ORIGINAL RESEARCH

An Impairment Rating Analysis Of Asthmatic Children Under Chiropractic Care

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Abstract — A self-reported asthma-related impairment study was conducted on 81 children under chiropractic care. The intent of this study was to quantify self-reported changes in impairment experienced by the pediatric asthmatic subjects, before and after a two month period under chiropractic care. Practitioners, representing a general range of six different approaches to vertebral subluxation correction, administered a specifically designed asthma impairment questionnaire at the appropriate intervals. Subjects were categorized into two groups; 1–10 years and 11–17 years. Parents/guardians completed questionnaires for the younger group, while the older subjects self-reported their perceptions of impairment. Significantly lower impairment rating scores (improvement) were reported for 90.1% of subjects 60 days after chiropractic care when compared to the pre-chiropractic scores ($p < 0.05$) with an effect size of 0.96. As well, there were no significant differences across the age groups based on parent/guardian versus self rated scores. Girls reported higher (less improvement) before and after care compared to boys, although significant decreases in impairment ratings were reported for each gender. This suggested a greater clinical effect for boys which was supported by effect sizes ranging from 1.2 for boys compared to 0.75 for girls. Additionally, 25 of 81 subjects (30.9%) chose to voluntarily decrease their dosage of medication by an average of 66.5% while under chiropractic care. Moreover, information collected from patients revealed that among 24 patients reporting asthma "attacks" in the 30 day period prior to the study, the number of "attacks" decreased significantly by an average of 44.9% ($p < .05$). Based on the data obtained in this study, it was concluded that chiropractic care, for correction of vertebral subluxation, is a safe nonpharmacologic health care approach which may also be associated with significant decreases in asthma related impairment as well as a decreased incidence of asthmatic "attacks." The findings suggest that chiropractic care should be further investigated relative to providing the most efficacious care management regimen for pediatric asthmatics.

Key words: asthma, adjustment, children, chiropractic, impairment rating, pediatric, vertebral subluxation.

Introduction

Bronchial asthma is a disorder of increased tissue responsiveness of the tracheobronchial tree to various stimuli, resulting in paroxysmal contraction of bronchial airways.[1] The airway obstruction in asthma is due to a combination of factors that include spasm and edema of the smooth muscle of the airways, and increased mucus secretion.[2] With more severe asthma, the asthmatic is forced to compensate for bronchoconstriction in order to permit gas exchange to take place. This is done by breathing at high lung volumes, which enlarges the total lung capacity, resulting in a mechanical opening of the airways. Unfortunately, breathing in a hyperinflated state requires a marked increase in the inspiratory muscle forces and results in varying degrees of dyspnea and fatigue, likely due to the patient's use of accessory muscles of ventilation (platysma and S.C.M.[3]). Sternocleidomastoid muscle contractions have been shown positive correlation with the development of severe airflow obstruction, hyperinflation, and a marked reduction in gas exchange.[4]

A positive correlation between chiropractic care administered for the correction of vertebral subluxation and the patient's perception of decreased respiratory effort, and severity of symptomatology, has been noted in several studies of patients ranging from 2 to 63 years of age.[5,6,7,8,9,10] Chiropractic care has been proposed to significantly reduce non-specific bronchial hyperactivity (n-BR) as well as patient rated asthma severity.[7] Non-specific bronchial hyperactivity (n-BR) measures the resistance to breathing of the bronchial airways after histamine dihydrochloride challenge. Although objective evidence is slow emerging in regard to the effect of chiropractic care on respiratory function there have been some reports.[11,12] Of particular interest is a recent report showing improved forced expiratory volume in patients following adjustments for upper cervical subluxation.[13]

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Vertebral subluxation is characterized, in part, by vertebral misalignment (kinesiopathology), neuropathology and myopathology.[14 15 16 17] It has been demonstrated that pressures as little as 10mm Hg can cause significant neural dysfunction, decreasing the number and amplitude of action potentials by up to 60% of initial values.[18 19 20] This mechanical pressure on the nerve and surrounding tissues which may cause tissue ischemia is proposed to result in the release of chemical inflammatory agents such as substance P[21 22], bradykinin, and histamin[22] as a result of the osseous misalignment and subsequent neuromuscular pathophysiology. This neuromuscular pathophysiology can exist with or without associated pain.[23]

Recent study on the neurogenic mechanisms of asthma has focused on the release of neuropeptides by an axon reflex pathway. These peptides, which include substance P, calcitonin-related peptides, and neurokinin A (a bradykinin), have been shown respectively to have vascular permeability and mucus secretagogue activity, bronchial vascular dilation effect, and a bronchoconstrictor activity.[2] These are the same neurotransmitters postulated to be released from tissues in the presence of vertebral subluxation,[21] which may initiate and/or complicate the asthmatic condition.

As the vertebral subluxation is believed to negatively effect neurological function, [21] the neuroanatomy and physiology of structures associated with respiratory effort could be affected by this condition. In this regard, the neuroanatomy and physiology related to the cervical area reveals that the respiratory center consists of neurons located bilaterally and divided into three major collections. These are the dorsal respiratory group located in the dorsal portion of the medulla oblongata which mainly regulates inspiration, the ventral respiratory group which regulates both inspiration and expiration located in the medulla oblongata, and the pneumotaxic center located dorsally in the superior portion of the pons which helps to regulate rate and pattern of breathing.[24] The medulla oblongata passes inferiorly through the foramen magnum and the C1 spinal canal.[25] It has been theorized[26] that misalignment (a component of vertebral subluxation) of C1 can cause stress and subsequent neural dysfunction to the medulla oblongata and spinal cord. Additionally, the phrenic nerve from the cervical plexus, which innervates the diaphragm, receives fibers from the third, fourth and fifth cervical nerves.[27]

Accessory muscles of breathing such as the platysma and sternocleidomastiod muscles also receive innervation from nerves of cervical origin. The platysma muscles are innervated by the cervical branch of the facial nerve, and the sternocleidomastiod muscles are innervated by the spinal branch of the accessory nerve as well as branches from the anterior rami of the second and third cervical nerves. These nerves are intimately associated with the upper cervical area.[25 27]

Misalignment of thoracic vertebra may cause neural dysfunction to the nerves which innervate anterior serrati, scaleni, abdominal recti, and internal and external intercostal muscles which function to raise and lower the rib cage during respiration. Misalignment of thoracic vertebra may also cause costotransverse fixation, which can limit diaphragmatic excursion and increase respiratory effort. Additionally, the lower thoracic nerves also contribute to the innervation of the diaphragm.[27] Consequently, the presence of vertebral subluxation, i.e. kinesiopathology, neuropathology and myopathology, may increase the asthmatic patients perception of respiratory effort. The present study, therefore, was designed as a preliminary assessment of perceived change in the extent of impairment of pediatric asthmatic patient's while under chiropractic care for the correction of vertebral subluxation.

The importance of gathering data relative to the pediatric population is apparent considering current statistics. In the United States, asthma affects an estimated 14–15 million persons, including 4.8 million (6.9%) under 18 years.[28] In 1993, asthma accounted for an estimated 198,000 hospitalizations and 342 deaths among persons less than 25 years of age. Children were more likely than teens and adults to receive asthma care in the outpatient settings; adolescents and young adults were more likely than other age groups to receive emergency care.[28] Although the treatment of asthma by medication is prevalent, and for many life sustaining, the health complications associated with this approach are well known.[29 30 31 32] Since the correction of vertebral subluxation is non-invasive, the documentation of changes in asthma related impairment, which could reduce or eliminate the need for medication, is a necessary step in evolving the most efficacious care for the millions of children challenged by this condition.

Methods

Subjects

Potential subjects for this study were sought through newspaper advertisement. All subjects between the ages of one to seventeen years of age with a previous medical diagnosis of asthma were considered. Informed consent was obtained from the parents, and/or legal guardian, consistent with the Human Subjects Committee protocol of the Michigan Chiropractic Council. Qualifying subjects were required to be studied for a period of 60 days. A total of 81 subjects participated, all of whom completed the study duration of 60 days. The subject population consisted of 37 females and 44 males ranging in age from one to 17, with a mean age of 10 $\pm$ 4.13 years.

Practitioners

A total of 33 chiropractors in various locales of the state of Michigan volunteered to participate in this study. All practitioners were members of the Michigan Chiropractic Council. Each practitioner followed the same procedures in obtaining data for the study. Subjects were evaluated over a period of 60 days during which time they were examined for the presence of vertebral subluxation in accordance with the protocols of the techniques employed by each participating chiropractor. These techniques included, Activator Methods, Diversified, Gonstead, Upper Cervical Technique-H.I.O, Network Spinal Analysis, and Thompson Terminal Point Technique, all of which have been described elsewhere.[33] When vertebral subluxation was indicated to be present, subjects were administered chiropractic adjustment(s) followed by an evaluation for the correction of vertebral subluxation according to the procedures of the methods practiced. No recommendations concerning the use of medication in the treatment of bronchial asthma were made to subjects by

any of the chiropractors participating in the study.

Self-Reported outcomes of Asthmatic Impairment

It was necessary to develop an instrument appropriate to survey the population of subjects in the present study. The most suitable format was found in the Oswestry Low Back Pain Disability Questionnaire.[34,35] This questionnaire was chosen because its disability orientation closely related to anecdotal reports from Michigan Chiropractic Council members regarding the level of impairment observed in patients who had been diagnosed with asthma. However, it was necessary to modify the instrument to reflect areas of impairment which would specifically relate to breathing difficulty instead of low back pain. This was accomplished by substituting the phrase "breathing problems" in the place of "low back pain," and changing the content of the ten broad areas (Appendix). In its final form, the instrument was composed of ten questions. For each of the ten questions, participants were asked to choose one of the six replies that best described their impairment. These answers were subsequently scored 0-5, with 5 being the highest level of impairment. As with the Oswestry Questionnaire, the final score was a percent of the highest score which could be reported (5 x 10 = 50). Since some of the questions were not relevant to the age level of participants (such as walking difficulties), these sections were not answered. Therefore, the highest score attainable was adjusted accordingly, with the percentage reflecting the change. This instrument, adapted from the Oswestry format is herein referred to as the Modified Oswestry Impairment Rating Scale (MOIRS).

In each practice, the questionnaires were completed prior to the commencement of care, and again 60 days following the initial visit. Subjects 11 years and older completed the questionnaires, while parents or legal guardians acted for younger patients. Additionally, subjects or parents/ guardians were asked to supply information regarding changes in number of asthma attacks, and medication usage via an informal questionnaire.

Analysis of Data

Pre and post care scores on the MOIRS were evaluated by a two tailed paired sample t-test assuming equal variances,[36,37] and a two tailed independent t-test assuming unequal variances[36,37] for (1) gender effects, (2) age effects, and (3) response scores based on completion by the subject versus parent or guardian. Significance was determined for all analyses at $p < 0.05$. Response scores were not evaluated as a function of the practice from which they were derived since the number of individual subjects per practice was too low to achieve statistical power.

Additionally, utilizing scores from the MOIRS as a measure of change in impairment, effect sizes[38] were determined to assess the clinical significance associated with chiropractic care. Effect size was determined by the following relationship [mean MOIRS pre care score — mean MOIRS post care score / std. dev. of MOIRS pre care scores]. This measurement allowed for expression of the extent to which a post intervention measurement [post MOIRS rating] varied from normal variation around the mean of pre intervention measurements [pre MOIRS rating]. Following the relationship described, a value of 0.2 is taken to mean a small clinical effect, 0.5 is taken to mean a moderate clinical effect, and 0.8 is taken to mean a large clinical effect.[38]

Results

Content and Construct Validity and Internal Consistency of the MOIRS Questionnaire

As presented in the introduction, content validity was initially established by having practitioners participating in the study validate the content of the survey relative to its intended purpose. The content, either adopted from the Oswestry Pain Disability questionnaire or originally developed, was approved unanimously by these practitioners as reflecting the type of disabilities reported by their asthmatic patients. Following the study, practitioners reported that subjects found the questionnaire to be clear and complete, both primary attributes of content validity.[39]

Since construct validity is a process requiring considerable evidence gathered over a period of time through repeated uses of the instrument, no gold standard currently exists with regard to the type of questionnaire administered in this study. However, several initial measures of validity did arise from the present study. First, since the instrument was intended to discriminate "post intervention" effects, its ability to detect statistical differences between pre and post chiropractic care (presented below) attests to its validity in that regard.[40]

Reliability was examined by determining Cronbach's coefficient alpha[41] for the ten questions in the survey instrument before (0.70) and after chiropractic care (0.77). These coefficients reveal a substantial level of internal consistency within the instrument. This level of reliability also contributes to the initial phase of evaluating its construct validity. Further use of this instrument in similar asthmatic populations will be required to continue the validation process.

MOIRS Ratings Before and After Chiropractic Care

Significantly lower MOIRS scores of 20.6 ± 12.1 were reported 60 days after chiropractic care when compared to the pre-chiropractic scores 32.1 ± 12.0 ($p < 0.000$). Within the population of 81 patients, there were 73 (90.1%) reports of decreased impairment. In 4 (4.9%) there was no reported change, and in 4 (4.9%) there were reports of increased impairment (Table 1).

Additional information supplied by patients or parent/guardian revealed that among 24 patients reporting asthma "attacks" in the 30 day period prior to the study, the number of "attacks" decreased from an average of 2.96 ± 3.30 incidents per 30 days prior to study, to 1.3 ± 2.60 incidents per 30 days during the study. This represented a significant decrease of 44.9% ($p < .05$). Additionally 25 of 81 (30.9%) patients chose to voluntarily decrease their dosage of medication by an average of 66.5%, with a range of 20% to 100% per month.

Subject Categories

Self-Reported versus Parent/Guardian-Reported Responses

Subjects were divided into age ranges according to their

Table 1. Impairment Score Changes* in Bronchial Asthma Pediatric Patients Before and After Chiropractic Care.

Patient Categories	Scores		Probability †	Effect Size‡
	Pre	Post	(p)	
A. Total Population	32.1 ± 12.0	20.6 ± 12.1	0.000	0.96
B. Age Range/Gender				
1-10 years				
Males	30.4 ± 10.5	15.8 ± 12.1	0.000	1.40
Females	30.8 ± 11.9	21.1 ± 12.0	0.000	0.81
11-15 years				
Males	30.7 ± 11.2	19.4 ± 10.5	0.000	1.00
Females	37.4 ± 14.5	26.7 ± 12.7	0.000	0.73
C. Gender				
Total Population				
Males	30.3 ± 10.3	17.8 ± 11.1–	0.000	1.20
Females	34.2 ± 13.5	24.0 ± 12.5	0.000	0.75

• Impairment rating scores were obtained from the Modified Oswestry Index Rating Scale (MOIRS, see Methods for protocols). Higher Scores represent greater impairment.

† Probability values of less than 0.05 were significant.

‡ Effect size (see Methods) is a measure of clinical effect, where 0.2 is a small effect, a moderate effect, and 0.8 a large effect.

– Compared across (between) groups, post care males scored significantly ($p = 0.02$) lower (improvement) than females. No other comparisons between groups were statistically significant.

apparent ability to complete the questionnaire alone, or requiring a parent or guardian to act for them. The division was made between 1 to 10 years and 11 to 17 years. Although MOIRS scores were lower in the younger age bracket prior to and after care than the higher age group, there was no significant difference between the age categories. This suggested that guardian versus self-reporting elicited the same range of responses. Moreover, in both age groups, MOIRS scores were significantly lower (improvement) following chiropractic care compared to pre chiropractic MOIRS scores ($p < 0.000$).

Gender Differences

Girls showed slightly higher impairment scores (34.2 ± 13.5) before chiropractic care than did boys (30.3 ± 10.3). Although both genders reported significantly decreased impairment after care, scores were significantly higher among girls (24.0 ± 12.5) when compared to boys(17.8 ± 11.1), suggesting a more profound clinical effect for males. This possibility was further explored by investigating effect sizes, separately, for the genders.

Effect size, derived from MOIRS scores before and after chiropractic care, was used as a measure of estimating the extent of clinical change. While, overall, the clinical effect was large for the subject population as a whole (0.96), boys demonstrated a higher effect size (1.20) than did girls (0.75), as can be seen in Table 1, thus supporting a proposed larger clinical effect for males.

Discussion

The Survey Instrument (MOIRS)

Due to lack of previous use of the MOIRS, its internal construct validation is in the initial phase. The instrument is administered easily, lending itself to use by parents/guardians as well as self-rating by young adults. It is anticipated that it will continue to be used by chiropractors and other practitioners interested in assessing health outcomes associated with asthmatics. Since the demonstration of internal and external validity for any questionnaire is a process[42] rather than a singular event, it is important that data be gathered from a number of studies for comparison. As a first step in this process, this paper has introduced data which provides a base for comparison. Consequently, while the statistical differences and effect sizes reported in this investigation are compelling, they must be interpreted with caution while awaiting continued evidence regarding validation of the instrument.

Perceived Changes in Impairment Due to Asthma

The information collected concerning change in the number of asthma "attacks" during this study needs to be viewed in consideration of the timing of the study (May–September), since some atopic (allergic) asthmatic events may be contributed to by seasonal factors such as exposure to higher amounts of pollen. Additionally, influences due to the incidence of non-atopic (nonreagenic) events and atopic asthmatic events incited by exposure to environmental antigens which can not be related to seasonality, such as animal hair, cigarette smoke, and various chemotoxins, were not considered in the present study. To some extent, therefore, the number of asthmatic "attacks" could be related to these factors. However, the significant reduction in asthmatic "attacks" coupled with the high percentage of respondents (or their parent/guardian) voluntarily reducing medication levels, suggests a more permanent effect. This is based on the logical presumption that asthmatic subjects or parents/guardians would be expected, through their personal experience, to recognize "typical" seasonal or occasional environmental influences related to "attack" frequency.

Although demonstrating significant decreases in scores (improvement) pre to post chiropractic care, the 11-17 year old subjects of both sexes demonstrated a trend of self-reporting higher scores than younger subjects (one–ten years). While these differences were not significant, the trend may reflect some level of variation in perception between those self-rating, as opposed to parents/guardians. As pediatric studies will frequently involve this type of design, this issue should remain an important concern as it impacts on validation of the instrument.

While there were no significant differences in age groups within genders, females reported significantly less post improvement than males. The implication that a more pronounced clinical effect was apparent for males than females, while substantiated by statistical significance as well as effect size, currently lacks explanation. However, some evidence exists which suggests that females tend to report their health lower than males even though they may not exhibit other indicators of a lower state of health. Verbrugge [43] proposes that this could be a reflection of the more frequent utilization of helath care by females. As this information is specific to adult populations it may or may not account for the observation regarding gender differences in the present study, especially considering the fact that responses from approximately half of both the male and female subjects were reported by parents/guardians. Certainly, a follow up study investigating more subjects will be needed to attest to the consistency of this finding. Moreover, evaluation of the inference that the significant reduction in impairment was due to chiropractic care will require a controlled clinical research design to focus on gathering evidence related to cause and effect. Relative to this issue, the diversity of techniques employed by different chiropractors participating in the study could be broadly grouped into six general approaches. While it is not possible from the data collected in this study to ascertain if one technique was more effective than another, it is evident that, overall, subjects or parent/guardians responded similarly, regardless of the chiropractic approach used for correction of vertebral subluxation. Further study, among those advocating specific approaches will be necessary to elucidate any distinctions in efficacy. Moreover, it will be of interest to conduct additional study regarding the consistency of segmental locations which are adjusted among the different approaches, concomitant with reported changes in asthma impairment. Such information could offer considerable insight regarding the range of possible approaches effective in the correction of vertebral subluxation.

Conclusions

The authors of this study do not suggest that chiropractic care is to be considered a substitute for prudent, proper medical attention for the asthmatic patient. However, it should be noted, that traditional pharmacological approaches to the management of asthma have been shown to represent a risk to the patient,[29 44 45] with several studies calling into question the efficacy of such treatment in the management of asthmatic conditions.[29 30 31 32] Therefore, when considering pharmaceutical agents in the management of asthma in the pediatric patient, the expected benefit must be weighed against the inherent risks. As shown in the present study, chiropractic care, a safe nonpharmacologic health care approach, may also be associated with self-reported decrease in asthma-related impairment to the patient, including the patient's perception of reduced respiratory effort, as well as a decreased incidence of asthmatic "attacks." In view of these findings it is suggested that chiropractic care be further investigated regarding its role in the overall health care management of pediatric asthmatics.

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Appendix

Asthma Research Program

Quantitative Asthmatic Index

This questionnaire has been designed to give the doctor information as to how breathing difficulty has affected your ability to manage everyday life. Please answer every section and mark in each section the ONE box which applies to you. We realize you may consider that two of the statements in any one section relate to you, but please mark the box which most closely describes your condition

1) Current difficulties

- ☐ I have no breathing problems at this moment.
- ☐ I have mild breathing problems at this moment.
- ☐ I have moderate breathing problems at this moment.
- ☐ My breathing problems are fairly severe at this moment.
- ☐ My breathing problems are severe at this moment.
- ☐ My breathing problems are very severe at this moment.

2) How many times have you ever been hospitalized for Asthma

- ☐ Never.
- ☐ One Time.
- ☐ Two Times .
- ☐ Three Times.
- ☐ Four Times.
- ☐ Five or more times.

3) When was the last time you had a severe flare-up or needed treatment for your asthma?

- ☐ Never.
- ☐ More than twelve months ago.
- ☐ Within the last twelve months.
- ☐ Within the last six months.
- ☐ Within the last month.
- ☐ Within the last week.

4) Mild Activity

- ☐ I can walk any distance with no problems.
- ☐ I can walk any distance with occasional problems.
- ☐ I can walk a lot but have frequent breathing problems.
- ☐ I don't walk much because I have frequent problems breathing .
- ☐ I walk rarely because I have frequent and severe problems breathing .
- ☐ I never walk because of severe breathing problems.

5) Vigorous Activity

- ☐ I participate in vigorous activity with no breathing problems.
- ☐ I participate in vigorous activity with mild breathing problems.
- ☐ I participate in vigorous activity with moderate breathing problems
- ☐ I participate in vigorous activity with severe breathing problems.
- ☐ My activities are rarely vigorous because of severe breathing problems.
- ☐ I am never vigorous because of severe breathing problems.

6) In the past 4 weeks how much time have you missed from work, school, or usual activity because of asthma?

- ☐ None.
- ☐ One to three days.
- ☐ Four days to one week.
- ☐ One to two weeks.
- ☐ Two to three weeks.
- ☐ Three to four weeks.

7) How often do asthma attacks awaken you at night?

- ☐ Never.
- ☐ Less than once a week.
- ☐ Once or twice a week.
- ☐ Three or four times a week.
- ☐ Five or six times a week.
- ☐ Every Night.

8) School / Work

- ☐ My breathing never interferes with work activity.
- ☐ My breathing rarely interferes with work activity.
- ☐ My breathing moderately interferes with work activities.
- ☐ My breathing interferes very much with work activities.
- ☐ My breathing prevents me from doing most jobs.
- ☐ My breathing prevents me from doing any work.

9) How much does your asthma interfere with your social activities (family, friends, neighbors or groups)

- ☐ Never.
- ☐ Rarely.
- ☐ Slightly.
- ☐ Moderately.
- ☐ Frequently.
- ☐ Extremely.

10) Medication

- ☐ I never take medication or inhalants.
- ☐ I very rarely take medication or inhalants.
- ☐ I rarely take medication or inhalants.
- ☐ I sometimes take medication or inhalants.
- ☐ I frequently take medication or inhalants.
- ☐ I use my inhaler most days.

Case Study

Improvement Following Chiropractic in a 45-Year-Old Female Suffering from Asthma: A Case Study & Review of Literature

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Abstract

Objective: To assess the outcomes following chiropractic for a female patient suffering from asthma, headaches, insomnia, low back pain, and sinus problems

Clinical features: The patient was a 45-year-old female who presented to the office with complaints of asthma, headaches, insomnia, low back pain, and sinus problems. At the beginning of treatment, she was on an inhaler (Ventolin) for her symptoms.

Intervention and Outcomes: The patient was managed utilizing Torque Release Technique™. After four months of care, the patient reported improvement in her symptoms.

Conclusions: This case report describes chiropractic care in an adult asthmatic. More research is encouraged on the effectiveness of chiropractic care in adults with chronic asthma.

Keywords: *Asthma, chiropractic, respiratory, airways, adult, Torque Release Technique, adjustment, spinal manipulation, vertebral subluxation*

Introduction

Epidemiology

Asthma is loosely defined as an inflammatory disorder of the airways involving the recruitment of inflammatory cells such as eosinophils, basophils, and mast cells.[1,2] Asthma continues to be a major disease affecting a large portion of the population. Of the United States population, 5% are diagnosed with the disorder, making up two million emergency department visits annually as well as 470,000 hospitalizations and 4,500 deaths.[1]

It has been found that asthma prevalence is higher in blacks compared to whites as well as higher in female Hispanics.[3] The airway obstruction which occurs during asthmatic attacks are most commonly due to allergic responses to inhaled particles which causes symptoms such as wheezing, shortness of breath, cough, and chest tightness.[1]

Pathophysiology

These symptoms are associated with airway obstruction caused by an increased reaction of the bronchial smooth muscle due to increased inflammatory cells, edema, and hyper-secretion of the bronchioles.[1] There are two main pathways believed to be responsible for the dramatic allergic response in individuals with asthma, both of which rely heavily on the use of T-helper cells.[1] These T-helper cells are responsible primarily for the production of cytokine receptors which encourage the production of inflammatory products.[1]

The first pathway of asthma is due to a type 1 hypersensitivity response, or an immediate allergic response and is mediated by the immunoglobulin IgE.[1] These immunoglobulins are produced by B cells which are activated by the cytokines produced from the T-helper cells[1]. The receptors for the IgE are primarily located on the immune regulating cells such as mast cells, basophils, and eosinophils.[1,2]

When this process occurs, these immune cells will release inflammatory molecules ultimately resulting in airway obstruction.[1] The second pathway of asthma is due to a type 4 hypersensitivity response which is again mediated by the cytokines produced from T-helper cells.[1] These cytokines will directly respond with the bronchial airway smooth muscle epithelium resulting in a hyper-reactive response including increased production of eosinophils as well as glycoproteins.[1]

Both of these pathways result in the increased presence of eosinophils, basophils, and mast cells.[1,2] Eosinophils and basophils mature in the bone marrow, and will only be released into the blood stream under pathological circumstances, such as asthma.[2] On the other hand, mast cells will leave the bone marrow as immature cells and finish maturation in the peripheral tissue.[2] The mast cells are the first ones to reach the lungs during an asthma attack and are responsible for the first phase of the allergic response as well as signaling in the presence of other inflammatory cells such as the basophils and eosinophils resulting in hyper-secretion of the airways, airway obstruction, and thusly difficulty breathing.[2]

The presence of mucus in the airways is a common and necessary part of normal function. This protects the airways from damage and will contribute to trapping any unwanted particles from getting to the alveoli.[4] With the occurrence of an asthma attack, there is resultant goblet cell hyperplasia which is responsible for the production of airway mucus.[4] Mucus overproduction and resultant mucus plugs are the most common cause of death in asthma patients.[4] Another contributor to the increased amount of mucus secretion is the submucosal gland hypertrophy, where the glands increase 2-4 times from the normal average.[1,4]

The mucus becomes so viscous, that it is very difficult to clear these plugs from the airway making this a markedly clear difference between asthma and other respiratory diseases such as chronic obstructive pulmonary disease (COPD).[1,4] Both submucosal hypertrophy and goblet cell hyperplasia contribute to deaths from attacks, but the submucosal glands are more of a general finding while goblet cell hyperplasia is a distinct finding of the detrimental outcome.[4] Not only is the mucus production increased, but also the viscosity of the mucus is also increased- another specific change found in asthma patients. This increased production and viscosity leads to two main problems: airway obstruction and change in airway responsiveness.[4]

Obstruction of the airways occurs due to the plug formation as well as ciliary dysfunction.[4] With this ciliary dysfunction, the airways are unable to dislodge and clear the plug from the affected area.[4] With the plug blocking the proper flow of air through the lungs, the patient will begin to experience arterial hypoxemia as well as stimulation of chemoreceptors resulting in difficulty breathing and hyperventilation.[4] Due to the obstruction causing increased airflow resistance, the bronchioles respond with constriction (airway responsiveness) making it even more difficult to breathe normally.[4]

Another contributing factor to the increased responsiveness of the airways is due also in part to the increased size of the underlying smooth muscle. This muscle particularly tends to thicken as the asthmatic's age increases. As the mucus is brought into and taken out of the bronchioles, fibronectin is brought along with the mucus and then deposited in the airways increasing the role of myofibroblasts whose job is to build new muscle.[1] Individuals who die from asthma on average have smooth muscle increases of 2-3 times greater than the normal average.[1]

Treatment Options

Asthma treatment is first approached with the use of inhaled corticosteroids.[5] As the patient progresses in the pathology, they are put on an increased dose of corticosteroids with the addition of another therapy including long-acting beta-2 agonists, leukotriene modifiers, or theophylline.[5] The most commonly used corticosteroid is salbutamol, which is a short-acting bronchodilator inhaler.[6] These are typically given to the patient to use during any asthmatic attacks that might occur.[6]

It is beneficial to the patient to add on the other therapy options to the inhaled corticosteroids as this helps to reduce the amount of corticosteroids being taken as the side effects of regular corticosteroid use include: growth retardation in children, decreased bone density, eye disorders, sleep problems, and anxiety.[5,6] Another option for the asthmatic patient includes the use of inhaled anticholinergic muscarinic antagonist, specifically tiotropium bromide, which has a therapeutic effect lasting up to 24 hours.[7]

These effects have been noted to be decreased mucus production, controlling airway inflammation, and increasing parasympathetic activity.[7] New medicinal treatment options have been recently explored, particularly with the use of long-acting muscarinic antagonists which could provide patients with fewer numbers of attacks as well as hospital visits.[6] These drugs specifically block the acetylcholine neurotransmitter of the nerves, glands, and smooth muscle in the airways.[6] Side effects of this new approach have been recorded to be: dry mouth, constipation, diarrhea, cough, and headache.[6]

Risk Factors

Exact risk factors and triggers differ from patient to patient. It has been found that genetics play a large role in predicting asthma development with a wide range of 36-87%.[8] There have also been strong correlations found between asthma and early exposure to tobacco smoke as well as to fungal exposure, and nitrogen dioxide.[8] The environmental exposures play a large role in asthma development such as tobacco smoke, drugs which may cause a pharmacogenetics effect.[9] Most commonly, asthmatic attacks are associated with environmental exposures such as pet allergens, tobacco smoke, air pollution, mold, and pollen.[3]

Complications

It has been found that 40% of patients poorly control their asthmatic attacks.[7] The most common cause of death in asthmatic patients are cardiovascular diseases.[10] This is then followed by malignancy and infection.[10] In elderly patients, the top three causes of death for asthmatic patients are cardiovascular disease, non-neoplastic lung disease, and neoplastic lung diseases.[10]

Case Report

History

The patient was a 45-year-old female who presented to the office with complaints of asthma, headaches, insomnia, low

back pain, and sinus problems. She had sought previous care from her medical doctor and was on birth control, blood pressure medication, and an inhaler (Ventolin). She denied ever being in an auto accident, knocked unconscious, or fracture of any bones. In the past two years she reported having problems with headaches, chronic sinus issues, asthma, digestive disorders, sciatica, low back pain, and insomnia.

Examination

After the initial intake and history was taken, motion and static palpations were performed, and findings were noted. She reported pain in the cervical spine during range of motion evaluation. Areas of decreased range of motion and uneven paraspinal muscle palpation included C1, T10, and L5. She also received rolling thermography and surface electromyography (sEMG) of the entire spine utilizing Insight technology.

The purpose of thermography is to determine any temperature difference between paraspinal muscles from side to side. These differences are associated with dysfunctions in the autonomic nervous system and has been utilized since the 1920's.[11] temperature differences do not show where the specific misalignments are present, but rather that there is a dysfunction present of the autonomic nervous system.[11]

The overall reliability has been proven to be excellent and is a tool for the assessment of nervous system function.[11] The initial thermography scan shows one to two standard deviations from normal in the following segments: C6, T4, T5, T9, T12-L2, and L4 Three standard deviations from normal were found in the following segments: C1-C3, T10, and L5 (Figure 1).

Surface EMG of the paraspinal muscles was also used as another measurement tool. The purpose of the SEMG is to determine the quality of muscle tone both compared to what is considered normal as well as a comparison from side to side of the paraspinal muscles.[13] This measurement tool is often used due to its convenience for both patient and doctor, convenient, and noninvasive as well as having strong reliability in use.[13] The initial sEMG testing showed bilateral deviations of more than three at C1, C7 on the left, T12 on the left, L3 on the left, and L5 on the right. Deviations of one to two were found at C7 on the right, T1 bilaterally, T2 on the right, and L5 on the left. All other segments appeared normal during this testing (Figure 2).

Technique

The technique of choice in this case is Torque Release Technique™. This technique was founded by Jay Holder D.C. and Marvin Talsky D.C.[14] This method works along the model of the Brain Reward Cascade which gives an understanding of the neurophysiological mechanism of how the mesolimbic system expresses its state of well-being.[14]

If a subluxation is present, it will cause insult to Brain Reward Cascade and thereby to the state of well-being of the individual.[14] Torque Release Technique™ utilizes the analysis from fifteen of the most popular chiropractic techniques and is founded upon the basis of D.D. Palmer's original theory of the chiropractic based subluxations as a tonal model.[15]

This technique was created out of a double blinded randomized control study whose mission was to assess the use of chiropractic treatment and well-being. This study was done on individuals with depression and anxiety at a local addiction center.[15,16] It was found that patients who received torque release technique™ treatments held a 100% retention rate, compared to 75% retention rate for those receiving only chiropractic care, and 56% retention of those who received no adjustments at all and only the standard addiction treatment protocol.[15,16]

The Torque Release Technique™ is different in that it is a non-linear protocol.[15] At one given moment in time, there is one primary subluxation that should be adjusted.[15] There will also never be an adjustment given to the patient in the same order at any given time.[15] The patient is to receive three adjustments a visit maximum, under the theory that with each primary subluxation adjusted nine other secondary subluxations are addressed as well.[16]

This technique also falls into the tonal model, based on the knowledge that the tone of the nervous system is due to the dural attachments of the spinal cord to the bony framework of the spine.[16] By removing any dural tension on the spinal cord, the individual will be able to function at a higher potential.[16] The areas of specific dural attachments include sphenoid, occiput, C1, C2, C5, sacrum, and coccyx; these are also the areas where subluxations are most likely to occur.[16]

In order to deliver reproducible and reliable results with this technique, the Holder Institute created an instrument unique to any other used in the chiropractic profession- the Integrator™, the first FDA approved chiropractic instrument.[14,15] This is a handheld instrument which is able to deliver a third dimensional aspect to the adjustment that no other instrument is able to do.[14] This third dimension utilized is known as torque.[14] The Integrator™ has a pre-cocking tip-sensitive automatic release mechanism which will fire when a predetermined contact pressure is reached, and will fire at 1/10,000 of a second.[14,15] This allows for the chiropractor to know when the adjustment has been delivered.[14] With this pre-determined pressure, this allows for true inter-professional reproducibility.[14,15]

Chiropractic plan

The patient received 68 chiropractic visits over the course of 12 months. The first four weeks the patient was to come in three times a week. For the next 12 weeks the patient was to come in two times per week, and for the last 32 weeks the patient was to come in 1 time a week. The patient would also receive three progress re-assessments over the 12-month period. The adjustments given were through the Torque Release Technique™ method with the use of the Integrator™. At each of the progress re-assessments, thermography and sEMG readings were performed.

Results

At the first re-assessment, the patient reported that she was still suffering from insomnia, but that her low back pain and

headaches had improved by 75%. She marked "mild improvement" for her headaches and low back pain. She also marked "moderate improvement" to her asthma. Postural analysis showed anterior head posture as well as a high left ilium.

The thermography scan showed much improvement. Changes of more than 1-2 standard deviations showed at C1, T6, T9, and L5. Changes for more than three standard deviations was only present at T10 (Figure 3). The sEMG showed improvement as well. Standard deviations of more than 3 were shown at C1 and C3 on the right, and L3 on the left. Deviations of 1-2 were found at C1 on the left, C5 on the right, C7 on the right. T4 on the left, and L5 on the left (Figure 4).

At the second re-evaluation, the patient reported that her insomnia was beginning to have "mild improvement". Her headaches, low back pain, and asthma had "much improvement" over the course of 4 months. Her thermography scan showed deviations of 1-2 at C1, T3,T4, T7, T10, and L5. This scan also showed deviations of 3 at C2-T2, T8, T9 (Figure 5). The sEMG had noted changes as well. Deviations of 3 were found at C1 bilaterally, C3-C7 on the left, and T12 on the right. Deviations of 1-2 were found at C5-C7 on the right, T1-T2 bilaterally, T4 on the left, T6 bilaterally, T8 on the right, L3 on the right, and S1 on the right (Figure 6).

Discussion

The purpose of this case study was to determine the effectiveness of chiropractic care, specifically Torque Release Technique™, on a 45-year-old female asthmatic patient. There was notable improvement in her asthma under chiropractic care. These changes were seen in both her subjective assessment as well as objective findings through both paraspinal thermography readings and sEMG readings.

The thermography findings showed that the nervous system was subsequently responding to the adjustments given to the patient. Thermography is shown to have a direct correlation between significant temperature differences and autonomic nervous system dysfunction as well as being highly reliable in relating to these dysfunctions.[11] The sEMG scans were able to show the activity of the paraspinal muscles. This is a non-invasive and highly reliable form of instrumentation for assessment of the nervous system.[13] The patient showed improvement in the sEMG readings as well.

There are many research articles concerning the use of chiropractic care for asthma control in children and adults, with a much heavier focus on children. Many of these vary from technique used, but all apply the art of chiropractic to determine the outcome of asthma in each of these patients.

Leboeuf et al looked at seven different countries to assess 5,607 individuals on the effect spinal manipulations had on common musculoskeletal complaints. This was a self-reported study as each patient was to answer a questionnaire within two weeks of starting care. It was found that the most common musculoskeletal improvement reported was improved breathing at 27%.[16]

Cuthbert et al discusses a case of a 10-year-old boy who was on 4 medications for asthma attacks and still experienced symptoms during exercise. After the application of applied kinesiology treatments to both the spine and cranium, the boy saw improved respiratory distress as reported by both himself and his parents. It was also reported that the boy was off all four medications for asthma and had no asthma symptoms for two years.[17]

Whittle-Davis et al reported on the treatment of a 23-month-old female with symptoms of asthma which began at 11 months of age. After receiving chiropractic through Diversified and Activator adjustments, her parents reported 90% improvement of all symptoms and no more asthmatic episodes.[18]

One study by Davis et al showed improvement in a 2-year-old male. He was on 2 medications of asthmatic symptoms. He received a combination of Diversified and Activator adjustments. After the course of 4 weeks of care, he was no longer having asthmatic attacks nor taking either of his 2 medications.[19]

A study reported by Dr. Rectenwald demonstrates the improvements of a 19-month-old male patient. His asthmatic symptoms began at the age of 9 months, and at 12 months he was hospitalized for acute respiratory distress. After 7 months of chiropractic treatment using the Othospinology technique, improvements were seen after 8 days. After 9 weeks, all signs and symptoms of asthmatic attacks were no longer present in the child.[20]

Fedorchuck et al wrote on a case study concerning an 11-year-old female. She had been diagnosed with asthma and on several medications to help with allergies and asthmatic triggers. She received chiropractic care through 2 different techniques. The first technique was with the Impulse Instrument, an FDA approved adjusting tool, for the first 7 visits. For the subsequent 19 visits the technique utilized was Chiropractic Biophysics. She showed marked improvement and was free of any asthmatic symptoms.[21]

Another self-reported population study performed by Leboeuf-Yde et al looked at 1,504 patients of Swedish chiropractors. He found that through spinal manipulation, 25-26% of patients who filled out the questionnaire shared that they had a positive experience in relation to their non-musculoskeletal complaints. Of this group, 26% showed improvement in breathing capabilities.[22]

One pilot study from the *Journal of Manipulative and Physiological Therapeutics* by Bronfort et al sought to perform a prospective clinical series with a randomized control group. There was a total of 20 patients placed in the active group, and 10 patients placed in the sham adjustment group while both received typical medical treatment at the same time.

Participants were given 20 treatments over a period of 3 months through the manipulation of dysfunctional joints. The technique was through the use of drop mechanisms. The placebo group was given a sham treatment through the drop

mechanisms by setting the tension very light in comparison to the active treatment. After the 3-month period, it was concluded that children who received the active treatment reported their quality of life to be higher as well as their asthma severity to be lowered.[23]

A literature review performed by Pepino et al looked at 3 different databases for the association between respiratory distress and one of three alternative treatments (chiropractic treatment, osteopathic treatment, and massage therapy). The paper utilized eight different papers for complete analysis. The conclusion of the paper found that manual techniques have proven to be beneficial to children with respiratory distress. The paper did not go into detail as to which manual therapy provided the better outcomes.[24]

A study published by *The New England Journal of Medicine* sought to compare active versus simulated chiropractic manipulations for the treatment of asthma in children.[25] The study concluded that there was no strong correlation between chiropractic treatment and improvement in asthma symptoms.[25] There are several problems with how this study was carried out, therefore skewing the results observed. One such problem includes the sham chiropractic adjustment given. The sham group received a massage in replacement of active treatment.[25]

The massage itself could have caused positive effects on the patients and thereby altering the validity of the sham adjustment.[25,26] Next, patients were required to stay on their medication throughout treatment. It is possible that this medication covered positive effects that occurred during the active treatment. The patients were able to report their progress based upon a questionnaire.[25,26] The ages of these individuals began as young as seven, and it is difficult to rely on a 7-year-old to answer the questions at the fullest level needed in understanding.[25,26] These issues clearly show that this study is unreliable for the interpretation in the comparison of active chiropractic care to sham adjustments.

One case report done by Postles et al shows improvements in asthma in a four-year-old child. The child had experienced asthmatic symptoms of coughing, wheezing, and difficulty with breathing since the teething age. It was unknown as to what triggered his asthma symptoms.[27] The child was put on a Seretide inhaler along with corticosteroids as well as a Ventolin inhaler in case of no symptom relief.[27] Due to the medications the child has increased chest infections, flu symptoms, as well as more regular asthma symptoms.[27] After 2 months of sacro-occipital technique treatment, the mother reported the child no longer experience asthma symptoms.[27]

A 10-year-old boy was found to have improvements in his asthma from Applied Kinesiology techniques. Cuthbert et al reported that the boy had been experiencing occasional severe exercise induced asthma for the past 4 years.[28] He was on several medications for this.[28] Upon receiving adjustments, the child no longer experienced asthmatic symptoms for 2 years.[28]

Finally, a case report by Kachinsky showed improvement in a 3-year-old boy suffering from asthma as well as neurofibromatosis type 1. After receiving chemotherapy to remove an optic tumor, his mother reported that the boy began to experience asthma symptoms.[29] With resolution of the chemotherapy, the asthma attacks increased in severity resulting in hospitalization 2 times per month.[29] He was put on Albuteral inhaler which did not seem to help the symptoms.[29] After a month of chiropractic care the boy ceased to experience any asthma attacks as well as no longer used the inhaler.[29]

Conclusion

Through the use of chiropractic care, it is evident that the proper alignment of the spine results in optimal functioning in the body. Objective measures such as thermography and sEMG, chiropractors are able to note any dysfunctions present in the autonomic nervous system. There are many studies which look into the use of chiropractic for the asthmatic pediatric patient; however, there have not been as many studies performed concerning adult asthma. This is an area of research which would be highly beneficial given the large amount of the population who are asthma sufferers. A continuation of research not only for asthma but also for general lung functioning would be beneficial.

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Appendix

Figure 1. Initial thermography scan of paraspinal muscles. There are significant temperature changes found at C1-C3 on the left, T9 on the right, and L5 on the left.

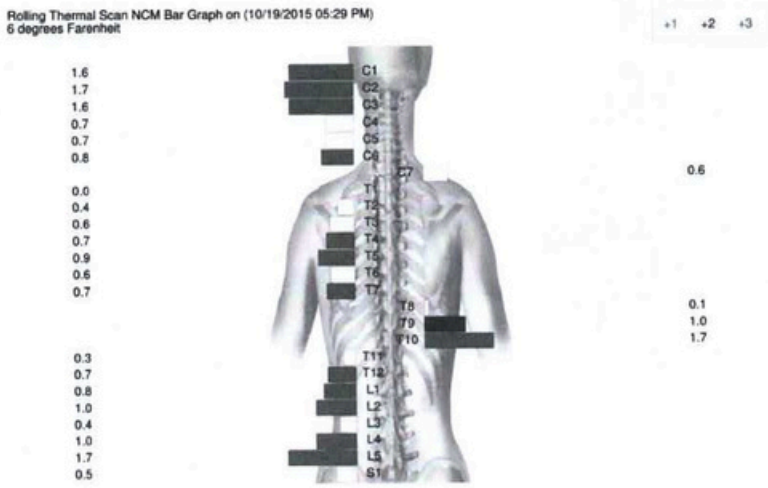


Figure 2. Initial sEMG scan of paraspinal muscles. Hypertonicity is noted at C1 bilaterally, C7-T2 bilaterally, T12 on the left, L3 on the left, and L5 on the right. Hypotonicity is noted at T8-T12 on the right.

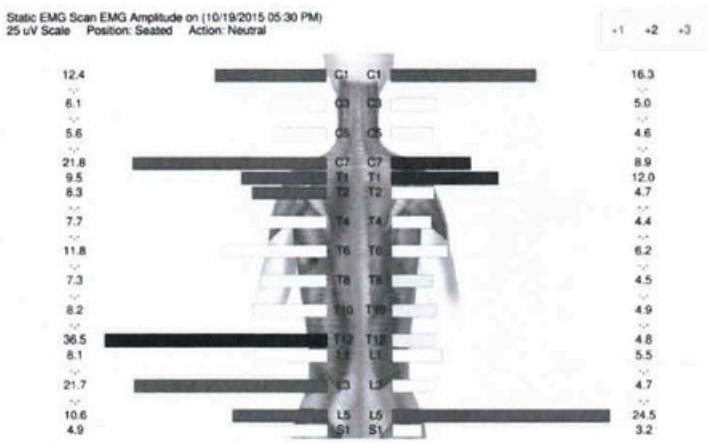
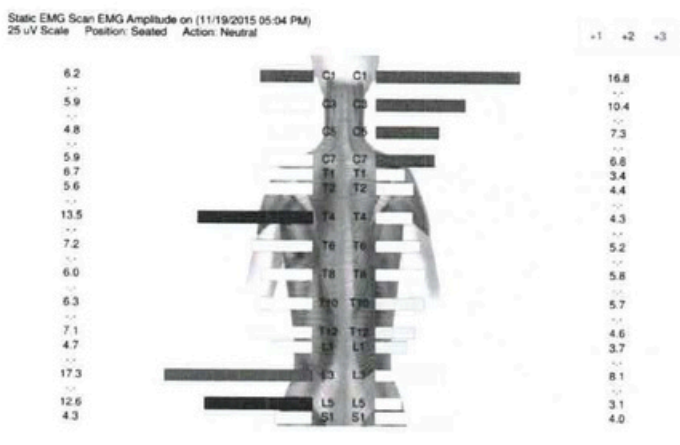


Figure 3. First re-assessment thermography scan of paraspinal muscles. Improvement was noted with significant temperature differences present at C1 on the left, T6 on the left, T9-T10 on the right, and L5 on the left.

Figure 4: First re-assessment sEMG of paraspinal muscles. Improvement was seen with hypertonicity present at C1 bilaterally, C3 on the right, C5-C7 on the right, T4 on the left, L3 on the left, and L5 on the left. Hypotonicity was present from T10-L1 on the right.



Case Study

Resolution of Allergic Asthma in a 38-Year-Old Female Undergoing Chiropractic Care for Vertebral Subluxation: A Case Study & Review of Literature

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Abstract

Objective: To report on the outcomes of a female adult patient suffering from allergy-induced asthma undergoing subluxation-based chiropractic care.

Clinical Features: A 38-year-old female who presented with the primary complaint of allergy-induced asthma. She reported that she had been suffering from asthma since her teenage years. She also complained of allergies, chronic sinus issues, headaches, and leg numbness in her right leg. The patient did not have any previous chiropractic care and was not taking any medications at the time of care.

Interventions and Outcomes: Specific Torque Release Technique adjustments were delivered using the handheld Integrator™ instrument to subluxations within the spine over the course of six months. Surface electromyography and thermography were monitored at the beginning of care and at two progress assessments using the Insight Subluxation Station™ scanning technology. After six months of care, the patient reported complete improvement in her asthma and allergies as well as improvement in her other complaints.

Conclusion: The results of this case suggest that specific chiropractic adjustments delivered to primary subluxations can be beneficial to people with allergic asthma. It is recommended that further research be performed to assess the benefits of chiropractic care in the management of people with asthma.

Key Words: *chiropractic, adjustment, spinal manipulation, asthma, allergy, Torque Release Technique™, subluxation, sinus, thermography*

Introduction

Overview of the Disease

Asthma is a common respiratory condition affecting 25.7 million people with increasing prevalence.[1] Asthma is more frequently seen in children and is the leading cause of pediatric admissions to hospitals, as well as absences from school.[2-3] Data collected by the National Health Interview Survey shows that 9% of children aged 0-17 years of age were suffering from asthma in 2007.[3]

Asthma is more commonly seen in infants, but can continue on from childhood or have an onset in adulthood.[4] The incidence of asthma in children under the age of 12 is higher in boys than girls, but in adulthood, asthma is more common in women than men.[5] In addition to an overall increased prevalence in females, female patients are more likely to suffer from the more severe signs and symptoms when compared to their male counterparts.[5] In addition, females tend to have greater comorbidity with allergies, which may contribute to the increased severity of asthma found in females.

Asthma is a condition that has high variability in the progression of the disease; while some patients can recover quickly and completely, others may suffer from symptoms of asthma through their adulthood.[4]

There are two main presentations of asthma: allergic asthma and non-allergic asthma.

Allergic asthma, also referred to as atopic or extrinsic asthma, typically has an onset in childhood or teenage years.[4,6] Allergic asthma occurs when an individual is exposed to irritants in the environment such as plant pollen, mold, dust

mites, cold air, exercise, smoke or animal dander.[7-8] The allergens that exacerbate asthmatic individuals are usually allergens that the individual did not encounter in their childhood, whether it is due to climate change, location change, or other factors.[4] A large risk factor for allergic asthma is a family history of asthma, particularly parental allergic asthma.[6] Fortunately, allergic asthma is not usually a debilitating condition, and typically will not change or progress with age.[4] However, the first asthma attack will occur earlier in life.[9] Allergic asthmatics are more likely to die of acute asthma.[10] Increased severity of asthma is seen in May, June, September and October.[10]

In non-allergic asthma, the onset typically occurs in adulthood, commonly following a viral respiratory infection.[6] Non-allergic asthma is seen more commonly in females.[9] The ratio of males:females for non-allergic asthma is 1:2 while with allergic asthma it is 0:8. These patients will not have exacerbated asthmatic reactions to external allergens or irritants. However, asthmatic attacks in non-allergic asthma patients are typically more severe than the attacks seen with allergic asthma.[9] Non-allergic asthmatics are more likely to die of a severe asthma attack.[10] Non-allergic asthma has increased severity in the months of January, February, March and April.[10]

Allergic and non-allergic asthma is differentiated based on reactions to skin tests using aeroallergens.[9] A positive test will show increased serum IgE antibodies. Increased IgE antibodies are characteristic to allergic asthma. However, while IgE is commonly seen in increased amounts in patients with allergic asthma, it is not a typical presentation seen in patients with non-allergic asthma.[6]

Risk factors for asthma include having a history of hay fever or a history of allergic dermatitis.[9] Other risk factors for young adults include low socioeconomic status, being African American, substance abuse, food allergies and allergies to extrinsic allergens.[4,7]

Pathophysiology

Asthma is still not completely understood in its pathophysiology and treatment. Despite an unclear pathology, however, it is certain that there are many structural changes apparent with asthma. Structural changes seen include the presence of Charcot-Leyden crystals in the sputum. Charcot-Leyden crystals are formed by eosinophils and aggregate within exudate present in the sputum of Curschmann's spirals.[11] The presence of the exudate leads to changes in the lumen within the airway, resulting in the formation of mucus plugs.

Contributing to mucus plug formation is bronchial wall hypertrophy, which occurs when hyperplasia of both the mucus glands and bronchial smooth muscle occur within the walls.[12] The exudate with the bronchial wall hypertrophy is associated with an inflammatory reaction where the capillaries are dilated allowing infiltrate to enter. This infiltrate contains eosinophils and immunoglobulins and results in interstitial edema.[13] The effectors of the inflammation are mast cells, which are in the deep submucosa of the upper lung airways.[11] These mast cells are typically located near the tight junctions of the basement membrane.

The balance of bronchodilation and bronchoconstriction, dependent on the nervous system, determines bronchial smooth muscle tone. The airway smooth muscle cells contain β_2-adrenergic receptors that are activated by the sympathetic nervous system resulting in relaxation of the bronchial smooth muscle and bronchodilation.[12] The parasympathetic nervous system complements this by acting on airways directly and resulting in bronchoconstriction and increased mucus secretion. Bronchoconstriction of the airways could be explained by the various nerve receptors located in the bronchi that allow for rapid shallow breathing.[11]

Through a reflex mechanism, the nerve receptors send out signals through the afferent nerves, which are located near the tight junctions of the cells, in response to external irritants such as dust, smoke and allergens. After the signals are processed, efferent nerves, which lead back to the basement membrane, cause the smooth muscle walls of the airway to constrict leading to hyper-reactive bronchospasm.[11] Based on this knowledge, a proposed mechanism of asthma is a hyperactive parasympathetic nervous system or deficiency in the airway smooth muscle cells to bronchodilate.[12] Hogg attributes the hyperactivity of the bronchospasm to an impaired nerve connection and reflex mechanism.[11]

A third component of the nervous system involved in the pathophysiology of asthma is referred to as the non-adrenergic, non-cholinergic (NANC) nervous system that is widely known to control gut functions.[14] In addition to being involved with the gut, the NANC nervous system has been shown to be associated with the urogenital tract, eye function, cardiovascular system, and the pulmonary system. Recent research indicates that the NANC nervous system plays an important role in how the airways may act irregularly in asthma.[12]

Afferent nerves contain nociceptive receptors that respond to harmful stimuli by releasing excitatory neuropeptides that lead to bronchoconstriction, vasodilation and increased mucous secretion, which is a typical function of the parasympathetic system.[12] The NANC efferent nerves, however, release inhibitory neuropeptides that cause bronchodilation. Research suggests that the NANC nervous system may be functioning improperly, and since this is the primary inhibitory neural system in the airways, causing hyperactive bronchoconstriction.[14] However, it is still unclear how the NANC nervous system plays a direct role in asthma.[12]

Asthma and Allergies

Asthma and allergies are closely associated with allergens commonly accepted to be a causative factor for asthma.[12] Allergens that are ingested or inhaled first contact the bronchial airways at the mucosal surface.[13] B cells produce immunoglobulin E (IgE) that stimulates mast cells and basophils to release mediators such as histamine, leukotrienes, prostacyclins, and cytokines that exacerbate asthmatic reactions.[12] The mast cells are triggered to release pro-inflammatory chemical mediators leading to hypersensitivity reactions when crosslinking of the IgE antibody by the antigen occurs.[13] The first mediator proposed for the pathogenesis of

asthma was histamine, due to the presence of histamine in early animal studies on allergic anaphylaxis.[12] Another mediator discovered to be involved in asthma was a slow-reacting substance of anaphylaxis (SRS-A), which leads to anaphylaxis in addition to causing bronchoconstriction, increased capillary permeability, increased mucous secretion and increased recruitment of eosinophils.[12] Other mediators found to be involved include arachidonic acid products such as leukotrienes, prostacyclins, and cytokines.

Inflammatory cells, such as eosinophils, neutrophils, lymphocytes, and macrophages, have been shown to lead to inflammation within patients with asthma causing changes in the smooth muscle of the airways such as hypertrophy of bronchial smooth muscle, hyperplasia of the mucous glands, thickening of the basement membrane, injury to the epithelial cells, metaplasia of the mucous cells and leukocyte build up within the epithelium of the airway.[12]

Evaluation

Evaluation of an asthmatic patient typically includes a detailed medical history, past medical history, family history of asthma and assessment on the effects of symptoms on activities of daily living.[3] In pediatric patients, birth weight, date of birth, gestational age, and gender may be taken into account.[8] Considerations may also include duration of breastfeeding, presence of pets or siblings, history of respiratory conditions and if the patient attends daycare. Objective measures taken assess the pulmonary function of the individual using spirometry, typically measuring forced expiratory volume (FEV). When FEV increases by 12% with administration with bronchodilators, this indicates airway obstruction as seen in asthma.[3]

Treatment

Treatment options for asthma have evolved significantly since the discovery of the disease. Early treatment of asthma focused on treating the bronchospasm seen with asthma with natural bronchodilators, like coffee and tea.[6]

Unfortunately, while there have been many therapeutic treatments made available for asthmatic patients, there has yet to be a definitive cure available for asthma. Current available medications (antihistamines, anticholinergics, corticosteroids, theophylline, adrenaline) provide temporary relief of symptoms, but will not completely treat the problem.[2]

Treatments for asthma include:

- Xanthines
- β_2 agonists
- Anticholinergics
- Cromones, antihistamines and ketotifen
- Corticosteroids
- Antileukotrienes
- Complementary and Alternative Medicine

Early treatment for asthma included natural bronchodilators through xanthine like coffee and tea to address the bronchospasm by inhibiting phosphodiesterase (PDE), resulting in bronchodilation.[6] Hirsch first discovered theophylline, a PDE inhibitor, as an effective treatment for asthma in 1922 and was used as a treatment for decades. Theophylline proved to be effective initially but had many side effects causing a decline in use as a treatment.

β_2 agonists act by relaxing the smooth muscles within the airways of the bronchi. However, while β_2 agonists may relieve symptoms short-term, it does not address the chronic inflammation present within the airways.[15] Long acting β_2 agonists (LABAs) prove to be successful in controlling the symptoms of asthma. However, research shows that long-term use of LABAs lead to increased risk morbidity and mortality in asthma deaths.[2,6]

The "asthma cigarette," which contains alkaloids from the Belladonna plant, causes acetylcholine to inhibit muscarinic receptors, therefore resulting in bronchodilation. Anticholinergics are not commonly used as primary treatments for asthma today but are beneficial for patients that are genetically predisposed to experience complications from β_2 agonists.[6]

Cromones, also known as "mast cell stabilizers," prevent mast cells from releasing histamine and other pro-inflammatory mediators when stimulated by IgE.[6] Cromones are used today to treat mild cases of asthma. Antihistamines and ketotifen, a drug that inhibits mast cell release of pro-inflammatory mediators, have shown to be ineffective.[2,6]

Corticosteroids are a relatively recent discovery for treatment of asthma. First used around fifty years ago, corticosteroids were given to asthmatic patients intravenously and orally.[6] Initially, the corticosteroids proved to be successful in managing the symptoms of asthma, but were later shown to produce many side effects from long-term corticosteroid use, such as stunted growth and bone demineralization.[2] The first topical corticosteroid, beclomethasone diproprionate, was introduced in the 1970s and effectively treated asthma without the mentioned side effects.[6] Inhaled corticosteroids gained popularity in the late 20th century once the inflammatory paradigm of asthma became clear. Today, corticosteroids prove to be the most effective treatment of asthma with its anti-inflammatory properties.

Leukotrienes have been shown to have many similarities to the symptoms of asthma by causing hyper-reactivity of the airway smooth muscle, inflammation, and structural changes within the airways.[6] Anti-leukotrienes effectively reduce inflammation seen with asthma and provide relief in asthmatic patients.[2]

Research has yet to prove the efficacy of complementary and alternative medicine (CAM) therapies for treatment of asthma. However, it is suggested that certain therapies such as deep breathing techniques and yoga may aid with controlling asthma symptoms.[16-17] More individuals are searching for alternative methods of treatment for their asthma by seeking CAM therapies such as acupuncture, homeopathy, hypnosis, massage, herbalism, etc.[15-18] It appears that patients suffering from severe asthma, chronic asthma and lack of positive changes are seeking out CAM as an alternative to medicine in order to alleviate their symptoms.[19]

The purpose of this paper is to discuss the positive health outcomes in a patient with asthma undergoing chiropractic care.

Review of the Literature

Chiropractic care is widely known to treat musculoskeletal symptoms such as neck and low back pain. However, chiropractic has seen success in treating non-musculoskeletal symptoms, beginning from the first adjustment by DD Palmer[20]. Chiropractors have been addressing non-musculoskeletal symptoms on the premise that misalignments, or subluxations, in the spine will cause nerve interference, which can lead to dysfunction even in the visceral organs.[20] Most chiropractors do not place importance on the treatment of patient's symptoms but rather on providing chiropractic adjustments to misalignments in the spine to reduce vertebral subluxation with the potential of indirectly helping the symptomatic complaints.[21]

Neuropathophysiology addresses dysfunction within the nervous system because of a subluxation in the spine.[2] As previously mentioned, a proposed hypothesis for asthma is dysfunction of the nervous system resulting in hyper-reactivity of the airway smooth muscle causing bronchoconstriction in asthma. Theoretically, a subluxation in the spine could be the cause of the dysfunction in the nervous system and thus, a chiropractic adjustment to the spine could alleviate the nervous system dysfunction leading to decreased bronchospasm to cause improvement in asthmatic symptoms.[2]

A chiropractic adjustment can create a somato-visceral response through a reflex arc and therefore serve as an option to treat asthma.[7] Blum suggests that "there are specific vertebra that are associated reflexly with the lungs, diaphragm and adrenal glands" and goes on to associate the third thoracic vertebra in the spine to the lungs.[22]

Several studies have been done to determine if chiropractic care can improve asthmatic symptoms. A systematic review of literature performed by Kaminskyj et al. gathered eight studies performed on chiropractic care on patients with asthma consisting of one case series, one case study, one survey, two randomized controlled trials, one randomized double blinded cross over trial, one single blind cross study trial and a self-reported questionnaire. Three of the studies showed no statistical difference between objective measures (spirometry readings), six of the studies showed improvement in subjective measures (lower impairment ratings, increased quality of life, decreased medication use, improved breathing, improvement of non-musculoskeletal symptoms) and two studies showed positive objective findings (peak flow).[2-3]

Particularly, one study performed by Bronfort et al. subjects rated their quality of life to be higher and asthma severity to be lower because of chiropractic care, which stayed consistent on a follow up study a year later.[15] A positive finding in this systematic review is that no patients reported any negative or worsening outcomes while under chiropractic care.

While there were positive objective findings in two of the studies, Kaminskyj et al. suggests that the studies did not have enough randomization to groups, blinding of participants or specific outcomes. Although there was a trend of improved subjective findings and some objective findings, none were statistically significant. In conjunction, a systematic review completed by Hawk et al. showed that evidence from controlled studies showed improvement in symptoms and decrease in medication use in patients with asthma under chiropractic care.[24]

A study by Rectenwald details a 19-month-old child case that was diagnosed with severe asthma and treated with chiropractic adjustments. This child improved completely after 9 weeks of care and no longer suffered from difficulty breathing, wheezing or coughing.[7] Another study performed by Davis and Byrley showed improvement in asthma symptomatology after just 4 adjustments over 3 weeks.[8]

An article was published by the New England Journal of Medicine in 1998 reporting that chiropractic care was of no benefit to children suffering from mild to moderate asthma.[25] Balon et al. conducted this study that was questionable in nature. Kent responded to the study pointing out inconsistencies. Kent lists the first and most significant flaw of the study to be the lack of differentiation between the active chiropractic adjustments and the sham adjustments.[26]

He points out the lack of mention on analysis performed and objective measures recorded for the patients to see if they had any subluxations or if actual subluxations were even addressed. This opinion is shared by Rosner in his statement, who goes on to point out other inconsistencies. He states that the effects of chiropractic care may have been masked by the medications that all of the patients were taking during the study and emphasizes that the study done by Balon et al. could only conclude that chiropractic care did nothing for asthma when combined with medication use.[27] Rosner also points out that there were improvements seen with decreased medicine use and daytime symptoms with increases in peak expiratory flow, which Balon et al. failed to mention in his conclusion.

Case Report

Patient History

A 38-year-old female presented with allergy-induced asthma that began when she was a teenager. The patient also complained of allergies that she had also been suffering from since she was a teen. She rated the severity of her allergies as an 8/10 at the initial visit. In addition, the patient also complained of chronic sinus issues, headaches, and leg numbness. The patient denied any medication use or previous chiropractic care.

Examination

The doctor completed a physical examination on the patient after a history intake for family history, past history, and current illness. As part of the physical examination, chiropractic analysis was employed using static and motion palpation. Pain and discomfort, asymmetry with postural deficits, decreased range of segmental motion, and spasm of the surrounding musculature were found at C1, C7, T4, and L4.

In addition to the chiropractic analysis, the Chiropractic Leadership Alliance Insight Subluxation Station™ was used to take thermal and surface electromyography (SEMG) scans paraspinally. Paraspinal thermography is widely used by chiropractors as it detects heat production using infrared scanners. The autonomic nervous system, composed of the sympathetic and parasympathetic system, work in balance to regulate body heat. Theoretically, the surface skin temperature readings should be symmetrical paraspinally.

The premise is that although skin temperature will change depending on the person and the environment but should stay symmetrical with a normally functioning nervous system. Paraspinal thermography has been shown to have high inter- and intra-examiner reproducibility. It has also been shown that using infrared thermography is a valid method of measuring paraspinal skin surface temperature.[28-30]

SEMG is used by chiropractors to evaluate the motor aspect of the nervous system. The SEMG scan places electrodes on the skin surface to examine muscle tone. SEMG scans are helpful in evaluating asymmetrical muscle contraction, muscle splinting, severity of conditions, aberrant muscle recruitment patterns, dysponesis, responses to dysafferentation and responses to chiropractic adjustments.[31] SEMG has been found to have high inter- and intra-examiner reliability.[32]

The initial thermal scan revealed temperature asymmetries in multiple areas of the spine, See Figure 1. There were differences greater than one standard deviation (green) at vertebral levels T3, T8 and T9. There were differences greater than two standard deviations (blue) at vertebral levels C1, C2, C6, T7, T11 and L4. There were differences greater than three standard deviations (red) at vertebral levels C7, T1, T2, T4, T5, T6, T12, L1, L2, L3. In total, there were thermal asymmetries found at nineteen different levels.

The initial SEMG scan revealed tonal asymmetries in multiple areas of the spine, See Figure 4. There were differences greater than one standard deviation (green) at left C3 and left L1. There were differences greater than two standard deviations (blue) at bilateral C5. There were differences greater than three standard deviations (red/black) at right C1, left L5 and right S1.

Chiropractic Care Plan

Based on the patient's history intake and physical examination, the doctor recommended a care plan of 60 chiropractic visits over 12 months. In this care plan, the patient would have office visits in three phases: adjustments 3 times a week for 2 weeks, followed by 2 times a week for 8 weeks and lastly 1 time a week for 38 weeks. Specific, consecutive Torque Release Technique™ (TRT) adjustments were delivered using the handheld Integrator instrument to subluxations within the spine.

Three progress reassessments would take place in between the different phases of care. Progress assessments consisted of chiropractic analysis, subjective findings, and thermography and SEMG scans.

Chiropractic Technique Utilized

TRT is a technique developed by Dr. Holder and Dr. Talsky.[33] Dr. Holder conducted a large human population study in a residential addiction treatment setting. This study was a randomized clinical trial setting, double blinded with placebos. The study showed that participants who received chiropractic care had a 100% retention rate in the addiction treatment center, with noted improvement in anxiety and depression.[34]

TRT was developed as a tonal model and is non-linear in its testing priorities. This technique is focused on relieving cord tension through specific adjustments to primary subluxations with the Integrator™. Under this technique, primary subluxations typically occur in the areas of dural attachment, such as the upper and lower cervical spine, sacrum, coccyx, and pelvis. A subluxation is a result of cord tension within the spinal cord leading to dysfunction in the body.

TRT employs a hand-held instrument called the Integrator™, approved by the FDA, that was originally designed for the initial study Drs. Holder and Talsky conducted. The Integrator™ fires at a speed of 1/10,000 sec. and is pre-loaded and placed on the segmental contact point of listing. The Integrator™ is built with a tip that is sensitive to pressure and will release automatically when placed firmly on the segmental contact point. This aspect of the Integrator™ is crucial for inter-examiner reproducibility.[34-35]

TRT seeks to find the primary subluxations present within the spine using the indicators of disease and spinal subluxation divided into 5 categories: Observation, Palpation, Cervical Syndrome, Bilateral Cervical Syndrome and Derifield. Observation includes postural faults, abnormal breathing patterns, congestive tissue tone, inappropriate sustained muscle contractions, functional leg length inequality, abduction tendency, foot flare and foot pronation/supination. Palpation involves scanning for abnormal temperatures, tissue tone, static and motion palpation, and heel tension.[34]

Outcomes

The patient had her first progress assessment approximately 1 month after beginning care with 3 office visits per week. Her second progress assessment took place approximately 6 months after beginning care with 2 office visits a week. The patient is currently still active on her care plan, now visiting 1 time a week.

During the patient's first progress assessment, the patient reported that she experienced considerable improvement with her asthma. The patient also reported that her ability to function had improved 40% since her initial presentation. In addition, the patient stated that she saw moderate improvements in her headaches and leg numbness, and mild improvement with her sinus issues.

In the first progress assessment, the thermal scan reveals temperature asymmetries in multiple areas of the spine, See Figure 2. There are differences greater than one standard deviation (green) at vertebral levels C4, T4, T7 and T10.

There are differences greater than two standard deviations (blue) at vertebral levels C3, C5, C6, C7, T1 and L5. There are differences greater than three standard deviations (red) at vertebral levels C1, C2 and T9. In total, there are thermal asymmetries found at thirteen different levels. When comparing the patient's initial thermography scan to the results of her first progress assessment, See Figures 1-2, patient improvement is noted. Overall, there is a decrease in the total number of thermal asymmetries found at the spine from nineteen on the initial scan to thirteen on the first progress assessment scan. In addition, there is a decrease in the number of segments with asymmetry of greater than three standard deviations from ten on the initial scan to three on the first assessment scan.

The first progress assessment SEMG scan reveals tonal asymmetries in multiple areas of the spine, See Figure 5. There are differences greater than one standard deviation (green) at right T1. There are differences greater than two standard deviations (blue) at right C3 and left T8. There are differences greater than three standard deviations (red/black) at bilateral C1, bilateral C5, left C7, left T10, left L3, bilateral L5 and left S1. When comparing the patient's initial SEMG scan to the results of her first progress assessment, there are changes present, See Figures 4-5. The first progress assessment SEMG scan shows an overall increase in number of segments with tonal asymmetries in the spine.

During the patient's second progress assessment, the patient reported that she experienced complete improvement with her asthma with no symptoms bothering her. She noted that she experienced complete improvement with her allergies. The patient also stated that she experienced significant improvement with her headaches and leg numbness with complete improvement with her sinus issues.

The second progress assessment thermal scan reveals temperature asymmetries in multiple areas of the spine, See Figure 3. There are differences greater than one standard deviation (green) at vertebral levels T3, T8, T10 and T12. There are differences greater than two standard deviations (blue) at vertebral levels C1, C7, T2 and T9. There are differences greater than three standard deviations (red) at vertebral levels T1, T4, T5 and T6. In total, there are thermal asymmetries found at twelve different levels.

When comparing the patient's initial thermography scan to the results of her second progress assessment thermography scan, patient improvement is noted, See Figures 1 and 3. Overall, there was a decrease in the total number of thermal asymmetries found at the spine from nineteen on the initial scan and thirteen on the first progress assessment scan to twelve on the second progress assessment scan, See Figures 1-3.

The second progress assessment SEMG scan reveals tonal asymmetries in multiple areas of the spine, See Figure 6. There are differences greater than one standard deviation (green) at left C3, bilateral C5, left C7, left T1, right T2, right L1, left L3, and right L5. There are differences greater than two standard deviations (blue) at right S1. There are differences greater than three standard deviations (red/black) at bilateral C1, bilateral T12 and left S1. When comparing the patient's initial SEMG scan to the results of her second progress assessment, there are changes present, See Figures 4 and 6. The second progress assessment SEMG scan shows an overall increase in number of segments with tonal asymmetries in the spine. However, when compared to the first progress assessment SEMG scan, a decrease in the number of segments with tonal asymmetries greater than three standard deviations in the spine is noted, See Figures 5-6.

Discussion

The purpose of this case study was to document the outcomes of chiropractic care on a 38-year-old female patient suffering from allergy-induced asthma. This case study demonstrates the positive effects of subluxation-based chiropractic care on non-musculoskeletal conditions, namely asthma.

Subjective findings show that the patient had complete improvement in her allergy-induced asthma. In addition, the thermography scans gathered using the Chiropractic Leadership Alliance Insight Subluxation Station™ demonstrate objective improvement in thermal asymmetry in her spine. The patient also saw a decrease in the number of segments with tonal asymmetries when comparing the first assessment SEMG scan to the second assessment SEMG scan. It is unclear why both assessments' SEMG scans do not show improvement when compared to the initial scan but may be attributed to various factors such as inconsistent scanning protocol or patient activities.

Asthma has been an obscure disease with neither a complete pathophysiology nor a definitive treatment for many years. It is a common condition in the United States, in both children and adults. As a common condition, many scientists have attempted and successfully discovered various therapeutic treatments for the disease, but there is still no definitive cure for asthma. As a result, many asthmatic patients have been seeking alternative therapeutic options such as CAM care. As shown through this case study, chiropractic intervention may serve as a different and successful approach to the management of people with asthma.

TRT is a subluxation-based technique that aims to find the primary subluxations within the spine, using specific and gentle adjustments with the Integrator™ instrument. TRT chiropractic adjustments are delivered to release any cord tension within the spinal cord allowing the nervous system to function without any nerve interference, allowing visceral organs to function properly.

As previously mentioned, a current hypothesis for the pathophysiology of asthma is that erratic nerve function may be causing the bronchial hyper constriction seen in asthmatic patients. In this model, a chiropractic adjustment delivered to the area of subluxation causing nerve dysfunction may allow proper neural input into the airways allowing for normal function through a somato-visceral response.

The lack of objective measurements of lung function present within this case study serves as a weakness. It is suggested for future studies that objective measurements for asthmatic patients include lung function tests and spirometry.

Conclusion

This case study outlines the history, symptomatology, treatment, and outcomes of a 38-year-old woman suffering from a history of allergy-induced asthma. After 6 months of chiropractic care with the TRT technique, the patient reported that she saw complete improvement in her asthma. She also saw significant improvement in her other complaints. This case supports chiropractic care in the management of people with non-musculoskeletal conditions, namely asthma. Further research is necessary to further explore the role of chiropractic for people with asthma.

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Appendix

Figure 1. Initial Thermal Scan

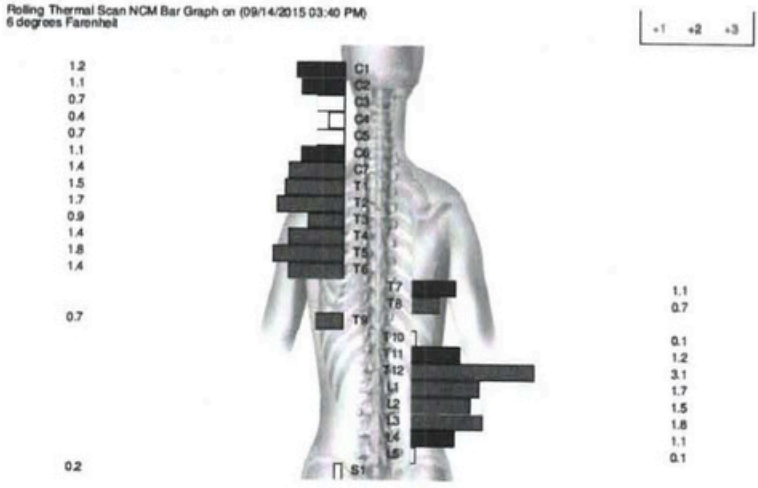

Figure 2. First Progress Assessment Thermal Scan

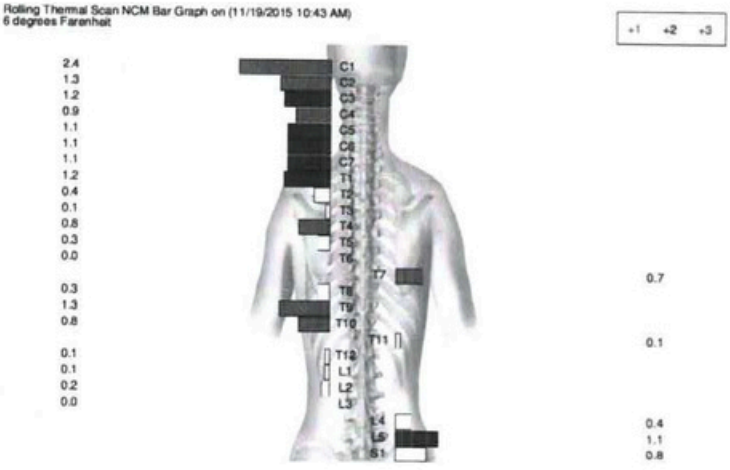

Figure 3. Second Progress Assessment Thermal Scan