

CASE STUDY

Improvements Following Chiropractic in an Infant with Excessive Crying, Screaming, Feeding Difficulties & Sleep Disturbances: A Case Report & Selective Review of Literature

Kayla Feltz, DC¹ & Delta Stark, DC²

Abstract

Objective: To review the outcomes of chiropractic care of an infant with disturbed sleeping patterns and excessive, inconsolable crying.

Clinical Feature: A 6-week-old female was presented for chiropractic evaluation by her mother with complaints of frequent crying and screaming, disturbed sleeping patterns, favoring her right shoulder, and feeding difficulties. Autonomic system dysfunction was noted using thermography scans.

Intervention and Outcomes: Diversified technique was used to evaluate and adjust the patient via a sustained contact adjustment at atlas; as well as Logan Basic technique adjustment at sacrum. The patient immediately relaxed following her first adjustment. The mother reported the infant slept for six hours the night after her first adjustment and she was able to feed equally on the left and right sides. It was also reported that she no longer cried inconsolably and was able to lie on her back without extreme discomfort.

Conclusion: This paper reviews the results of a patient undergoing chiropractic care with symptoms of disturbed sleeping patterns and excessive, inconsolable crying that showed significant improvement following three adjustments. There is more research needed to show the connection between vertebral subluxation, infant crying, irritability, sleep disturbances, and feeding difficulties and the effects of chiropractic care on these symptoms.

Key Words: *chiropractic, adjustment, vertebral subluxation, sleep disturbances, crying, feeding difficulties, thermography, Diversified, Logan Basic*

Introduction

Crying in infants is considered normal and natural, however, excessive crying in infants can result in distress of not only the infant, but also their parents as well.¹ Frustrations can lead to “maternal depression and child abuse” in parents who have infants with excessive crying habits.¹ It is typically reported that one in five parents identify a problem of excessive crying or irritability in the first three months of their infant’s life.¹⁻²

However, only one in 20 cases is known to have an organic cause to explain the infant’s symptoms.²

Infant crying and sleeping disturbances are amongst the two most common symptoms in infants presenting by parents to healthcare professionals.³ In a study of 194 infants presenting to a chiropractic office, it was reported that 21% had

1. Private Practice of Chiropractic, Lima, OH
2. Private Practice of Chiropractic, Madison, MS

complaints of crying and 32% had complaints of some level of sleeping disturbances.⁴ An estimated annual \$104 million dollars is spent on infants with these two complaints in the first twelve weeks of life, making these conditions a huge economic burden.³

No single intervention has been shown to be more effective than another, which is suggested to be due to the non-homogenous nature and etiology of the infants presenting symptoms.¹ Common types of interventions for crying babies include pharmaceutical interventions, dietary modifications, behavioral changes and chiropractic treatment.⁵

Associated symptoms of excessive crying can divide infants into subgroups or specific syndrome disorders.¹ There are three different syndromes noted to potentially cause infant crying disorders and sleeping disturbances, these include infantile colic, irritable infant syndrome of musculoskeletal origin (IISMO), and inefficient feeding crying infant with disorder sleep (IFCIDS).¹ Other common causes of excessive crying could be due to gastroesophageal reflux disease (GERD) or cow's milk protein intolerance.⁵

Infantile colic is characterized by loud, disturbing crying often in the late afternoon and is commonly seen within the first two weeks to three months of life. Physical examination may reveal a tense abdomen, a flexed or curled posture, kicking or flailing of extremities, and the infant may be inconsolable, even when picked up. Patients may also exhibit additional signs of pain, sudden changes in demeanor, and constantly wanting to be swaddled or held.¹ Wessel's "rule of 3's" is commonly used to diagnose infantile colic, his criteria for diagnosis includes fussing or crying in an infant lasting for a minimum of three hours per day, three times per weeks, for at least three weeks.⁵⁻⁶

Irritable infant syndrome of musculoskeletal origin (IISMO) is characterized by high pitched crying any time of the day, often caused by change in position of the infant outside of resting posture.¹ This disorder commonly presents between the ages of three weeks to three months, when the infant can begin to hold its own antalgic posture for comfort.¹ Physical examination may reveal an abnormal or antalgic posture, asymmetrical movements, unilateral spinal hypertonicity, tactile defenses, musculoskeletal sensitivities, and decreased eye contact.^{1,7}

Other signs and symptoms may include restless sleep, with specific difficulty sleeping in the supine position.¹ This disorder confirms the fact that infants can experience pain immediately following birth, and that crying and restlessness is their form of communicating pain and discomfort.⁷ It is suggested that there is a possible link between IISMO syndrome in infants and vertebral subluxations.⁷

Inefficient feeding crying infant with disordered sleep (IFCIDS) syndrome, which can also be known as infant fuss-cry-irritability with sleep disorder syndrome, is characterized by multiple episodes and long bouts of crying, usually peaking mid-day.^{1,5}

The infant's cries are usually of high intensity and piercing; which usually begin between one to six months of age.^{1,5}

Physical examination may reveal grimaced facial expressions, arching postures, general fussiness and irritability with difficulty soothing.^{1,5} This condition is more common in males (60:40 predominance), and it is typically associated with feeding difficulties and sleep disorders.^{1,5}

In the following case report, clinical indicators were not present to determine the exact diagnosis or etiology of the infant's presenting symptoms.

Case Report

History

A 6-week-old female was presented by her mother for chiropractic care with a complaint of frequent crying and screaming, disturbed sleeping patterns, and favoring her right shoulder. The mother had a high-risk pregnancy resulting in five ultrasounds during the pregnancy. The mother experienced bilateral numbness in her legs and frequent charley horse or calf cramps during her pregnancy. In addition, she had multiple left shoulder dislocations during pregnancy and a past medical history of osteopenia with eleven previously broken bones. The mother reported no complications during birth.

During the history, the mother reported the infant usually only slept two to four hours per night and could only sleep on her stomach. During the day she did not sleep for more than an hour and a half at a time, which was usually followed by at least 30 minutes of screaming or crying upon awakening. The crying usually lasted until the infant became fatigued from her crying and fell asleep. The infant was extremely distressed and irritable when swaddled, lying on her back, or in a car seat, and as the mother reported would "scream bloody murder" in any of these positions. The patient's normal resting posture was curled in a tight, spastic ball.

The patient had a difficult time latching at birth and the mother eventually stopped breastfeeding at two weeks. The mother reported feeding the infant Similac formula, after previously trying Gerber and Enfamil formula, both of which caused projectile vomiting in the infant. She reported having a difficult time feeding the infant formula due to the infant's current state.

Physical Examination

The patient was presented in great distress and cried throughout the entire examination process. A postural examination revealed anterior head translation and right lateral flexion of the head towards the right shoulder. Limited passive cervical and lumbar ranges of motion were noted in all directions. The patient was unable to rotate her head past midline to the left at all, and an attempt to do so caused the patient extreme duress. There was an absence of suckling reflex and Babinski's reflex on the left.

Thermal scanning using the Insight Technology was performed from spinal levels S1-C1, which can be seen in Figure 1. Paraspinal thermography scanning has been previously shown to be both a valid and reliable objective outcome assessment for vertebral subluxation and autonomic

system dysfunction.⁸⁻⁹ Her thermal scan showed severe autonomic system dysfunction (dysautonomia) on the right at spinal levels C1, T7, T9, and T12 and on the left at spinal levels C6, C7, T1, and T4. Moderate autonomic dysfunction was noted on the right at spinal levels C3, T8, T11, and L1 and on the left at spinal levels C5 and L4. Mild autonomic dysfunction was noted on the right at spinal level T6 and on the left at spinal level L3.

Upon chiropractic examination and Diversified technique analysis, static palpation revealed severe neck spasm on the right, overall severe hypersensitivity overall, and left lumbar paraspinal muscle spasm. Motion palpation revealed hypomobile intersegmental motion and end point tenderness at spinal levels C1, C2 spinal levels and sacrum.¹⁰ Logan Basic technique analysis revealed a right gluteal crease deviation indicating a right anterior-inferior (AI) sacral subluxation.¹¹

Intervention and Outcomes

Following the new patient exam, the doctor utilized a Diversified technique sustained contact adjusted on the atlas subluxation.¹⁰ Diversified technique is a generic term used to encompass multiple technique symptoms, but typically describing a high-velocity, low-amplitude (HVLA) force.¹⁰ The broad philosophy used by Diversified practitioners is that adjusting subluxations remove nervous system interference allowing the body to heal itself.¹⁰

Subluxations are typically identified using a combination of patient history, static palpation, motion palpation, x-rays, thermography, and leg checks; however, in this case x-rays and leg checks were not used due to patient's age and current condition.¹⁰ The technique was modified for the infant's age, and a light pressure, sustained contact was applied with a lateral to medial line of correction on the patient's atlas.

Additionally, a Logan Basic technique adjustment was performed using a sustained, light-force contact on the right sacrotuberous ligament for a right Anterior Inferior sacral subluxation.¹¹ The primary goal of Logan Basic technique is to reduce body distortion through adjustments of the sacrum to promote health, eliminate nervous system interference, and to facilitate homeostatic regulation of the body.¹¹ Analysis of the patient includes the use of a gluteal crease test.¹¹

Gluteal crease test are performed by the doctor using the palms of their hands, or thumbs in infant patients, to squeeze gluteal tissue towards the midline.¹¹ Deviation of the gluteal crease towards one side during this test indicates the side of inferior sacral base.¹¹ The doctor used a pinky to apply light, sustained lateral and superior pressure to the sacrotuberous ligament, while using the other hand to monitor the patient's relaxation response. Common relaxation responses include changes in paraspinal musculature and changes in respiration.¹¹ This type of adjustment can typically take about one to three minutes to perform, however on rare occasions it can exceed up to twenty minutes.¹¹

The infant relaxed immediately after the first adjustment, and the mother reported this was the first time she had seen her baby stretch out and lay relaxed since birth. It was recommended at this time that the patient follow a three times

per week care plan.

She returned five days later for her second visit. At this visit, the infant could equally actively rotate her head both to the left and to the right. She could also lie on her back without screaming or appearing to be in any discomfort. The infant never resumed the spastic curled resting position she initially presented with, and the mother reported the infant slept for six hours the night after her first adjustment. The infant began feeding equally on both the left and right sides following her first adjustment. The same subluxations were found, and the same adjustments were applied again on this second visit.

At her third visit two days later, her symptoms were still resolved, and she continued to receive subluxation-based chiropractic care on a wellness basis.

Discussion

Selective Review of Chiropractic Literature

Miller and Croci⁷ presented a case report on a 4-week-old male to a chiropractic office with complaints of irritability and crying when lying on his back, which was diagnosed by the chiropractor as having irritable infant syndrome of musculoskeletal origin (IISMO). He was previously diagnosed with colic by another healthcare professional.⁷ The patient also experienced symptoms of discomfort while breastfeeding.⁷

During the physical exam, extreme discomfort was noted during any passive movements outside of resting posture.⁷ Segmental dysfunction was found between spinal levels C1-C2, and an adjustment was performed using light fingertip pressure on the posterior aspect of atlas, in addition to gentle stretching of the suboccipital muscles.⁷ The patient experienced complete resolution of symptoms following two weeks of care.⁷

Hipperson¹² reported two case studies on seven and ten-week-old infants. The first infant was only able to sleep for 25-45 minutes at a time, followed by four to five hours of constant crying. The second infant usually had crying episodes for six hours at a time. Both infants demonstrated postures with knees drawn up to the chest.¹² Diversified technique adjustments were applied to both infants in the cervical, thoracic, and sacral spinal regions.¹² The first infant was completely asymptomatic and sleeping ten hours per night following three weeks of chiropractic care, and the second infant's symptoms were completely resolved following the two weeks of chiropractic care.¹²

Killinger and Azad¹³ reported a case study on a five-and-a-half-month old infant with symptoms of colic. The infant had never slept through the night since birth, and often woke up many times a night with episodes of colic. The infant was analyzed by the chiropractor using a neurocalograph, static palpation, and radiographs of the cervical spine.¹³ An atlas subluxation was found, and the patient was adjusted using Toggle Recoil technique.¹³ Following the patient's first adjustment the parent were excited to report the infant sleep throughout the entire night for the first time since birth, and following the patient's second adjustment the patient's other

colic symptoms additionally resolved.¹³

Castellucci¹⁴ reported a case study of an eight-week-old female with colic and associated symptoms of crying for five hours at a time, disturbed sleep patterns, and difficulty breastfeeding. The patient cried and was in obvious distress throughout the entire first visit and exam. Subluxations were found following chiropractic analysis at spinal levels C1 and T11.¹⁴ Light impulse adjustments were applied to both subluxations.¹⁴ The patient returned the next day for her second adjustment, and she was asleep at the time of the adjustment and in no distress.¹⁴ Her parents reported that the patient slept through the entire night and had no crying spells following her first adjustment.¹⁴

In a case study by Colman and Merced,¹⁵ a three-month-old infant presented for chiropractic care with a chief complaint of frequent screaming and crying without a known cause. Patient was extremely uncomfortable in a car seat and did not like to be put down.¹⁵ Intervention included chiropractic adjustments at spinal level C1, sacrum, and cranial bones using a variety of techniques, probiotics, and elimination of dairy from the mother's diet.¹⁵ The patient's symptoms improved following seven adjustments and the patient's care plan was changed to as needed.¹⁵

Batte¹⁶ reported a case study in which a two-week-old male presented with a history of excessive crying, gastrointestinal symptoms, and disturbed sleeping patterns. The patient was not sleeping through the night and was unable to nap throughout the day due to excessive crying.¹⁶ The patient was distressed throughout the chiropractic evaluation. Logan Basic technique was utilized for subluxations in the cervical spine, lumbar spine, and sacrum.¹⁶ Following his first adjustment the patient immediately had a bowel movement and then fell asleep.¹⁶ Additionally, after 16 adjustments the mother reported improvement in all of the patient's symptoms.¹⁶

In a case study by Spear and Alcantara,¹⁷ a six-week-old male presented for a chiropractic consultation with complaints of colic, reflux, irritability, restlessness, and sleep disturbances that began following a birthing trauma. Vacuum extraction was utilized during the birthing processing resulting in a large hematoma on the left posterior lateral aspect of the patient's skull. Chiropractic exam revealed bilateral posterior occiput, atlas, T12, and L1 subluxations.¹⁷ The patient was adjusted using an Activator at spinal levels T12 and L1 and with a sustained contact adjustment at atlas.¹⁷ The patient's mother reported the patient was able to take a long nap following the first adjustment, and all other symptoms had improved by the patient's 7th visit.¹⁷

In a case report by Alcantara and Anderson,¹⁸ a three-month-old female presented for a chiropractic consultation with a chief complaint of GERD. The mother additionally reported interrupted sleep, excessive crying, and difficulty breastfeeding. The patient typically only slept for a maximum of two hours consistently at night, and she slept for even shorter periods of time throughout the day.¹⁸ The patient was in distress throughout the physical examination. The patient was adjusted using Diversified technique at C1 and T4.¹⁸ At the patient's 7th visit the mother reported the infant was feeding equally from both breasts, and she was able to

sleep for four to five hours at a time at night and for two hours during the day.¹⁸ The patient's crying patterns also became less frequent and lasted for shorter periods of time.¹⁸

In a study by Cuhel and Powell¹⁹, a twelve-day-old male presented for chiropractic care with a complaint of fussiness and difficulty breastfeeding on the right breast. There was limited range of motion in the cervical spine and the infant experienced visible distress upon palpation of musculature on the right.¹⁹ Atlas was adjusted using toggle-recoil technique modified for an infant patient. Relapse of symptoms occurred throughout the patient's care.¹⁹ However, following a combination of discontinuation of contraceptive injections, nutritional support, and adjustments there was an improvement immediately following adjustment, but not resolution in breastfeeding difficulties.¹⁹ Weaknesses of this study were multiple variables of treatment including the discontinuing of contraceptives use for the mother and use of probiotics for the infant.¹⁹

In a study by Williams-Frey,²⁰ a four-month-old male presented for chiropractic care with complaint of excessive crying, as well as abnormal feeding and sleeping patterns. The parents were also noticeably distressed due to infant's condition.²⁰ The patient presented with head malposition and associated hypertonicity of the suboccipital muscles.²⁰ Diversified technique was used on the infant in the cranium, upper cervical, and thoracic spine, with additional soft tissue stretching.²⁰ Parents were advised on coping mechanisms, and symptoms completely resolved following four weeks of chiropractic adjustments at a frequency of twice per week.²⁰

In a study by Hewitt,²¹ an eight-week-old female presented for chiropractic care with symptoms of irritability and fussiness with associated difficulty sleeping, increased abdominal gas, and preference towards feeding on the right breast. Upon chiropractic evaluation the infant exhibited signs of cervical and cranial subluxations.²¹ The infant's subluxations were treated with Diversified adjustment and craniosacral therapy.²¹ The infant fell asleep during her first adjustment, and all symptoms had resolved following a total of five treatments.²¹

In a case report by Rubin and Istok,²² a three-month-old male born six weeks premature presented for chiropractic care with complaints by his mother consisting of excessive crying and torticollis. He additionally had complications with head rotation to either side, the left being worse, and therefore had difficulties breastfeeding and supplementation with formula was required.²² The patient was extremely distressed and crying throughout the entire physical exam. Subluxations were found at atlas and occiput and adjusted using Diversified Webster pediatric adjusting and Craniosacral therapy.²²

After the first adjustment the infant immediately relaxed, and his mother reported at the next visit that the patient began sleeping with his head rotated to the left and the infant was much more happier and crying less.²² Following the patient's fourth adjustment, the patient's colic and torticollis complaints were completely resolved and the mother reported improved sleeping habits and must less frequent crying.²²

In a case report by Lanjopoulos and Lanjopoulos,²³ a two-year-old female presented for chiropractic care with the

inability to sleep through the night and irritability. Additional symptoms included chronic otitis media and skin sensitivities, and a medical history of a broken clavicle at birth.²³ Subluxations were found using pressure tests and the Activator technique analysis protocol, and the patient was adjusted using Activator technique at C1, C2, and T2-6.²³ The patient's sleep disturbances were completely resolved, and the patient's irritability was significantly improved following three chiropractic adjustments.²³

In a case report by Wittman,²⁴ a three-year-old male presented for chiropractic care with poor sleeping habits, as well as a sensory processing disorder, speech delay, and constipation. Subluxations were found upon chiropractic evaluation in the cervical, lumbar, and sacral spinal regions, and the patient received adjustments to those areas. The patient was reevaluated eight weeks after beginning care, and the patient's mother reported the child was sleeping through the night four out of seven nights per week.²⁴

Additionally, seven months after the onset of care, the patient was consistently sleeping through the night.²⁴ Weaknesses of this study included that the patient received additional treatments for his symptoms in the form of B12 supplementation, joint compression, and sensory activities making it hard to determine the exact effects of the chiropractic adjustment.²⁴

In a case report by Rollette and Monroe,²⁵ a one-month-old male presented for chiropractic care with a history of previously diagnosed gastrointestinal reflux (GERD) and infantile colic by his medical doctor. Due to the patient's conditions, he was in constant discomfort and crying frequently which resulted in sleep deprivation for the infant and his parents.²⁵ Autonomic system dysfunction was found using thermography scans, and subluxations were found in the cervical, thoracic, and sacral spinal regions.²⁵ The patient was adjusted using Diversified technique, and three weeks following the onset of treatment, the patient's excessive crying symptoms were resolved.²⁵ The patient was additionally sleeping for six and a half hours at a time.²⁵ Weakness of this study included the patient additionally being on prescription Zantac for colic and GERD symptoms making it difficult to determine true effects of chiropractic care.²⁵

In a case study of a sixteen-year-old cerebral palsy patient, Goodsell and Schneider²⁶ described the patient sleep disturbances secondary to the patient's disorder. Subluxations were found at spinal levels C1 and C7, and the chiropractor utilized gentle mobilization technique of the cervical spine, and an Activator when the patient was resistive towards the doctor's adjustment.²⁶ Following the patient's sixth chiropractic adjustment the patient's mother reported the patient was sleeping normally throughout the night.²⁶

In a case study by Cassista,²⁷ a four-year-old male presents with a previous diagnosis of ADHD and sleep disturbances. Thermography, sEMG, and cervical spine radiographs were used to assess the patient for vertebral subluxations.²⁷ The patient's occiput was adjusted using Pettibon technique. Following the patient's thirteenth adjustment his mother reported improved sleep patterns and less hyperactive behaviors.²⁷

A longitudinal study by Davies and Jamison² was conducted on infants in three chiropractic clinics with symptoms of continuous, inconsolable crying and/or at least two of the following symptoms "flushed face, clenched fists, legs pulled to abdomen, breast refusal, cold feet, or distended abdomen".² Infants previously diagnosed with milk protein allergy or intolerance or GERD were excluded from this study.²

Objective data was obtained by the clinicians upon initial visits and reexaminations, and subjective data was reported by parents in the form of interviews on previous documentation in a cry-diary.² Symptoms were considered resolved if the patients remained symptom free for at least a period of 30 days.² There were a total of 52 patients amongst the three clinics.² Thirty-one of the fifty-two patients saw improvement in their symptoms within the first 24 hours following their first adjustment, five patients saw no change over the course of care, and one patient's symptoms became worse.²

This study showed there appears to be a correlation between the presence of subluxation and symptoms presenting in infants with irritable baby syndrome.² However, more research must be done to prove a causal relationship between the two.²

In a pilot study by Nicolas-Schmid et al⁴, of 194 infants presenting to chiropractic offices, it was reported that 21% had complaints of crying, 20% complaints of feeding problems, 32% with either discomfort in the supine position or general sleeping problems. Mothers reported overall being pleased with chiropractic care and the results their children received.⁴ However, this study has particular weakness in that it cannot determine efficacy of chiropractic care for any of the former complaints, and further research must be done.⁴

Mechanisms of Subluxation

In Kent's article, Models of Vertebral Subluxation, a definition of subluxation, as described originally by Harrison in 1821, states that "when a vertebra becomes displaced or too prominent, the patient experiences inconvenience from a local derangement in the nerves of the part".²⁸ This definition can be used to describe neurological complications resulting from vertebral subluxations.²⁸

Rome lists 296 variations and synonyms for the term subluxation, however according to Lantz, common to all definitions of subluxation are "some form of kinesiological dysfunction and some form of neurological involvement".²⁸

In this case report, the infant had clear signs of vertebral subluxation and autonomic nervous system dysfunction confirmed through an objective assessment using paraspinous thermal scanning.⁸⁻⁹ Using the dysafferentation model of subluxation, as described by Kent, we can hypothesize that the patient's neurological dysfunction was a result of vertebral subluxations found in the cervical spine and sacrum.²⁸ Intersegmental motion dyskinesia was noted in the cervical and sacral spinal region.

Restriction of the intervertebral motion segment causes biomechanical dysfunction causing an alteration of the normal nociception and mechanoreceptor responses.²⁸ This can lead to an aberrant flow of information to the central nervous system

resulting in dysponesis.²⁸

Dysponesis is analogous to “garbage in, garbage out”, or errors in energy expenditures due to changes in physiological state.²⁸ It can hypothesized that this could be a cause of excessive crying and sleep disturbances in an infant without other known organic causes, due to the hypersensitive state of the patient’s nervous system as a result of vertebral subluxations.²⁸

Limitations

A case report represents only a small sample size and allows for no control group for comparison of the results of this study. Other limitations of this study include no post adjustment objective evidence of removal of subluxation found during examination, and a lack of definitive diagnosis for presenting symptoms of the patient. The report also only follows the patient through the first three visits of care, and therefore long-term effects of care including a relapse of symptoms or maintenance of improved symptoms after that period are unknown.

Conclusion

This case described the response of a patient with symptoms of disturbed sleeping patterns, excessive, inconsolable crying to chiropractic adjustments, which resulted in significant improvement.

Chiropractic adjustments should be considered for infants who have inconsolable crying, irritability, and sleep disturbances. Pediatric chiropractic adjustments are gentle, noninvasive and may remove interference within the nervous system to allowing the baby to have reduced discomfort. Further research in the form of additional case studies and randomized control trials demonstrating the effects of chiropractic care on infants are needed to help document the connection between vertebral subluxation and infant crying, irritability, and sleep disturbances.

References

1. Miller J, Newell D. Prognostic significance of subgroup classification for infant patients with crying disorders: A prospective cohort study. *J Can Chiropr Assoc.* 2012;56(1):40 – 8.
2. Davies N, Jamison J. Chiropractic management of irritable baby syndrome. *Chiropr J Aust.* 2007;37(1):25-9.
3. Morris S, St. James-Roberts I, Sleep J, Gillham P. Economic evaluation of strategies for managing crying and sleeping problems. *Arch Dis Child* 2001;84:15-9.
4. Nicolas-Schmid P, Hetlevik M A, Miller J. Infant presentations and outcomes at a chiropractic clinic in the UK: Parent report of treatment outcomes using the United Kingdom Infant Questionnaire. *JCCP.* 2016 May;15(2):1236-41.
5. Miller J. Cry babies: a framework for chiropractic care. *Clin Chiropr.* 2007.10:139-46.
6. Kvitvaer BG, Miller J, Newell D. Improving our understanding of the irritable infant: an observational study in a chiropractic teaching clinic. *J Clin Nurs.* 2011 Apr;21(1-2):63-9.
7. Miller J, Croci S C. Cry baby, why baby? Beyond colic: is it time to widen our views? *JCCP.* 2005;6(3):419- 23.
8. McCoy M. Paraspinal thermography in the analysis and management of vertebral subluxation: A review of the literature. *Ann Vert Sublux Res.* 2011 July;2011(3):57-66.
9. Hart J. Five-minute thermal pattern analysis and health perception: a follow-up study. *J Vert Sublux Res.* September 26, 2007;1-6.
10. Cooperstein R, Gleberzon BJ. Technique systems in chiropractic. Edinburg, PA: Churchill Livingstone; 2004 Apr 2. Chapter 17, Diversified Technique;143–9.
11. Cooperstein R, Gleberzon BJ. Technique systems in chiropractic. Edinburg, PA: Churchill Livingstone; 2004 Apr 2. Chapter 21, Logan Basic Technique; 173-9.
12. Hipperson AJ. Chiropractic management of infantile colic. *Clin Chiropr.* 2004 Dec;7(4):180-6.
13. Killinger L, Azad A. Chiropractic Care of Infantile Colic: A Case Study. *JCCP.* 1998;3(1):203-6.
14. Castellucci RR. Resolution of colic in an eight week old infant undergoing chiropractic care: a case study. *J Pediatr Matern & Fam Health.* 2012 Nov 28;109–12.
15. Colman LA, Merced J. Resolution of infantile colic in a three-month-old infant undergoing chiropractic care to reduce subluxation: a case report and selective review of literature. *J Pediatr Matern & Fam Health.* 2016 Mar;22-7.
16. Batte S. Resolution of colic, constipation and sleep disturbance in an infant following chiropractic care to reduce vertebral subluxation. *J Pediatr Matern & Fam Health.* 2010 Jan 1;1–5.
17. Spear D, Alcantara J. Resolution of birth trauma sequelae following adjustment of vertebral subluxations in an infant. *J Pediatr Matern & Fam Health.* 2016 Mar. 2016(1): 28-31
18. Alcantara J, Anderson R. Chiropractic care of a pediatric patient with symptoms associated with gastroesophageal reflux disease, fuss- cry-irritability with sleep disorder syndrome and irritable infant syndrome of musculoskeletal origin. *J Can Chiropr Assoc.* 2008;52(4):248.
19. Cuhel JM, Powell M. Chiropractic management of an infant patient experiencing colic and difficulty breastfeeding: a case report. *J Clin Chiropr Pediatr.* 1997 Oct;2(2):150-4.
20. Williams-Frey S. Management of atypical infant colic – a pain syndrome of infancy – and the emotional stress associated with it: Why treat a benign disorder? *Clin Chiropr.* 2011;14(3):91-6.
21. Hewitt E. Chiropractic care and the irritable infant. *J Clin Chiropr Pediatr.* 2004;6(2):394-7.
22. Rubin D, Istok M. Resolution of infantile colic, torticollis, plagiocephaly & feeding difficulties following subluxation based chiropractic: a case report. *J Pediatr Matern & Fam Health.* 2013;2013(2):24-7.
23. Lanjopoulos C, Lanjopoulos D. Resolution of chronic otitis media, difficulty sleeping and tactile hypersensitivity in a child undergoing subluxation-based chiropractic care. *J Pediatr Matern & Fam Health.* 2012 Sept; 2012(3):81-84.

24. Wittman RA. Chiropractic care of a child with sensory processing disorder, speech delay, constipation, and poor sleep: a case report. *J Pediatr Matern & Fam Health*. 2010 Dec;2010(Supplement):279-80.
25. Rollette D, Monroe C. Improvement of infant colic and reflux following chiropractic care: a case report & selective review of the literature. *J Pediatr Matern & Fam Health*. 2012 Apr;2012(2):43-8.
26. Goodsell L, Schneider J. Improvement in sleep and quality of life in a child with cerebral palsy undergoing chiropractic care. *J Pediatr Matern & Fam Health*. 2010 Aug;2010(3):130-5.
27. Cassista G. Improvement in a child with attention deficit hyperactivity disorder, kyphotic cervical curve and vertebral subluxation undergoing chiropractic care. *Ann Vert Sublux Res*. 2009 Apr;2009:1-5.
28. Kent C. Models of vertebral subluxation: a review. *J Vert Sublux Res*. 1996 Aug;1-7.

Appendix

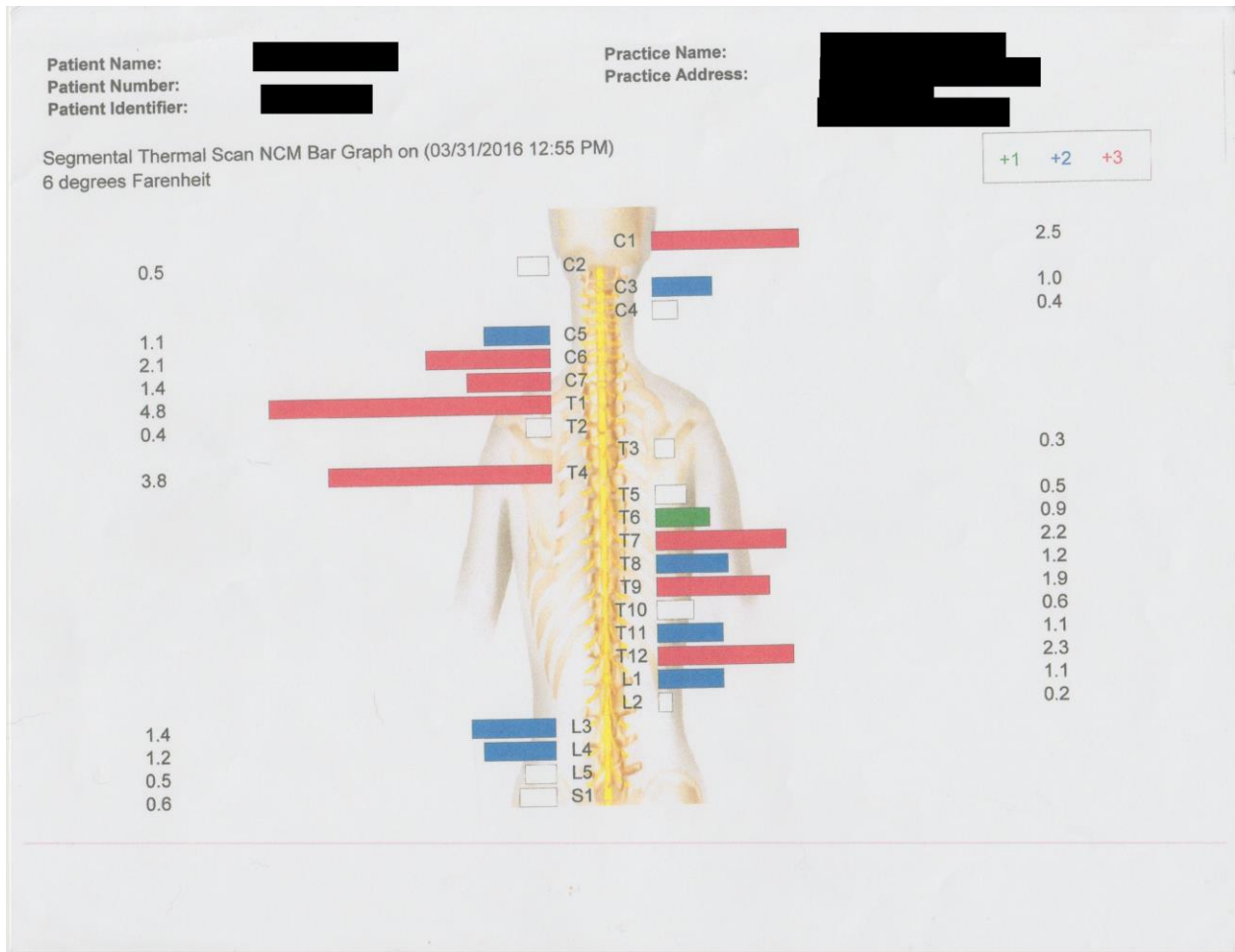


Figure 1. Paraspinal thermography scan performed at initial patient examination showed severe autonomic system dysfunction on the right at spinal levels C1, T7, T9, and T12 and on the left at spinal levels C6, C7, T1, and T4. Moderate autonomic dysfunction was noted on the right at spinal levels C3, T8, T11, and L1 and on the left at spinal levels C5 and L4. Mild autonomic dysfunction was noted on the right at spinal level T6 and on the left at spinal level L3.