Improvement in Nasal Turbinate and Adenotonsillar Hypertrophy and its concomitant symptomatology with Paediatric Chiropractic Care: A case report

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Abstract: *Objective* - Nasal turbinate and adenotonsillar hypertrophy appears to be common complaints for infants, toddlers, even adults. From a chiropractic standpoint, subluxation-based care that ensures optimal neural function contributes to both immunological and hormonal balance. This can be found to be a successful low risk intervention as opposed to surgery. We present here a case study of a 4-year-old girl suffering from sleep disturbance, breathing disturbance related to chronic adenotonsillar and nasal turbinate hypertrophy.

Intervention/Clinical Features - Subluxation-based care of a 4-year-old female patient whose mother reports her experiencing, since birth, nasal turbinate and adenotonsillar hypertrophy with sleep and respiratory disturbances, dental bruxism, chronic upper respiratory tract infections, and behavioural issues. The Chiropractic care proved to be highly effective in a brief period of time. The results were documented and verified independently by the patient's otorhinolaryngologist and dentist who initially were unaware of Chiropractic care.

Conclusion - Conventional Chiropractic care for the correction of subluxations in such patients may provide a safer and more effective alternative to long term medical treatment with antibiotics and possible surgical intervention for nasal turbinate and adenotonsillar hypertrophy. Further studies are needed to further corroborate these findings.

Indexing Terms: Chiropractic; Subluxation; adenotonsillar hypertrophy; turbinate hypertrophy, sleep and behavioural disturbance, bruxism, case report; case series

Introduction and anatomy

Turbinate (nasal conchae) hypertrophy, inferior turbinate hypertrophy, and nasal turbinate hypertrophy are all descriptive terms referring to a similar condition. This is when there is observed tissues on the lateral (outside) walls of the nasal cavity that are too large, causing nasal obstruction, respiratory distress, and a cascade of secondary physiological complications.

> *… management by chiropractors of a 4-year-old girl suffering from sleep disturbance, breathing disturbance related to chronic adenotonsillar and nasal turbinate hypertrophy, produced strongly positive patient outcomes. We recommend further study into likely mechanisms'*

Located along the lateral walls of the nasal cavity, there are three pairs of turbinates described by location as superior, middle, and inferior.

Between 8% and 80% of patients will possess either a unilateral or bilateral supreme turbinate as well. The bony components of the turbinates are referred to as conchae. The conchae of the middle, superior, and supreme turbinates are projections of the ethmoid bones, however, the inferior turbinate, which is the largest turbinate, is a separate bone. Beneath the attachment of each turbinate to the lateral nasal wall is a space known as a meatus, into which drain several different outflow tracts originating in the orbits and paranasal sinuses. (1)

The role of turbinates in immunological defense has been well documented. (2, 3, 4) The respiratory epithelium covering the erectile tissue (or l*amina propria*) of the turbinates play a major role in the body's first line of immunological defense. This respiratory epithelium contains mucus producing goblet cells. These secrete mucus that envelopes the nasal cavities. Functioning as a filter it traps air-borne particles larger than 2 to 3 micrometers.

The respiratory epithelium also provides an avenue of access for the lymphatic system which protects the body from being infected by viruses or bacteria. (1) The turbinates play an important physiological role as well by warming and humidifying inspired air and by regulating nasal airflow. Unfortunately, when hypertrophied they also contribute substantially to nasal airway obstruction, particularly in cases of allergy and viral upper respiratory infections. (5)

The inferior turbinate in particular has a well-recognised respiratory and immune function that provides the airway with appropriate warmth, humidification, and filtration of the inspired air. It functions as well as a sense organ by sampling the environment for pathogens. Normal functioning of the inferior turbinate relies on an intact autonomic nervous system to maintain homeostasis within the nasal cavity.

The autonomic nervous system innervates the submucosal glands and the vasculature within the turbinates, resulting in control of major turbinate functions like, nasal secretions, nasal patency, warmth, and humidification. Well documented is the finding that optimal functioning of the turbinates both physical and immunological depends on the autonomic system. (6)

The turbinate tissue is composed of rich groups of blood vessels, and can become swollen due to a variety of factors including allergies, colds and upper respiratory infections, inflammation, from exposure to certain medications, pregnancy, vitamin D3 deficiency, (7) or for unknown reasons. This condition can result in the sensation of difficulty breathing through the nose. It can also cause snoring, difficulty sleeping, and nosebleeds (epistaxis) because of turbulent airflow. This can result in drying (desiccation) of the mucous membranes lining the nose. Sense of smell can be affected and as well as interference in the detection of microbes. The maintenance of this tissue is paramount and reliant on the Autonomic Nervous System (ANS) for control of multiple mechanisms for homeostatic balance.

The blood supply to the turbinates is one of these mechanisms for homeostatic balance governed by the ANS. This supply of blood was found to be through the *sphenopalatine artery* (SPA), and the *posterior lateral nasal artery* (PLNA) which gives rise to the middle and inferior *conchal (turbinate) arteries*. The blood supply of the inferior nasal concha is mainly provided by the *inferior turbinate artery* (ITA) and its anastomotic contributors. (8) As in the rest of the body, blood flow is under control of the ANS, and depends on an unobstructed spinal nerve system free from subluxations.

Tissue drainage from the turbinates as discussed in literature, and the venous drainage is via the *Pterygoid plexus, inferior turbinate, inferior meatus* and posterior part of the *septum*, *ophthalmic vein, ethmoidal veins*, and *facial vein*. The lymphatic drainage is through the lymphatics of the skin, anterior part of the nose, *deep cervical lymph nodes* and *retropharyngeal lymph nodes*. It is important to notice the pathway of the drainage and the dependence of normotonic muscles throughout the route to ensure proper drainage; muscle tone that relies on ANS control.

The Sympathetic innervation (fight or flight) to the turbinates is observed to arise from the Sympathetic fibres of the Lateral horn of the spinal cord specifically T1-T3. The *Sympathetic ipsilateral chain* is derived as well from the superior cervical ganglion. Fibres arise from the Internal plexus deep petrosal nerve and great superficial petrosal nerve to the *Vidian nerve*. This runs through the *sphenopalatine ganglion* without synapses. The *Posterior nasal nerves* arise from the *maxillary nerve*. (9) Sympathetic tone, by causing vasoconstriction and emptying of the venous sinusoids via control of arteriovenous anastomoses, is the most important determinant in nasal patency. A reduction in sympathetic tone (Subluxation) causes venous sinusoids dilatation and contributes to symptoms of nasal obstruction. (10)

The *Parasympathetic fibres* (rest and digest) to the turbinates are derived from the *facial nerve*, *Geniculate ganglion*, *Great superficial petrosal nerve*, the *deep petrosal nerve* to the *Vidian nerve*, and *Sphenopalatine ganglion* which synapses and the post-ganglionic fibres travel to the posterior nasal nerves. (11) Both sympathetic and parasympathetic components are suggested to play a role in alternating unilateral nasal obstruction symptoms that behave much like an exaggerated nasal cycle. It has been demonstrated that attenuation of either sympathetic or parasympathetic innervation (i.e., Subluxation) to the nose obliterates the nasal cycle phenomenon. (12)

The *Adenoids* and tonsils are part of the *Waldeyer* ring that serve as a defense against inhaled and ingested pathogens and is important in B-cell precursors. (13. 14) The components of *Waldeyer's* ring are: the *palatine tonsils*, the *adenoids*, *tubal tonsil*, and *lingual tonsil*. The *palatine tonsils* serve as the primary lymphatic tissue of the *oropharynx*. This tissue contains B cells that will pass through the maturation process and produce all iso-types of immunoglobulins such as IgA, IgD, IgE, IgG, and IgM.

Recent research demonstrates that the tonsils have been shown to express T cell developmental intermediates that resemble those found in the thymus and bone marrow. Tonsils also have specialised surface antigens that are instrumental in the initiation of the immune reaction cascade. These special capture cells, called M cells, provide a mechanism for the uptake of antigens produced by pathogens. The M cells transmit the information that a foreign pathogen is present and an immune cascade then begins. (15) The lymphocytes in the tonsils produce immunoglobulins which are transported to the circulation. Also produced is a topical secretory IgA which is secreted into the salvia and mucous secretions to protect the human host at site of pathogen entry. '*The changes in these secretions as a result of recurrent tonsillitis and hypertrophy of the adenoids and tonsils should be further studied, because these are part and parcel of the defense system of the body, their surgical removal may deprive the human host of one of its defense systems*'. (16)

Environment and immune system interface

Due to their strategic location, tonsils are a point of contact between the environment and the immune system. Environmental input plays a key role in body function as we know that for example, the pineal hormone *melatonin* is influenced by environmental dark-light variations and then modulates the immune system. When measured, the amount of *melatonin* present in paediatric tonsillar infectious and obstructive processes is found to be highest in tonsillar hypertrophy and the lowest levels in recurrent acute tonsillitis, with or without hypertrophy. (17)

This demonstrates the hormonal controls over tonsillar tissue and its link to environmental changes. It is seen as well that tonsillar tissue frequently demands more blood to assist in immune responses to common illnesses like viral upper respiratory infections. The need for fine control over glandular profusion demonstrates the importance of neurologic control both parasympathetic and sympathetic. (18)

Optimal host defense against pathogens requires communication between the nervous and immune systems. The sympathetic-immune interaction is a major communication pathway in the body and hence, its importance for health and disease is significant. (19, 20) Sympathetic innervation of primary and secondary immune organs, as well as evidence for neurotransmission with cells of the immune system as targets, has been well documented. (21) Most research on neural-immune modulation in secondary lymphoid organs, has revealed complex sympathetic modulation resulting in both potentiation and inhibition of immune functions. SNS-immune interaction may enhance immune readiness during disease or injury induced '*fight or flight*' responses. Immensely important is that research also indicates that dysregulation of the SNS (i.e., Subluxation) can significantly affect the progression of immune-mediated diseases. (22)

The arterial supply of the adenoids is from the basisphenoid artery, the *ascending pharyngeal artery*, the *ascending palatine artery*, the *pharyngeal branch of the maxillary artery*, the t*onsillar branch of the facial artery*, and the *artery of the pterygoid canal*. The venous drainage of the adenoids is through the *pharyngeal plexus*. The *pharyngeal plexus* and the *pterygoid plexus* communicate, eventually draining into the *facial veins* and *internal jugular veins*. The lymphatic drainage of the *adenoids* is through the *pharyngomaxillary space* lymph nodes and the *retropharyngeal* lymph nodes. (1)

The parasympathetic innervation of the *palatine tonsils* is provided by the *lesser palatine nerve* which arises from the *maxillary division* of the *trigeminal nerve* and the *tonsillar branches* of the glossopharyngeal nerve (23) via the *pharyngeal plexus*. The *pharyngeal plexus* contains fibres of Cranial Nerves IX, X, and XI. (24) The preganglionic neurons of the PNS come from brainstem nuclei and the sacral spinal cord (specifically S2-S4). The axons of preganglionic PNS neurons are much longer than those of the SNS and synapse with the postganglionic neurons in ganglia at or near the effector organs. The very short postganglionic axons then relay signals to the cells of the effector organs. (25)

The sympathetic fibres to the head and neck originate from the thoracic region (T1-6) and therefore need to ascend to reach the structures in the head and neck. Exiting the spinal cord, the fibres enter the sympathetic chain. This structure begins from the base of the skull to the coccyx, and is formed by nerve fibres and ganglia. There are three ganglia within this chain that are of interest. The *superior, middle* and *inferior cervical ganglia*. The sympathetic fibres synapse with these ganglia, and the post ganglionic branches continuing into the head and neck.

The cervical ganglia

The *Superior Cervical Ganglion* is located posteriorly to the carotid artery, and anterior to the C1-4 vertebrae. Several post-ganglionic nerves originate from here and are important in our discussion. The nerve to *pharyngeal plexus*, a mixed plexus of nerves, has contributions from *Vagus nerve* (motor and sensory), *glossopharyngeal* (sensory), and sympathetic nerves from *superior cervical ganglion*. (vasomotor)

The *Middle Cervical Ganglio*n is not present in some individuals. When it is present, it is located anteriorly to the inferior thyroid artery and the C6 vertebra. Its postganglionic fibres, *Thyroid branches* travel along the inferior thyroid artery, distributing fibres to the *larynx*, *trachea*, *pharynx* and *upper oesophagus*. (24)

The *Inferior Cervical Sympathetic Ganglion* and the *First Thoracic Sympathetic Ganglion*, which is present in about 80% of people are located anterior to the neck of the first rib and contain neurons that supply sympathetic innervation to the head and neck. (26) The *inferior cervical ganglion* is situated at the crossroads of the neck, the thorax and the upper limb. It is formed by the coalescence of 4–6 cervical ganglia and one or two thoracic ganglia. It is located in the fossa inferior and posterior to the *pleura* (*fossa of Sebileau*). The ganglion is found on the posterior surface of the *subclavian artery* and often surrounds the vertebral artery. (27) We enter into such detail concerning neurological, circulatory, and lymphatic drainage of these structures and its innervation in order to accentuate the intimate relationship between the ANS and the healthy function of these structures.

Participation of the autonomic nervous system in tonsillar focal infection was investigated by measuring neurotransmitters, receptors, and micro vibration. In focal infection the volume of norepinephrine in the tonsil increased significantly and the number of a-adrenergic receptors decreased. These findings suggest that the focally infected tonsil exhibits a high degree of sympathetic nerve activity. (28)

How it works

Studies have revealed evidence that the branches of the autonomic nervous system, mainly the sympathetic, regulate cytokine production. Not only the primary (*thymus*, bone marrow) and secondary (*spleen*, *tonsils*, and lymph nodes) lymphoid organs, but also many other tissues that are involved in the immune reaction. These tissues appear to be heavily influenced by noradrenaline (NA) arising from varicose axon terminals of the sympathetic nervous system.

Varicose axon terminals are rapid and reversible formations, appearing as enlarged, structures along axonal shafts and very likely play a key role in CNS neuron mechanosensation which is a new form of neural plasticity. (29) It is observed that the sympathetic nervous system's catecholamines and the hypothalamic-pituitary-adrenal (HPA) axis' cortisol are the major integrative and regulatory components of different immune responses. Convincing evidence has been obtained that noradrenaline released non-synaptically from sympathetic axon terminals are further affected and enhanced by the close proximity of immune cells. This enables the inhibition of production of pro-inflammatory (TNF-alpha, IFN-gamma, IL-12, IL-1) and increase anti-inflammatory cytokines (IL-10). This indicates a fine-tuning control of the production of TNF-alpha and other cytokines by sympathetic innervation under stressful conditions. (30)

The lumbar sympathetic chain receives input from the first, second and the third lumbar and sometimes are connected by the white rami communicantes which contain the preganglionic neurons from the lateral horn of the spinal cord. These fibres unite to the *Superior Hypogastric plexus* that connects to the *Aorticorenal plexus* which innervate kidney and adrenal glands. (31) Adrenal insufficiency has been noted with children with moderate to severe obstructive sleep apnea and the phenotype of hypertrophic tonsils. Noted are reduced morning serum cortisol levels and potentially decreased glucocorticoid inhibitory effects on tonsillar growth. (32) For this reason entire spine observation for subluxation is highly suggested as there are multiple areas of the spine which can affect the structures in question directly, and indirectly via the immune system modification. This assures proper function to this area and underscores the importance of these lymph glands.

The importance of proper function

The importance of proper function of the *turbinates*, *adenoids*, and *tonsils* have been demonstrated through a plethora of studies. We observe that all primary and secondary immune organs receive a substantial sympathetic innervation from sympathetic postganglionic neurons. Although, neither the *thymus* nor *spleen* receive any sensory neural innervation, there is evidence that lymph nodes and bone marrow may be innervated by sensory neurons located in dorsal root ganglia, and hence susceptible to subluxation interference on a sensory level as well.

The primary pathway for the neural regulation of immune function is provided by the sympathetic nervous system (SNS) and its main neurotransmitter, norepinephrine. However, Bulloch and Moore (33) reported a major parasympathetic and motor neuron input to the glands that originated from both the *retro facial nucleus* (compact formation of the *nucleus ambiguus*) in the brain stem and ventral horn motor neurons in the upper cervical spinal cord. (34) Human lymph nodes contain sympathetic nerves in their capsule, trabeculae, cortex, medulla and hilum, both as para-vascular or as discrete structures. '*Discrete nerves were observed in relation to T cells and non-T cell-rich areas such as the hilar and capsular connective tissue. The presence of discrete nerves suggests neural regulation of structures other than blood vessels, which was further supported by the presence of varicosities in a portion of these nerves*.' (35)

Lymph nodes showed discrete sympathetic nerve concentrations in their capsules and occasionally in their trabeculae. The lymph node structures are known to contain a substantial amount of smooth muscle cells (SMCs) in addition to their fibrous connective tissue. This most likely represent the neural target tissue of the observed fine discrete sympathetic nerves. In vitro electrostimulation of capsular nerves resulted in contraction of these SMCs and hence contraction of the lymph node as a whole. Lymph node contraction affects lymph and blood flow, immune cell migration, and immune cell egression. (38) All these are under the control of the ANS. It appears that although the lymphatic system contains no pump, as does the cardiovascular system, activity in lymph tissue is significantly affected by the sympathetic nervous system through contraction of the SMC's.

Clinical application

Here we have displayed ample spinal nerve neurologic input that appears to be responsible for the maintenance and control of the turbinates, adenoids, and tonsils. Indicating probable avenues for Chiropractic influence in reestablishing homeostasis in these areas.

Besides the obvious physical affect that hypertrophy of *turbinates*, *adenoids*, and *tonsils* have over immunological dysfunction, and respiratory distress, there has been well documented reports of bruxism and clenching which have been deleterious to stomatognathic system.

We know that when chewing, the teeth never really touch while they cut and grind the food. We also know that the teeth do touch upon swallowing food and interestingly enough while swallowing saliva, and mucous which does occur with nasal congestion and postnasal drip. The neurophysiological basis of bruxism (36) is as the result of the *Mesencephalic trigeminal nucleus* (MTN) neurons. These neurons innervate the stretch receptors of the jaw elevator muscles and periodontal ligament mechanoreceptors. Bruxism activates again the MTN creating a vicious cycle.

The central branches of MTN neurons are observed to descend into the *latero-tegmental* area, forming the Probst tract, finally terminating at the *caudal trigeminal nucleus* and up to the first segments of the spinal cord (37, 38) creating an avenue for Chiropractic intervention.

Polysomnography shows that sleep bruxism is always accompanied by cardiac and respiratory activation and, most importantly, by brain function activation. '*Bruxism is not a parafunction, it functions to activate the Ascending Reticular Activating System (ARAS) nuclei*.' (39) If the RAS is up-regulated, we expect difficulty in getting to sleep and maintaining sleep. This would be reflected in decreased slow-wave sleep, insomnia, and fragmented sleep during the night, as well as increased rapid eye movement sleep drive, which is characterised by nightmares and frequent awakenings. (40) Alterations in motor control and in sympathetic autonomic nervous system control during sleep plays a central role in normal and abnormal masticatory organisation during sleep, as well as in *Sleep Bruxism* (SB) genesis. (41)

Masticatory activity is termed rhythmic masticatory muscle activity during sleep (RMMA). RRMA is a normal and automatic activity of the masticatory muscular system. In both normal individuals and SB sufferers there are indications that an autonomic dysfunction with an increase in sympathetic nervous system tonus (*ie* Subluxation) is present in primary SB sufferers. (41) Bruxism causes a stress reaction in the body and brain. In times of stress, people exhibit physical changes such as dilated pupils, faster breathing, and most pertinently, the tensing of muscles.

These days, stress is rarely caused by an encounter with some kind of predator, but hormones like cortisol and the activation of our sympathetic nervous system will still work to get our bodies ready for action. Just like elsewhere, the muscles in your jaw can tense up as part of the *fight or flight* response in reaction to stress, causing you to subconsciously grind your teeth together. (42) In cases where the threat is life-threatening, the fight-or-flight response plays a critical role in your survival. By gearing you up to fight or flee, the fight-or-flight response makes it more likely that you will survive the danger. This includes protecting the brain/skull by locking down the jaw and flexion of the neck.

One 2019 study demonstrated that people who suffer from bruxism have higher levels of stress hormones in their bodies, and recent research has found that before a person enters a grinding episode, their brain activity and heart rate may rise, implying that the autonomic nervous system plays a role in bruxism. (43) Sympathetic stimulation also reduced the EMG activity evoked by the jaw jerk reflex, which may reflect a sympathetic effect on spindle afferents. (44)

We have here established the well documented intimate connections between nervous system control over the circulatory system, immune system, fight or flight stress reaction, muscles of the stomatognathic system, and specifically the lymphatic system. We as well detail how turbinate, adenoid, and tonsillar function dovetail to provide an important impact on the body's ability maintain optimal function.

History of allopathic treatment and surgery

It is estimated that in the United States 1,400,000 tonsil surgeries were performed in 1959, around 500,000 in 1979 and 250,000 per year in the last decade. (45)

Data shows that during the '40s and '50s many illnesses of which the aetiology or physiopathology were not known were associated to tonsils as possible infectious focus. This resulted in thousands of surgeries. Tonsils were then removed and in many cases when there was no symptom improvement, so were teeth. (46) As time went by, due to lack of convincing results and excess of contraindications, this procedure lost its reputation, and as a consequence it was not recommended even for cases when there was such need.

Therapeutical advance in medicine, especially with the use of antibiotics, improvement in work conditions, and in public health services, contributed to a reduction on tonsil removal surgery. (47) In a comprehensive study, evolutionary biologists from the *University of Copenhagen's Department of Biology*, the *University of Melbourne* and *Yale* have demonstrated that people who had their tonsils and adenoids removed during childhood were subject to an increased risk of developing respiratory diseases, allergies and infectious diseases later on in life. The researchers analysed health data from nearly 1.2 million Danish children born between 1979 and 1999, from the age of 10 and up to 30-years-old. Furthermore, the study suggests an increased risk of pneumonia and asthma later in life as a result of tonsil and adenoid removal, as well as a far higher incidence of nose and eye allergies. (48, 49)

Historically, in the US DeMarino notes that '*Tonsillectomies were very common in the United States from the 1950s through the 1970s, with more than 1 million being performed each year, primarily on children ages 1-15.*' Today, however, this once common procedure is no longer a standard operating procedure. Why? DeMarino says that 'There are fewer tonsillectomies due to skepticism in the medical community over its usefulness in infection control'. In fact, '*Tonsillectomies are avoided if possible, especially in those cases in which other medical issues are involved, such as heart or lung disease, those who are sensitive to anaesthesia, and the elderly.*' (50)

It has been found in fact that removing the tonsils only modestly reduced throat infections in the short term in children with moderate obstructive sleep-disordered breathing or recurrent throat infections, according to a systematic review conducted by the *Vanderbilt Evidence-based*

Practice Center for the *Agency for Healthcare Research and Quality* (AHRQ). (51) The journal Pediatrics reported on this paper stating that '*the results regarding the effectiveness of tonsillectomy for treating children with obstructive sleep-disordered breathing or recurrent throat infections do not support the efficacy of the procedure*.' The papers concluded that more research is necessary to determine the long-term impacts of tonsillectomies in those groups. (51, 52)

Chinnadurai (52) went on to conclude stating '*I think that for any individual child who is considered a candidate for surgery, the family really has to have a personalised discussion with their health care provider about all of the factors that may be in play and how tonsils fit in as one factor in the overall picture of that child's health*.'

In another population-based cohort study of almost 1.2 million children, removal of adenoids or tonsils in childhood was associated with significantly increased relative risk of later respiratory, allergic, and infectious diseases. Increases in long-term absolute disease risks were considerably larger than changes in risk for the disorders these surgeries aim to treat. This published in *JAMA Otolaryngol Head Neck Surg.* (53)

Possibly, the most important notation in his medical text, Freidman (who developed the rating system for adenotonsillar status) states '*Children with even moderately severe recurrent tonsillitis may benefit from watchful waiting for a period of one year.*' (54)

Another health issue observed as a result of surgical intervention is *Empty nose syndrome* (ENS). This is characterised by paradoxical nasal obstruction that usually occurs after turbinate surgery. Patients with ENS may also experience significant psychiatric symptoms and sleep dysfunction, which negatively affect the quality of life of affected subjects. (55)

Clinical relevance

Among alternative and complementary medicine interventions, spinal manipulations have been used to treat tonsillitis. Through occiput-cervical manipulation, a favourable evolution has been obtained in recurrent or chronic childhood tonsillitis, in which a high rate of pathological blockages of joints was also found. (56) This favourable evolution might be due to the fact that spinal manipulation may influence the biomarkers of local and systemic inflammation. (57, 58) In one Osteopathic study they considered, erroneously, that cervical manipulations were considered riskier manipulations, although admitting that severe complications are very rare (59, 60, 61, 62) and now considered to be non-existent. Hence, in this study they elected manipulation of the thoracic vertebrae specifically, the vertebral segments T9 and T10 which innervate the adrenal glands. The adrenal glands produce cortisol, and patients with tonsillitis have been found to have altered cortisol levels. (63)

This hormone influences the immune response, and its levels are found to be modified after thoracic manipulation. (57, 58, 59) Thus, in this prospective study (75 participants) without a control group, manipulation of the lower thoracic vertebrae (mainly in the T9–T10 segments), obtained 55% resolution of tonsillitis symptoms sooner than 24h and 76% sooner than 48h, showing promising results for treating tonsillitis in both children and adults. (64) This particular study gave credence to the concept of intimate coordination and multiplicity of function within the nervous system and throughout the body.

According to the *Canadian Chiropractic Associatio*n, chiropractic is '*a health discipline concerned with the diagnosis, prevention and management of health deficiencies reversible by natural means with emphasis on the interrelationship between the function of the nervous, musculoskeletal systems and their effects on the other systems of the human body using spinal adjustment and manipulation*'. The philosophy of chiropractic is based on the premise '*that the human body has the natural power to heal itself, but sometimes it needs help in putting that power* *into action. Chiropractic assists the natural healing process by helping maintain, restore or enhance health, and it does so without drugs or surgery.'* (65)

Case report

History

In this case as in others, we have applied the concepts discussed above to intervene through Chiropractic to attempt to resolve the dysfunctional clinical presentation brought by the patient. This patient was evaluated on 9/13/22. Her mother reported that the child was a restless sleeper since birth. Right after she was born there were eye discharges and ear infections. She exhibits nocturnal bruxism, snoring, and poor sleep. The mother notices the child's tightness in neck muscles. There have been frequent colds, fevers, ear infections, and respiratory infections. For this reason, the patient underwent an adenoidectomy at the age of two. However, as research has shown, the patient's problems continued. The patient was been evaluated by five different doctors (dentist, her Primary Care Physician, Otorhinolaryngologist (ENT), pulmonologist, allergist). The dentist finding the tonsils hypertrophied, strongly recommended the removal of the tonsils to remediate the bruxism. The primary care physician referred the patient back to the ENT who removed the *adenoids*. The ENT found hypertrophied *Tonsils* and *Turbinates*. They prescribed steroid inhaler and a return visit to evaluate for possible surgery. The mother then took her to a homeopathic nurse practitioner, who recommended Chiropractic.

Presentation

In our clinic the patient was evaluated and we found upon postural analysis that she presented with a cephalic tilt to the left while exhibiting a cephalic rotation to the right. The right ilium was higher than the left. The patient demonstrated on the Bilateral Balances that she was carrying 3 lbs (1.3 kg) more on the left side. Considering that the patient's total body weight was 40 lbs (18.14 kg) this was significant as it represented 13.3% of body weight.

On examination

When we looked at fluid, pain free range of motion we discovered, flexion and extension were within normal expectations for age; left lateral flexion was restricted, right lateral flexion was slightly restricted. Left cervical rotation was found to be restricted and right lateral flexion was slightly restricted. Upon evaluation of the lumbar spine, we found flexion to be within normal expected range considering age, while extension was slightly restricted. Left lateral flexion was within normal expected range for age, but right lateral flexion was restricted.

When evaluating for *Thompson Leg Check* (66, 67) it was observed that the patient demonstrated an apparent short leg on the left by half an inch (1.27 cm), there was found a Double Cervical Lock which changed the pelvic tilt and apparent leg length. There was also found a LD-.

For readers unfamiliar with these matters the cervical spine rotation eliciting a pelvic shift that can be observed through apparent leg length change, is an indication of cervical subluxations. The exacerbation of the cervical subluxation's neurological effect on the nervous system and on brain is observed through the body's attempt to remediate the increased pressure on the peripheral nerves, cord, brain and the production of meningeal torque by acting through the stimulation of postural reflex arc to utilise the long muscles in the reduction of tension to the cervical area. Hence, by changing the pelvic position the apparent leg lengths will shift as well. Full spine palpation illustrated subluxation with fixation at L5, T8/9, T1, C2, and C1.

Imaging

In consideration of the patient's complaints and history radiographs of the cervical spine AP and Lat. were performed. (Figures #1 AP Cx, #2 Lrt Cx) The radiographs demonstrated in the lateral view a reversal of the cervical lordosis with apex at C2/3. C1 presents in flexion while C2 presents in extension. AP view demonstrated a curvature to the right, with cranial flexion to the left. This arrangement of subluxated vertebrae illustrates the very same effects that has been attributed to birthing trauma that is described in detail in multiple medical studies. (68, 69, 70, 71, 72)

Figure: 1

Figure: 2

Mitchell and Humphrey's in their study published in JMPT 1998, reported the presence of a connective tissue 'bridge' between the 1st and 2nd cervical vertebrae dural attachments and from the *ligamentum nuchae*. Tensions developed within the cranial dura mater may be transmitted to the spine and pelvis through the dural anchor attachments at C1, C2, C3, the sacrum and finally, the coccyx. As this dural tension is applied to the vertebrae of the spinal column misalignment and imbalance will occur. The upper-cervical vertebrae, ligaments, and muscles play a key role in the 'righting reflex' which strives to keep the eyes level to the horizon and the centre of gravity between the feet. Any misalignment in this vital area will result in further distortion of spinal architecture below resulting in a 'globally subluxated' spinal column. (73)

Management plan and progress

Considering our findings, the recommendation was that the patient begin a series of 28 appointments consisting of 3 times a week for 4 weeks, then 2 times weekly for 8 weeks. Care was begun. On 9/15/22. On 10/4/22 the patient's mother reported improved sleep both in duration and quality. The patient was not bruxing. Her mood had improved and apparent energy levels were increased.

The mother reported to us that on return visit to the otorhinolaryngologist (ENT) he asked the mother what they were doing. He asked because, as he stated, the child appeared much healthier, the turbinates were no longer swollen, tonsils were no longer swollen and inflamed. When the mother said the only thing they had done differently was Chiropractic care, the ENT paused and told her that this was the second case this month that he saw these changes with Chiropractic care.

The mother as well reported on 11/20/22 that during that week the other siblings in the home had flu and fever. Usually, this would cause the patient respiratory distress, bronchitis and a long-drawn-out episode of upper respiratory tract infection. This is the first time however, that although the patient did spike a fever of 102°F (38.9°C); the next day the body had dealt with the fever, it was gone and there were no other systemic complications from the flu. On 12/05/22 the mother again reports that the patient had a sore throat found to be strep. The tonsils swelled, but in two days after receiving her adjustment, the episode was resolved by the patient's body.

Conclusion

It appears that key structures as *adenoids*, *tonsils*, and the *nasal turbinates* contribute significantly to the immune system providing a first line of defense. Removal of these glands does not result in long term improvement for the patient, contrarily in fact it appears to leave the patient susceptible to further respiratory complications throughout life. It as well appears that these glands, as are every other part of the body, are intimately under the control of the nervous system, specifically the autonomic nervous system.

We have also demonstrated that Chiropractic care has the ability to reduce stress on the nervous system allowing proper balanced stimulation, both sympathetic and parasympathetic to the entire body including the *adenoids*, *tonsils*, and other nasal structures (*turbinates*). Worth noting, we have demonstrated that all three areas of the spine have influence over the homeostasis of the nasal and oral structures; C1, C2, T1-T3, T9, T10, L1-3, parasympathetic input comes from cranial nerves and S1-3. This again emphasises the need for full spine correction of subluxations. This normalisation of autonomic nervous system function enables the lymphatic glands discussed to return to normal function.

Thus, reducing the hyper-sympathetic chronic fight or flight reaction, that many times is produced through birthing trauma, and that results in those bodily signals that have been noted in cases such as these; immunological suppression, lymphatic swelling and congestion, respiratory difficulty, sleep dysfunction, bruxism, and mood changes.

Further clinical studies of large groups would be indicated for further validation as it is documented that the surgical removal of these structures does not resolve the recurrent infections, and actually leaves the patient vulnerable to multiple diseases later in life; whereas Chiropractic intervention has been shown to assist by removing neurological stress to facilitate better adaptation by the body and resolve the condition with 24 to 72 hours. (74)

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