CASE STUDY

Resolution of Tic Disorder in an 8-Year Old Boy Following the Grostic Technique: A Case Report

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ABSTRACT

Objective: The purpose of this paper is to discuss the effects of chiropractic management with a child medically diagnosed with a tic disorder.

Clinical Features: The patient was an 8-year-old boy who presented to the chiropractor after being diagnosed by his pediatrician with a tic disorder. Patient history revealed that the tics began at the age of 5 with head nodding and twisting of the head. The chiropractic examination revealed upper cervical subluxation, there was restriction on the left C0-C1, paravertebral muscle spasm on the right of C1-C7, edema on the left of C2, and tenderness at the C2 dorsal root ganglion.

Intervention and Outcomes: The treatment plan utilized the Grostic Procedure. Over the course of 7 months the patient was seen 12 times and adjusted twice at the atlas. There was complete resolution of the tic disorder and continued follow up care showed no return of the tics after 1 year.

Conclusion: The result in this case suggests that the Grostic Procedure may be responsible for the reduction and elimination of the neurological symptoms in this patient. The results in this case lend support to the subluxation based care of children with motor tic disorders.

Key indexing terms: *chiropractic, motor tic disorder, tic disorder, vertebral subluxation complex, subluxation, tics, Grostic Procedure, thermography*

Introduction

Tics are described as rapid involuntary contraction of skeletal muscle in functionally related groups, they are nonrhythmic stereotyped movements or sounds.[1,2] These tics occur primarily between the ages of 3-10. Tics lasting over the span of 1 year are considered to be chronic. There are two kinds of tics, simple (focal movements in 1 muscle group) and complex (sequential patterns of movements in >1 muscle group). Simple tics consist of blinking, facial twitches, head jerks, upper extremity movements, coughing, humming, and shouting. As for complex tics, they include jumping, spinning, throwing, echopraxia, copropraxia, palilalia, coprolalia, and echolalia.[3] Tics can easily resemble other movement disorders such as stereotypies, dystonia, chorea, ballism, and myoclonus.[3] The literature discusses the prevalence of this disorder in children to range from 1%-29%, higher in boys, and those in the special education population.[4-7]

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Following is the known criteria for tics from the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV):[8]

1. Transient tic disorder (TD) requires:
   - ●Single or multiple motor or vocal tics
   - ● Tics may occur multiple times a day
   - ● Lasting for at least 4 weeks
   - ● No longer than 12 consecutive months
   - ●Onset before the age of 18 years old
   - ● Disturbance is not due to the direct physiological effects of a substance or medical condition
   - ● Criteria have not been met for Tourette or chronic motor or vocal tics.

2. Chronic motor or vocal tic disorder (CTD):
   - ●Single or multiple motor or vocal tics (but not both)
   - ●Tics may occur every day or intermittently throughout a period of more than 1 year
   - ●During this period there was never a tic-free period of more than 3 consecutive months
   - ●Onset before 18 years old
   - ●Disturbance not due to any general medical condition

It has been postulated that the underlying cause of tics arise from a defect in the cortico-striatal-thalamo-cortical circuits, abnormalities with neurotransmitters in the synaptic cleft, and/or a genetic abnormality.[9,10] Within the corticostriatal-thalamcortical pathway the argument is that there is either an excitation or diminished inhibition causing disruption in the frontal cortex, leading to abnormalities in the secretion of neurotransmitters (i.e. dopamine, serotonin).[9,10]

There is research that suggests a possible connection between acquiring a streptococcal infection and the commencement of a tic disorder. After being diagnosed with pediatric autoimmune neuropsychiatric disorders associated with streptococcal infection (PANDAS), research showed that antistreptolysin O titers were elevated in 38% of children with tics, there is still controversy regarding this theory.[1,10] There remains to be an unknown etiology which prolongs the development of a cure for this disorder. The literature related to tic disorder history says that there is a marked decline during the course of adolescence.[6]

Comorbid conditions

In addition to tics, many children suffer from obsessive-compulsive disorder (OCD), attention deficit/hyperactivity disorder (ADHD) and Tourette's syndrome (TS).[1,3,6,7,11] Tourette syndrome is a neurological disorder manifested by vocal or motor tics which are usually suppressible for a brief moment in time and worsen with stressful situations.[8] It was first described in a French noble woman, the Marquise de Dampierre, by Itard in 1825.[7] The term "waxing and waning" is often used to describe the variation of severity.[7]

One in 2000 children have it and boys are four times more likely.[6] ADHD is a common result of these disorders, leading to disruptive behavior such as outbursts, disobedience, and fury.[11] As tic severity increases it is accompanied by OCD which is said to be seen in 1/3 of patients with a tic disorder.[1,12] Most children affected by OCD are without sex bias.[6] The characteristics with OCD would also include intrusive repetitive actions, and ritualized behavior on a daily basis.[6] This can easily be missed because these signs normally take place in the privacy of one's home. A cohort study by Scharf et al. showed the association between chronic vocal and motor tics and the development of OCD in 8% and ADHD in 33% of the studied population, concluding that in population-based samples OCD and ADHD has been reported in clinically ascertained TS cases.[6]

Some treatments considered are targeted counseling, psychotherapies, anger management, and various types of medication. It is unfortunate that OCD, ADHD often accompany the tic disorder causing a child to be more susceptible to significant injury, depression, learning disabilities, anxiety, sleep disorders, and developmental disorders. This paper discusses the effects of chiropractic care for the management of a child with a tic disorder.

Case Report

Patient history

An 8-year old boy's mother sought chiropractic help after being diagnosed by his pediatrician with a tic disorder (TD). According to the mother, the boy began having symptoms from the age of 6, starting with head nodding, and twisting multiple times a day. During major growth spurts the tics increased in intensity, and became continuous, occurring 1-2 times per minute. She did not report any other neurological signs or symptoms.

She worried mainly that this condition was keeping her son from experiencing a normal childhood, producing a decrease in self-esteem, and feeling of being an outcast from his peers. She informed the doctor that he had previously been seen by a chiropractor using the Gonstead technique, yet according to the mother the tics got progressively worse within 6 months of treatment. Past history of the patient revealed that the mother had a normal pregnancy and a non-complicated birthing process.

The immunizations of the child were up-to-date according to the guidelines of the Division of Public Health in the state of Florida. He reached all his developmental milestones in the appropriate time frame given by the Centers for Disease Control and Prevention. The mother denied a history of disease, current or previous medications, hospitalizations, auto accidents, or personal traumatic injuries.

Chiropractic Examination

After a thorough evaluation of the patient's history, a physical exam was performed by the attending chiropractor. He found normal (+2) bilateral upper/lower extremity reflexes, and normal (5/5) upper/lower motor muscle testing. The following orthopedic exams were all found to be negative: Tinel's Sign, Phalen's test, Soto-Hall, Lhermitte's, Laseque's, Braggard's, Homan's, Shoulder Decompression, Cervical Distraction, O'Donahue Maneuver of cervical spine, Fajersztajn's, Laquerres, Patricks, Modified Trendelenberg, Cervical Compression, and Ely test. Upon spinal palpation there was motion restriction on the left at C0-C1, paravertebral muscle

spasm on the right from C1-C7, and edema was present on the left at the C2 transverse process. Cerebellar function evaluation with Romberg's and Heel to Shin were also negative. Gait was normal with heel walk and toe walk. Range of motion in initial report showed a decrease in lumbar flexion (50 degrees), and right cervical rotation (45 degrees), all other findings were within normal limits.

The supine leg length was performed to determine the leg length inequality in order to determine neuromuscular dysfunction and vertebral subluxation.[13] As the patient laid supine on the firm table with legs hanging approximately 6" off the table, the doctor assessed the patient's functional leg length. The patient had a physiologically short leg of ¼" on the right. A leg length inequality, in chiropractic, can indicate nerve imbalance and subluxation.

There was an assessment of the upper cervical spine using specific radiographs that correlate with the Grostic Procedure technique; the nasium, lateral, and vertex views.[14] The Grostic Procedure uses an orthogonal analysis that calculates the height and rotation vector for each patient.[14] The atlas listing or vector coordinate was determined by using the Grostic Procedure analysis by taking measurements from lateral, nasium and vertex cervical radiographs. The analysis allows for a three dimensional calculation to determine Atlas laterality and rotation.[14]

These factors were measured by using a central skull line and an atlas plane line relationship on the nasium view and central skull line and mid-foraminal relationship on the vertex view. The transverse plane line deviation was measured from the nasium view. All measurements were collected in degrees and the vector coordinate was calculated from those measurements. The analysis for this patient revealed anterior translation, left lateral malposition of C1, and anterior rotational malposition on the left at C1. The Grostic Procedure listing was charted as atlas left high 2.5, anterior 2, spinous inferior 7, contralateral. These findings led to the diagnosis of a cervical spine subluxation of C1 (739.1) a diagnosis of transient tic disorder (307.21) and muscle spasm (728.85).

Chiropractic Management

During the chiropractic evaluation the patient presented with a right cervical lateral flexion motor tic that was uncontrollable.

The atlas misalignment was carefully addressed using the Grostic protocol. The patient was gently placed with his left side up on a Grostic table. Using the vector calculated from the radiographs, the patient required a height factor of high 2 ½ inches, and a rotational correction of anterior 2 inches. There was an inferior torque implemented to return the rotation of axis to its proper position in relation to the atlas. Following the low force adjustment, the patient rested for about 7 minutes in the side lying position and then was assisted to an upright position. The patient was asked to walk around the room before the post evaluation.

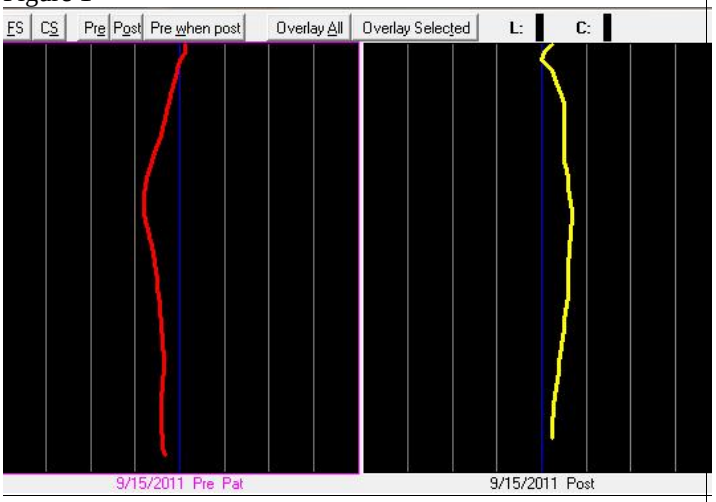
Post adjustment evaluation revealed a balance in leg length and a cessation of the tics. Scanning palpation of the C2 dorsal root ganglion (DRG) on the left that demonstrated a palpable and tender C2 DRG pre-adjustment was clear post adjustment with no palpable findings. The pre-adjustment evaluation showed restriction in glide at the Occiput-C1, and following the adjustment glide at Occiput-C1 was equal bilaterally. The cervical range of motion (ROM) was increased post adjustment.

The patient and his mother reported that the day after the adjustment there was a return of the tics, yet at a decrease to 10 tics per hour, and that the patient experienced a headache with no specific duration. Two days later the patient had an increase of tics, 1 every 5 minutes, but reported them to be less severe than usual.

The second adjustment followed the same Grostic Procedure protocol due to the same consistent palpatory findings and leg length inequality. In addition, a paraspinal thermal scan reading showed pattern at the C0-C1, C1-C2 area. In Figure 1 below, the pre-scan demonstrated approximately 1/2 degree of lateral deviation from the blue line representing zero temperature differential between the left and the right thermocouple.

The tics subsided following this second adjustment. The post scan demonstrated a gentle heat swing with less than 1/2 degree deviation from zero temperature differential. This change in temperature indicated that the neurophysiology controlling the microvasculature in the cervical spine had returned to its normal adaptive function.

Figure 1



The patient was evaluated 17 days later at which time he presented with no tics. He was assessed for subluxation and found to be holding his upper cervical alignment and the thermal scan revealed no subluxation pattern. Over the span of 7 months the patient was evaluated for 10 visits where no tics were reported or observed during examination, and no adjustments were administered.

The patient continued to demonstrate Thermal findings that were non-pattern, DRG was non-palpable, non-tender, motion palpation was a smooth glide at C0-C1, and a balanced leg length was observed. At the 1 year follow up, the mother stated the patient had not experienced another tic episode following the second adjustment. The patient attended a total of 12 visits, with 2 adjustments. The major subluxation

addressed was ASLA at the atlas (C1), and treated using the Grostic Procedure. The patient only experienced a headache following the first adjustment, and no other adverse effects were seen. There was no post x-rays taken to minimize exposure to radiation (per the parents' request). The patient continues to receive periodic chiropractic evaluation in their hometown, and remains tic free.

Discussion

Subluxation Model and Mechanism

Spinal manipulation dates back to the time of Hippocrates. He observed the relationship with spinal distortion and numerous forms of organ dysfunction.[14] There is an array of vertebral subluxation models that focus on addressing the spinal distortion Hippocrates mentioned in our ancient history. For example the Subluxation Degeneration Model, Neurological Consequences of Spinal Degeneration, Nerve Root Compression Model, Dysafferentation Model, and Neurodystophic Model.[15]

During the management of this case, the removal of atlas subluxation was addressed using the Dentate Ligament Theory with the Grostic Procedure.[16] This theory offered by John D. Grostic suggests that lateral and/or rotational malposition of the atlas vertebra in relationship to the occiput and axis can produce mechanical irritation resulting in neurological insult and indirectly, vascular compromise of the cervical cord.[16] Stress on the cord, in addition to venous occlusion with stasis, may result in anoxia which has far reaching and significant implications neurologically.[16]

Grostic Protocol

Eriksen and Grostic stated, from a neurological standpoint, a minute change in atlas laterality can alter thermal scanning and leg length equality.[14] When measuring the atlas laterality specific lateral, nasium, and vertex cervical radiographs are taken and examined by looking at the atlas plane line and central skull line. The angular relationship determines the listing of the patient. In early life some infants lacked the proper development of the lateral masses, causing asymmetrical structure in this region.[17] Biedermann mentions the importance of the sub-occipital structures in the first year of birth due to the areas high proprioceptive control of the entire body.[17]

With the use of the vertex radiographic view, Grostic evaluated the atlas and occiput rotation relationship with less magnification distortion.[14] After the evaluation of the x-rays, a supine leg check is performed as means of detecting nerve interference found from a kinesthetic feedback. The adjustment utilizes a close doctor stance, light atlas contact, and shallow thrust in the proper plane line determined for each patient.[14] Post radiographs are obtained and compared for the correction of the subluxation.

Infrared Thermography

A detection of bilateral paraspinal skin thermal asymmetry has been documented in numerous health issues, including peripheral nerve involvement.[18] Neurological assessments consist of thermography by 2 different interpretations: one observes the bilateral temperature asymmetry implicating a overall neurological compromise, and two determines if the asymmetries are persistent and the temperature differentials reveal pattern.[18] Static thermal differences of 0.5 degrees or higher, represent abnormal regulation of temperature which indicates neuropathophysiology.[19]

This temperature is regulated by the nervous system, and the temperature varies within a normal range. This variability is necessary to have homeostasis in the face of internal and external environmental stressors. When the nervous system fails to adapt, or we see thermal patterns that are identical, this is noted as pattern which may also be understood as the body's failure to adapt physiologically. While a straight line with no difference in Delta T (the temperature difference between the left sensor and the right sensor) might be considered ideal, minor variations less than 0.5 degrees represents normal physiological adaptation.[19]

McCoy et al studied the intra-examiner and inter-examiner reproducibility of paraspinal thermography utilizing the Insight Rolling Thermal Scanner (Insight Subluxation Station).[20] Results were good to excellent reproducibility for paraspinal thermal scanning using a variety of devices.[20]

Leg Length Inequality

The use of leg checks has become widely used in the chiropractic field, and during this examination we assessed the patient with the understanding that it could indicate a neuromuscular dysfunction and vertebral misalignment.[13] There are two kinds of leg length inequality (LLI), anatomical and functional. As we focus on the functional we hypothesize that it results from an asymmetric neurophysiologic response that originates from the kinetic chain. Research shows that a threshold of ¼-in LLI can be used to indicate a upper cervical vertebral subluxation.[13] The leg check has been shown to be both moderate and good in reliability by Woodfield et al.[13]

Medical Treatment

The medical management for treatment of this disorder would be the use of behavior therapy and medication. Malatesta studied behavioral recordings of tic frequency and frontalis EMG responses, and tried to establish the causation of frequency.[21] He conducted a controlled study that used the mother, father, and therapist as observers while the child put together a series of puzzles.[21] This allowed him to monitor the tic frequency in relation to the adult stimulus.[21] After discovering the known cause, his treatment consisted of cotherapy with the father who had the highest level stimulus. Allowing 3 weeks of therapy the facial tics had stopped completely.[21]

The medication approach often time use the scores provided from Yale Global Tic Severity Scale (YGTSS), Premonitory Urge for Tics Scale (PUTS), and Gilles de la Tourette Syndrome Quality of Life Scale (GTS-QOL) to determine the proper intervention.[3] After calculating these scores the first line of pharmacologic agents for the suppression of tics are alpha-adrenergic ie. Clonidine and Guanfacine.[3] These are said to have a lower potential for side effects.[3] Second would

be the use of antipsychotics such as Haloperidol and Pimozide.[3] These medications are increased by .5 mg to 2mg increments weekly until tics are controlled or severe side effects intervene.[9] Lastly a third line of agents would be Botulinum toxin injections.[3] Other listed medications used less often would be Risperidone (in 4 RCTs) , Fluphenazine, Ziprasidone (in 1 RCT), Guanfacine, Olanzapine, Tetrabenazine, Baclofen, Mecamylamine, Flutamide, and the Nicotine patch.[3] It is said that 40% of patients treated with Haloperidol experience these side effects; lethargy, poor school performance, and extra-pyramidal symptoms.[9]

As for the use of clonidine (RCT) which is effective in 50% of patients, its side effects include dry mouth, sedation, hypotension, and depression.[1,9] Research shows that although Clonidine has been studied in randomized controlled trials, the results have not been shown to be consistent.[22] Many of these medications can also be used for the treatment of the comorbidities previously mentioned, but there are concerns for short- and long-term side effects.[22] A pharmacological study suggests that treatment with stimulant medications is not recommended for treating tics in children.[22] There still needs to be further evaluation done with stimulants and nonstimulants for the treatment of tic disorders, ADHD, and OCD in children and adolescents.[22]

Review of Chiropractic Literature

Tics are within the class of neurological symptoms causing spontaneous motor movements, and phonic expressions.[23] They affect up to 23% of all children. Although, in this case report, the patient presented did not meet the characterization to conclude the existence of the comorbidities, there is still a high prevalence to acquire them in the school-age population.[9]

There are a some studies suggesting the use of chiropractic care to be effective in diminishing the symptoms of tic disorders. Here we will discuss a few that report successful treatments. Alcantara et al reported on a 6 year old girl who was diagnosed with transient motor tic disorder of 6 month duration.[24] During the chiropractic examination they found postural abnormalities, an ASR listing of the atlas, static and dynamic palpation findings in the thoracic region and right sacroiliac joint.[24] They demonstrated the use of the Gonstead Technique, and Toggle Recoil during treatment, following the first adjustment there was an increase in the time interval of tics from 3-5 seconds to 5 minutes.[24] The care was conducted for 10 visits over the span of 4 months and resulted in resolution of the tic disorder.[24]

Elster reported on a case that involved a 9 year old with TS, ADHD, depression, asthma, insomnia and headaches.[25] Elster used radiographic and thermographic evidence to support the diagnosis of a subluxation found in the upper cervical region.[25] Patient history from the mother confirmed a traumatic birthing experience with the use of forceps, which was thought to be a causation factor of the underlying subluxation.[25]

This patient received an adjustment to correct the left laterality of the atlas while in a knee chest table, post thermal imaging showed a thermal difference of only 0.1 °C, which is considered normal.[25] Following 2 months of upper cervical care, incidences of the previous reported symptoms and diagnoses had resolved.[25] A follow up evaluation was conducted 5 months and 1 year after care and the patient was reported to be asymptomatic.[25]

There is not much inclusion of chiropractic treatment for children found in the literature. More research should be available to outline the benefits of chiropractic care, leading to a widely accepted view of chiropractic management for tic disorders.

Conclusion

This case report demonstrates the improvement of one male child with a tic disorder that underwent chiropractic treatment. This case provides supporting evidence for the use of chiropractic care for tic disorders in children following the Grostic Procedure. We support and encourage additional research to be done on this topic. More clinical and observational trials are recommended to further evaluate the clinical benefit, and long term effects of chiropractic treatment for tic disorders and other related childhood disorders.

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