved cervical postural alignment, had reduced bruising around the hematoma, and was described as overall happier and more comfortable.¹⁹

This is a clear instance in which traumatic birth resulted in vertebral subluxations that produced harmful mechanical and neurological consequences for the infant. It is not far-fetched to believe that if this infant had not been under chiropractic care, that these health consequences could have continued throughout his childhood and possible into his adult life. Resell & Rudy go as far as to contend that one of the reasons for rates of sore throats and tonsillitis could be the neuro-immune effects of Traumatic Birth Syndrome.² As a result, when treating pediatric patients, it is vital for chiropractors to collect information on the mother's and the baby's experience of birth because it has the potential to alter the infant's nervous and immune system going forward.

Review of Allopathic & CAM Management

Besides chiropractic care, there are a variety of other approaches to the management of pediatric immuno-deficiency and respiratory diseases. Standard medical treatment for immuno-deficiency is comprised of: the prevention and treatment of infections with short and long-term antibiotics and boosting of the immune system with immunoglobulin, gamma interferon, or growth factor

therapy.²⁰ The failure of these medical treatments is often the underlying reason for parents to seek out allopathic and Complementary and Alternative Medicine therapies. As previously mentioned, respiratory disorders are one of the most common reasons for CAM use.^{3,4} In a study of CAM use in Canadian children with asthma, it was found that vitamins, homeopathy, and acupuncture were most commonly used, followed by chiropractic care.²¹ In regards to homeopathy, *Echinacea* is an herbal product that is often used in cases of pediatric upper respiratory illness.²² It has immunomodulatory effects due to its ability to stimulate leukocyte activity.²² Despite a multitude of patient testimonials on the benefits of these various therapies, an accurate assessment of their effectiveness is restricted by the scarcity of controlled research studies.²¹

Pepino et. al., conducted a review of literature on studies highlighting the effects of manipulative therapy in pediatric cases of respiratory illnesses such as cystic fibrosis, bronchiolitis, recurrent respiratory infections, and asthma.²³ He asserted that the use of manual techniques on children with respiratory diseases seemed beneficial. However, the amount of supporting evidence was small, limited, and suffered from poor methodological quality.²³ Having low quality studies also makes it more difficult to run meta-analyses, limiting out ability to make definitive conclusions. Contrary to the majority of cases outlined above, a separate researcher piloted a systematic review concluding that spinal manipulation was not more effective than sham-manipulation in improving lung function and was thus not an effective treatment for asthma.²⁴

Historically, the legitimacy and efficacy of chiropractic has been questioned by the medical community. This is even more prevalent when concerning the care of pediatric patients. It is not uncommon for general practitioners and even the public to believe that fatal complications may arise from spinal adjustments in children. Researchers like Spigelblatt have contended that there has been no conclusive evidence for chiropractic's effectiveness in treating children.⁴ She also asserts that the chiropractic profession relies heavily on anecdotal evidence rather than scientific fact.⁴ Since the time of publication of Spigelblatt's article, the chiropractic community has published thousands of journal articles documenting the neurological mechanisms substantiating chiropractic.

Much of what Spigelblatt relies on comes from Vohra²⁵ and the flawed nature of Vohra's paper has been thoroughly dissected and addressed by Alcantara.²⁶

Study Limitations

As a result of these investigator's findings, it is imperative for the chiropractic profession to conduct high-quality, controlled clinical trials that use appropriate research methods when investigating the effects of chiropractic care in children with respiratory disorders and more broadly, with any health disorder being studied.

In analyzing the quality of our own research, it is recognized that, due to its nature as a case study, it suffers from limitations. This is a unique and individual case that cannot be generalized to the entire pediatric population with weakened

immune systems or those with frequent respiratory illnesses. Further research must be conducted on this topic with clinical trials of larger sample sizes. In addition to increasing the number of subjects, it would be beneficial to include children of varying ages between 0-18 years to determine if there are any differences in treatment response between older versus younger individuals. Additionally, it would be advantageous to increase the time of observation from three months to a year or more in order to appreciate the long-term benefits of chiropractic care.

Overall, this case highlights the need for more research on the effect of chiropractic spinal adjustments in cases of pediatric immuno-deficiency in order to explore the role of collaborative care.

Conclusion

This case study provides supporting evidence on the benefits of chiropractic care in increasing immune system function in the pediatric population. By identifying the vertebral subluxation complex and correcting it through chiropractic adjustments, neurological function may be improved which can effectively restore balance to the immune system. Due to this study's limitations of sample size and the lack of similar published data on this topic, it is essential for more research to be conducted. In particular, research on the utilization of chiropractic spinal adjustments as an alternative therapy to frequent pediatric respiratory illnesses should be undertaken. This case additionally demands the need for more research on the advantages of abstaining from the consumption of dairy products and the use of cranial work in conjunction with spinal adjustments.

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Test Description		Results	Out of Range	Units	Reference Range
CBC w/ DIFF	White Blood Cells	12.4		k/cu mm	5.5-15.5
	Red Blood Cells	4.9		m/cu mm	3.9-5.3
	Hemoglobin		13.9 H	gm/dL	11.5-13.0
	Hematocrit		43.0 H	percent	34.0-40.0
	MCV		88 H	fL	75-87
	MCH	28		pg	24-30
	MCHC	32		percent	31-37
	Platelets	399		k/cu mm	150-450
	MPV	10.9		fL	9.8-12.7
	RDW-CV	13		percent	11-15
	Neutrophils		75 H	percent	32-54
	Lymphocytes		21 L	percent	27-57
	Monocytes	4		percent	4-14
	Eosinophils	0		percent	0-6
	Basophils	0		percent	0-2
	Neutrophil Count	9.3		k/cu mm	1.8-10.0
	Lymphocyte Count	2.6		k/cu mm	1.5-8.0
	Monocyte Count	0.5		k/cu mm	0.2-1.0
	Eosinophil Count	0.0		k/cu mm	0.0-0.9
	Basophil Count	0.0		k/cu mm	0.0-0.3
SED RATE (ESR)	Sed Rate	16		mm/hr	0-20
C4 Complement	C4	32		mg/dL	10-40
C3 Complement	C3	140		mg/dL	90-180
IgM, TOTAL	IgM, Serum	80		mg/dL	24-210
IgA, TOTAL	IgA, Serum	99		mg/dL	27-195
IgG, TOTAL	IgG, Serum	531		mg/dL	504-1465
Vitamin D, 25-OH (TOTAL D2/D3)	Vitamin D, 25-Hydroxy		122.0 H	ng/mL	30.0-80.0
IgE, TOTAL	IgE, Total	57.9		IU/mL	0.0-60.0
STREPTOCOCCUS PNEUMONIAE IgG (14 SEROTYPES), MAID	Serotype 1 (1)	<0.3		mcg/mL	
	Serotype 3 (3)	0.6		mcg/mL	
	Serotype 4 (4)	1.2		mcg/mL	
	Serotype 5 (5)	1.7		mcg/mL	
	Serotype 8 (8)	<0.3		mcg/mL	
	Serotype 9 (9N)	<0.3		mcg/mL	
	Serotype 12 (12F)	<0.3		mcg/mL	
	Serotype 14 (14)	<0.3		mcg/mL	
	Serotype 19 (19F)	1.5		mcg/mL	
	Serotype 23 (23F)	1.2		mcg/mL	
	Serotype 26 (6B)	1.0		mcg/mL	
	Serotype 51 (7F)	1.0		mcg/mL	
	Serotype 56 (18C)	0.7		mcg/mL	
	Serotype 68 (9V)	<0.3		mcg/mL	
	IgG Subclass 1		301 L	mg/dL	308-945
	IgG Subclass 2	161		mg/dL	61-345
Immunoglobulin G Subclasses Panel	IgG Subclass 3	35		mg/dL	10-122
	IgG Subclass 4	12.5		mg/dL	2.0-112.0
	Immunoglobulin G, Serum		504 L	mg/dL	592-1723
Tetanus Antitoxoid Antibody	Tetanus Antitoxoid	0.38		IU/mL	>0.15

Table 1. Laboratory results showing borderline immuno-deficiency in a young female patient prior to receiving chiropractic care. The Out of Range column reveals abnormal lab values.



Figure 1A. X-ray of Lateral Cervical Spine showing a decrease in the lordotic curve prior to receiving chiropractic care. The cervical curve was measured to be 5.4° and the angle of C1 was measured to be 96° .



Figure 1B. X-ray of Lateral Cervical Spine showing restoration of cervical lordotic curve after receiving chiropractic care. The cervical curve was measured to be 31.6° and the angle of C1 was measured to be 87.4° .



Figure 2A. X-ray of A-P Cervical Spine showing abnormal cervical posture prior to receiving chiropractic care. The left shoulder was 15mm lower than the right shoulder.



Figure 2B. X-ray of A-P Cervical Spine showing improved cervical posture after receiving chiropractic care. The left shoulder was measured as 5mm lower than the right shoulder.