CASE STUDY

Chiropractic Care of a Down's Syndrome Patient with Vertebral Subluxation and Strabismus

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Abstract

Objective: The chiropractic care of a pediatric patient with Down's syndrome and bilateral convergent strabismus is described. The purpose of this case report is to demonstrate the effects of vertebral subluxation reduction on aberrant ocular presentation and to propose vertebral subluxation mechanisms responsible for these effects.

Clinical Features: The patient is a 4-year old male with Down's syndrome who was born with convergent strabismus of approximately 15 degrees bilaterally. After surgical intervention, the left eye was corrected to its neutral position. The patient presented with an internally rotated right eye of approximately 15 degrees and no other health concerns in the interest of checking for vertebral subluxation.

Intervention and Outcomes: The patient received a series of contact specific, high- velocity, low-amplitude adjustments to the first cervical vertebra utilizing Gonstead's cervical chair method. After 2 months of care, both eyes abducted 15 degrees, which meant that the right eye corrected and was now in a central position, whereas the surgically repaired left eye was now divergent 15 degrees.

Conclusion: The results suggest that chiropractic care, specifically atlas subluxation reduction, might be responsible for the correction of convergent strabismus, without surgical alteration, in this case.

Key words: *Strabismus, esotropia, Down's syndrome, pediatric, chiropractic, Gonstead, vertebral subluxation, adjustment*

Introduction

Chiropractic is often mistakenly regarded as having a very limited scope of practice in general, i.e. neck pain, back pain and headaches. Yet, chiropractors and their patients experience a multitude of positive results beyond these musculoskeletal complaints, especially in children. Reports indicate that chiropractic care represents the most common type of complementary and alternative medicine (CAM) therapy for children which nearly doubled from 11% in the early nineties to 20% in the late nineties. Children represent 8%-11% of all chiropractic visits and chiropractic care in this group is mostly motivated by non-musculoskeletal conditions.[1] Some of the common pediatric conditions addressed by chiropractors include scoliosis, infantile colic, nocturnal enuresis, constipation, otitis media, seizures, autism, ADHD, asthma, cerebral palsy and strabismus.[2,3] However, one study revealed that wellness care was the highest ranking reasoning for pediatric chiropractic care. This suggests that

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there is some evidence of a paradigm shift in healthcare from a purely biomedical model to a more vitalistic and holistic approach than in the past, focusing on prevention rather than cure. [1]

D.D. Palmer, the Founder of chiropractic, defined chiropractic as a science, an art and a philosophy. Chiropractors are concerned with the detection, analysis and correction of vertebral subluxation. While nearly 300 different definitions and explanations of subluxation exist, it is the "heart and soul of chiropractic" and what sets chiropractors apart from other health professionals.[4] Vertebral subluxation can be defined in simple terms as a misalignment of the spine which leads to nerve interference and subsequent loss of adaptability within the tissues being supplied. Chiropractic is based on the theories of Innate Intelligence and the body's ability to heal itself, once free of subluxation.

Strabismus is an ophthalmic disorder in which the two eyes do not align in the same direction and therefore do not look at the same object at the same time. It is a common ocular disorder that affects 3-5% of children worldwide,[5] with a much higher incidence in Down's syndrome individuals ranging from 30% to 44%.[6] Esotropia is the type of strabismus where one or both eyes turn inwardly (convergence). This type is more predominant in Caucasians and commonly associated with Down's syndrome.[6] Exotropia, where one or both eyes deviate outward (divergence), is more prevalent in the Asian population.[7] The etiology of strabismus can be either congenital or acquired. One study showed that subjects with strabismus were significantly more likely to have experienced complications at birth such as Cesarean-section or forceps delivery, involvement of nuchal cords, the presence of meconium or a low Apgar score.[5] Another study implicated low birth weight (<1500g), prematurity (<33 weeks), advanced maternal age and maternal smoking during the pregnancy. Factors related to strabismus include vision loss, reduced or absent depth perception, multiple surgeries throughout life, stigma and psychosocial problems. [7]

Case Report

Patient History

The patient is a 4 year-old male with Down's syndrome who was brought in to the office along with his family for chiropractic care in the interest of checking for vertebral subluxation. The patient presented with a convergent strabismus of the right eye, which was internally rotated approximately 15 degrees. During the history, the mother revealed that the patient was born with bilateral convergent strabismus, but had surgery to correct the left eye 16 months earlier. The left eye was surgically abducted 15 degrees to a central position in order to allow for better vision. The mother also revealed that the child had forceps used during delivery with a normal presentation. The health history revealed no other health concerns and no medications of note.

Chiropractic Spinal Analysis

The patient was analyzed according to the Gonstead technique protocol which is reported to be used by 58.5% of chiropractors.[8] The vertebral subluxation was theorized by Gonstead as a "complex entity consisting of various degrees of misalignment, joint fixation and nerve interference".[9] The Gonstead approach incorporates an array of tools to determine the existence of the vertebral subluxation, such as a detailed history, static and motion palpation, instrumentation and radiographic studies. In this case, a detailed history, static palpation (tenderness, edema and/or texture changes assessment), motion palpation (discernment of motion segments exhibiting fixation dysfunction and/or hypermobility) and instrumentation (bilateral temperature differential) were utilized.[9] Spinographic radiological films were not utilized in this case due to the young age of the patient. The nervoscope was used to indicate the level of subluxation and the listing was determined by static and motion palpation.

The Gonstead adjustment is a high velocity, low amplitude (HVLA) osseous thrust with a very specific contact. Gonstead's cervical chair is utilized for the majority of cervical adjustments which requires the patient to be in a seated position. It is a chair with an adjustable hinged back and an optional shoulder strap that aids in the stabilization of the patient during the adjustment.

The instrumentation used in this case was the dual-probed nervoscope which is a thermography tool measuring paraspinal heat patterns and nerve interference.[8] The instrument utilizes skin temperature, which is under autonomic nervous system control, to detect autonomic dysfunction.[10] "Pattern analysis" assesses temperature patterns which provide chiropractors information about the functioning of the nervous system and has been used since 1924.[11] A high level of similarity between repeated thermal scans is said to indicate that the nervous system's ability to adapt is reduced and therefore it is functioning at a less than optimal level.[10] The nervoscope indicates where there is a "break" in the temperature pattern as it is moved along the paraspinal musculature. It also provides a reading on the face of the instrument, which measures the direction and the magnitude of the "break" on a scale of points from 1-25 to the right and the left.

Upon initial analysis, motion palpation revealed a restriction at C1 in both left lateral flexion and left rotation. Static palpation revealed extreme tenderness of the left mastoid fossa in comparison with the right. The nervoscope also revealed a break at C1 on the right of 6 points. It was thus determined that the patient's atlas was out of alignment with a listing of ASLA. The listing is explained as follows: the anterior shift of atlas on axis (A), the superior movement of the anterior tubercle (S), left rotation restriction of C1 (L) and the anterior shift of the left lateral mass (A).

Intervention and Outcome

On the initial visit, C1 was adjusted in the cervical chair with the shoulder belt. The doctor contacted the anterolateral transverse process of C1 and administered a superior to inferior, left to right line of correction with a counterclockwise torque. The patient was then scheduled to return to the office 3 days later. The patient was seen for a total of 12 visits over 2 months. On the second, third and fourth visit similar findings were present on analysis and C1 was thus adjusted in the same

manner. On the fifth visit the palpatory tenderness at the left mastoid fossa was far less apparent. The nervoscope indicated a break at C1 on the right of 5 points and C1 was adjusted as ASLA. On the next visit, there was a 50% improvement in left rotation restriction of C1 and the palpatory tenderness at the left mastoid fossa was absent. The nervoscope reading was 4 points at C1 on the right and atlas was adjusted as usual.

On the seventh visit, there was still some mild restriction to lateral flexion at C1 on the left, but the nervoscope reading was only 2 points on the right, thus no adjustment was performed on this visit. At this point, the patient's biweekly visits were reduced to once a week. Over the next 5 weeks the patient was only adjusted twice as indicated by absence of positive spinal analysis findings.

On the patient's 12th visit, all palpatory findings (motion and static) were negative and the nervoscope reading was only 1 point, thus no adjustment was performed. During this visit, the patient's father accompanied the family for the first time. The mother revealed previously that her husband had not been happy about the family being under chiropractic care. On this visit, the father stated, "I'm the last to admit it, but his eye is fine." The boy's right eye was no longer rotated inwardly, but had corrected to a central position. The left eye which was surgically corrected, also abducted 15 degrees which meant that this eye was now divergent. The patient then continued care over the next eight months in the interest of checking for vertebral subluxation until the family relocated.

Discussion

Down's syndrome is the most common chromosomal anomaly and is associated with several ophthalmic abnormalities, which include refractive errors, amblyopia, nystagmus and strabismus.[12] The incidence of strabismus is 15 times more in Down's syndrome individuals than in the general population.[6] In general, strabismus is believed to arise from neural causes, peripheral mechanical causes or a combination of the two.[13]

High hypermetropia, especially during the first 12 months of life, has been associated with a risk of developing strabismus.[14,15] A much higher range of refractive errors, of which hypermetropia is the most common, have been reported in both Down's syndrome children and adults.[14] The range of refractive errors in Down's syndrome children also have been shown to increase with age, rather than decrease as in the normal population. Where refractive errors are often spontaneously reduced by emmetropization in normal children, failure of emmetropization is characteristic of Down's syndrome children.[12,14]

A much higher incidence of strabismus is evident in preterm and low birth weight infants, especially in those with cerebral palsy. Often brain injuries in these infants are due to intraventricular hemorrhage, resulting in a number of ophthalmological abnormalities. The resultant strabismus is usually of an early onset with a large angle convergence which persists. This esotropia may also be accompanied by vertical deviation and inferior oblique muscle overreaction.[16] Convergent strabismus is related to over reactive inferior oblique muscles in 75% of cases, which may be attributed to the distinctive facial structure of Down's syndrome patients.[6]

High resolution magnetic resonance imaging has revealed that extraocular muscles pass through connective tissue sleeves known as muscle pulleys. These pulleys are anchored to the orbital walls and therefore control the extraocular muscle behavior.[17] Elastin, collagen and smooth muscle make up the muscle pulleys and these structures are under the control of autonomic nervous system.[18] Histologically the medial rectus muscle is the best developed, containing the most fibroelastic and smooth muscle tissue granting it the most rigidity.[17] The pulley suspensions are especially rich in smooth muscle and are innervated by sympathetic, parasympathetic and nitroxidergic neurons.[18]

Recent functional magnetic resonance imaging studies in monkeys found that there was no difference in the lengths and strengths of the extraocular muscles of strabismic monkeys versus normal monkeys. These data indicate that strabismus was a result of dysfunctional central innervation to the extraocular muscles, rather than mechanical factors. However, the common clinical assumption is that of a "tight" or "overacting" medial rectus versus a "loose" and "underacting" lateral rectus in esotropia.[13,19]

Often the convergence in esotropia is attributed to a diminished sympathetic tone in the lateral rectus supplied by CN VI (Abducens), while the divergence in exotropia is due to a shift in autonomic balance away from the parasympathetic effect on the medial rectus by CN III (Oculomotor). The inability of the lateral rectus to abduct due to CN VI dysfunction is often termed Abducens palsy by ophthalmologists. The etiology of cranial nerve palsy leading to strabismus is still undetermined in 23% to 35% of patients. A study by Tsai and Demer suggest that non-aneurysmal neurovascular compression should be considered as a cause. Neuropathic strabismus of CN III, IV and VI have been reported, but the abducens nerve is more susceptible to injury as a result of its smaller diameter and its long and angulated course.[20]

When strabismus is acquired soon after birth, the extra visual image created by the ocular misalignment is suppressed. This leads to blind areas in the visual field known as scotomas. Where scotomas eliminate visual confusion and diplopia in the child, it also eliminates the error signal that is necessary to create an adjustment in muscle tone to reposition the eye properly.[21]

Strabismus also has a genetic component which has been identified through studies of families with forms of hereditary strabismus. The few gene mutations discovered to cause strabismus were few and linked to very rare and complex forms. The primary cause of childhood strabismus (strabismus not caused by nerve palsy) is still unknown. A possible genetic etiology was investigated in a study by Altick et al. Differences in structure and function of strabismic extraocular muscles were evident compared to normal extraocular muscles. The study revealed a down regulation of specific myosins and related decreased expression of contractility genes, whereas genes related to expression of extracellular matrix cells were up regulated. They concluded that the extraocular muscles of the periphery and the innervating neural networks function interdependently, possibly regulated through trophic feedback systems.[22]

A link between strabismus and a diagnosis of mental illness in adulthood has been suggested by recent studies. Olson et al conducted a study which found that the odds of developing a mental illness by early adulthood were increased 2.6 times with congenital esotropia. Individuals with constant exotropia have been shown to have a genetic predisposition to schizophrenia. However, the psychosocial stressors experienced by children with strabismus have not been shown to contribute to the development of mental illness.[5]

Terrett and Gorman performed a review of the literature on the ocular effects of spinal manipulation in 1995. Changes in visual acuity, oculomotor function, intraocular pressure and papillary size due to chiropractic care were reported. The report also states that visual improvement is mentioned by patients more often than it is recorded in the literature.[23]

A search for literature specifically regarding strabismus and chiropractic care produced two articles of note. A case study by Amulu presented a 5 year old female patient with autism, asthma, irritable bowel syndrome, strabismus, and overall illness susceptibility. The patient's atlas was adjusted utilizing a specialized upper cervical adjusting procedure on a knee-chest table. The patient showed marked improvement overall and the mother noticed an improvement in her daughter's left strabismus after only 3 adjustments. She reported that after 8 months of care the strabismus was a rare occurrence, only when the patient was extremely tired.[24]

Another case study by Sweat and Pottenger presented a 75 year old female with seizure, ataxia, fatigue, strabismus and migraine complaints. Upon examination it was revealed that the patient exhibited strabismus in the left eye when tracking to the right. The patient was analyzed and adjusted utilizing the Atlas Orthogonal method. After the first adjustment, all the patient's symptoms were reduced subjectively and objectively. The patient reported an improvement in her vision overall, including clarity, brightness and color perception. The left strabismus resolved and the patient reported being able to read for extended periods of time without her eye getting tired.[25]

Three vertebral subluxation mechanisms can be offered as hypotheses for the often seen improvement in these cases with chiropractic care. In the first proposed mechanism, the semicircular canals serve as sensory receptors for the nerve impulses which are responsible for the coordination of the lateral and medial rectus muscles. Extraocular muscles are innervated by three groups of motor neurons whose cell bodies form nuclei in the brainstem. These impulses are relayed to the extraocular muscles through the vestibular and oculomotor nuclei. The information is drawn to the brainstem directly where a process of consideration of value is placed on the data (referred to as "weightings" by neurophysiologists). The information of function is refined here and then delivered from the brainstem to the lateral and medial rectus, hereby controlling eye positioning. The possible explanation of chiropractic adjustment and the resulting coordinate function in this model is through the influence of C1-C3 upon the trigeminal nuclei directly into the brainstem. A vertebral subluxation affecting any of these first three cervical nerves could be rationalized in this manner.[26,27]

A second model is based on the influence of the sympathetic nervous system on the lateral rectus. Nerve fibers from the superior cervical ganglion project into the abducens nucleus through the oculomotor nucleus into the lateral rectus. Therefore an incoordination involving a vertebral subluxation in the sympathetic portion of the spine (T1-L3) could result in a convergent strabismus.[26,27]

The third mechanism is a tonal model. Similar to the second model, the sympathetic supply from the superior cervical ganglion projections into the abducens nucleus is considered. In addition to the lateral rectus muscle, it also influences the smooth muscle supporting sleeves or pulleys through which both the rectus muscles and inferior oblique muscle travel. These pulleys also receive supplies from the parasympathetic Edinger Westphal Nucleus. Any disturbance in proper tone due to autonomic dysfunction will result in an altered eye position.[13,17,18,26,27]

Medical treatment of strabismus involves correction of any refractive errors, an eye patch to equalize vision or surgery depending on the characteristics and severity of the strabismus.[28] The timing of the management is crucial, especially in the case of surgical intervention. In infantile esotropia it is recommended that the eyes should be aligned before 10 months of age to optimize the likelihood of a binocular result.[7] Multiple operations may be necessary and the strabismus may never be fully corrected.[28] Complications from strabismus surgery can be self-limiting or severe and include ocular perforation, orbital infection, slipped or lost musculature and scleritis.[29]

Conclusion

The results of the reduction of vertebral subluxation in this case suggest that chiropractic care may be beneficial in the correction of strabismus. Had the patient not undergone the operation to repair the left eye, we propose that both eyes would have been centered in the neutral position. Nerve interference had been removed and the patient's Innate Intelligence was able to regulate coordination to the structures to restore them to their natural position. Unfortunately, the outside-in surgical procedure distorted the structure and interfered with the body's ability to correct itself.

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