

# Original Research

## Resolution of Orthostatic Intention Tremors in a 3-week-old Male Great Dane Following Chiropractic: A Case Report & Review of the Literature

Gene Giggelman, DVM<sup>1</sup>  
Ashley Shiver, DC<sup>2</sup>

1. Private Practice of Veterinary Medicine & Animal Chiropractic, Dallas, TX
2. Private Practice of Chiropractic, Dunwoody, GA

### Abstract

**Objective:** To review the resolution of tremors in a canine following chiropractic care.

**Clinical Features:** A three-week-old male Great Dane canine presented to a private veterinary and animal chiropractic clinic with symptoms of orthostatic intention tremors and signs of vertebral subluxation.

**Intervention and Outcomes:** Vertebral subluxations were managed using an Activator Adjusting Instrument. Analysis of the subluxations were through static and motion palpation, muscle tone and the presence of pain. After chiropractic adjustments and low level laser therapy, the canine immediately fell asleep. Three days after, the canine showed marked improvement and two-weeks later the tremors were resolved.

**Conclusions:** Research related to animal chiropractic management is limited. More research is necessary to explore the role of chiropractic in canines.

**Key words:** Animal chiropractic, intention tremors, low level light therapy (LLLT), Activator Adjusting Instrument, B Complex Vitamin, L-phenylalanine, subluxation, adjustment, orthostatic tremor, generalized idiopathic tremor syndrome

### Introduction

Tremors and involuntary movements (IM) have been reported in canines over the last 10 years, although the frequency and etiology is unknown.<sup>1</sup> Due to the limitations of the physical examination when performing neurological tests, it can be difficult to diagnose and classify the type, contributing factors and mechanism of canine tremors. Canines, like humans, can display resting and/or action tremors and there are correlating conditions between the two species.<sup>1</sup>

One of the action-related canine tremor classifications is a high-frequency orthostatic tremor which is mainly observed in the extremities, is only seen when the canine is standing, and typically found in giant dog breeds younger than 2-years-old.<sup>1</sup> Specifically, Great Danes commonly display orthostatic tremor with dyskinesia even though it is generally classified as a resting tremor.<sup>1</sup>

Another action-related canine tremor is idiopathic generalized tremor syndrome and it is mostly seen in less than 2-year-old

small white-color breeds but it can be in any color or breed.<sup>1</sup> It is an intention tremor of the head and limbs and is exacerbated with stress, excitement and movement but is absent during sleep.<sup>1</sup> Usually, the neurological examination on these dogs is unremarkable and the signs worsen over 1-3 days but may spontaneously retract in the following months.<sup>1</sup>

Resting tremors such as those seen with Parkinson's disease are more commonly observed in humans. However, there is a similar condition seen in small animals, especially Chinese crested and Kerry blue terrier canines, called multiple system degeneration.<sup>1</sup>

As with the human population, the prevalence of canine tremors in young animals is rare. The frequency, etiology and mechanism is not well understood but trauma may be a contributing factor.<sup>2</sup> The history and physical examination are essential components for evaluating and diagnosing a tremor.<sup>1,3,4</sup> Current treatments include corticosteroids to

suppress the immune system, benzodiazepines,<sup>1</sup> Vitamin B<sub>6</sub> and levodopa (a precursor to dopamine).<sup>5</sup>

Chiropractic adjustments and manipulation may help reduce the frequency and severity of human tremors and has been practiced and recorded since the early 1900's with positive results.<sup>6-8</sup> There are limited case reports, anecdotes or research on canine tremors but this case report may spark more interest in both canine and human health care.

## Case Report

### *Patient History*

A 3-week-old male Great Dane canine, the first born of the litter and birthed in a breech position presented to a private veterinary and animal chiropractic clinic with the chief complaint of tremors. Post-delivery, the owner recalls that his rear paws were cyanotic and cold but warmed and became pink shortly after the owner put a blanket under them.

The canine demonstrated weakness in his hind quarters when he began walking and the owner reported that he was shaking "as if he had Parkinson's disease." Although the canine's tremors had improved without medical intervention, he continued to shake when he walked. The canine ate normally and displayed normal bowel and bladder habits. The owner reports breeding the same stud dog in the past and knows other breeders who have as well. No other offspring displaying these symptoms were reported previously.

### *Physical Examination*

The physical examination revealed a 4.1 lb puppy with 100° F rectal temperature displaying severe shaking with ambulation and absent at rest. The treating veterinarian reports that the incidence looked like an intention tremor. Eye, ears, nose, and skin/hair/coat examinations were unremarkable, and the owner reports that the canine produced normal and regular bowel movements. The canine did not exhibit palpable lymph nodes and was urinating normally. Only one testicle was palpable at the time of examination. At birth, the canine gonads are within the body cavity and descend into the scrotum within the first 6-8 weeks of life before it is considered abnormal.<sup>9</sup>

The heart and lung examination was unremarkable and without evidence of a murmur. The musculoskeletal examination revealed that the canine was in good flesh with normal musculature, normal skull shape and without front fontanelle bulging.

The neurological examination was unremarkable except for the presence of tremors, which also make it difficult to complete a thorough examination. There was no evidence of proprioceptive deficit, and the canine ambulated normally while violently shaking.

The veterinarian discussed the possible causes of the tremors with the owner at the time of the physical examination which included cerebellar disease, L-dopa deficiency, hydrocephalus, and/or toxicity such as toxoplasmosis.

### *Chiropractic Examination*

The chiropractic examination consisted of static and motion palpation for the purpose of assessing restrictions with possible pain and muscle tone along the spine, especially about the suboccipital muscles. Palpation revealed the following subluxations: right dorsal atlas (C1), C4 body right, T10 posterior left and sacral base posterior.

Subluxation can be defined as a joint with decreased range of motion and altered arthrokinematics of the articulating vertebral segments. Static and motion palpation can be essential procedures for locating these areas and diagnosing subluxation.<sup>2,10</sup> Static palpation allows the practitioner to evaluate soft tissue and osseous structures by feeling for abnormalities and imbalances, which may indicate primary issues or compensations.

Motion palpation may reveal "spine buckling" and changes in the "neutral zone," which are terms universally recognized by manual therapists.<sup>11</sup> Spine buckling occurs when the spine is unstable due to trauma causing neurological misfiring, or miscommunication, between the large postural muscles, small intrinsic muscles and vertebral segments resulting in abnormal muscle contraction strength, bending of the spine, and subsequent incoordination.<sup>11</sup> The neutral zone describes the normal range of motion in a joint, which includes six degrees of freedom and is dependent on physiological or surgical alterations.<sup>11</sup>

Like with humans, a complete history, physical examination and chiropractic evaluation of a quadruped includes postural and gait analysis, vital measurements, and short (hind) leg and eye level analysis in addition to static and motion palpation.<sup>3</sup>

### *Physical Therapy and Chiropractic Intervention*

Following complete evaluation, the canine received cold laser therapy from an Erchonia PL5000 dual head device set at 635nm for 2 minutes at the base of the skull and the previously listed segments were adjusted with an Activator Adjusting Instrument (AAI). After the adjustment, the canine immediately went to sleep.

### *Cold Laser Therapy / Low Level Light Therapy*

The Erchonia PL5000 is a handheld low-laser therapy unit that emits low intensity photonic energy and is used as a treatment modality for humans and animals.<sup>12</sup> The treatment is non-invasive, fast, and painless (most human patients report that they do not feel anything), and the Erchonia device has been market cleared by the FDA.<sup>12</sup>

The laser amplifies light through radiation emission stimulation and the absorption of this light energy can be specifically directed towards certain tissues.<sup>13</sup> If the receiving tissues absorb the light energy, it is believed that the cells undergo a photochemical reaction that engages the mitochondria to produce ATP and promotes healing.<sup>13</sup> Low level laser therapy (LLLT) has been shown to have a better result than the same amount of light given at higher energies.<sup>14</sup> Treatment is typically given in the red or near red infrared spectrum, 600-1000nm, at a power density/irradiance of 1mw-

5W/cm<sup>2</sup> to the injury site for a minute or so, a few times a week for several weeks.<sup>14</sup> Longer treatment wavelengths greater than 660nm may penetrate deeper tissues but may also heat the tissue too high and compromise the DNA structure.<sup>13</sup>

While lasers have been evaluated for therapeutic application over the last 40 years, the usage remains controversial in mainstream medicine.<sup>14</sup> Positive results using LLLT have been documented, but negative studies have also been reported.<sup>14</sup> As a result, ongoing evaluation of dosage, duration, and target area for laser therapy as well as concurrent medication is still being investigated.<sup>14</sup> Overall, LLLT, or cold laser therapy, has been proven in both human and animal studies to reduce pain, inflammation and edema, improve topical wound, nerve, bone, tendon, and organ damage by preventing further tissue damage and cell death.<sup>14</sup> The benefits of laser therapy have been documented for a variety of conditions including skin conditions, osteoarthritis,<sup>13,14</sup> back pain, muscle fatigue, tendinopathies, strokes, peripheral nerve injuries<sup>14</sup> and improvement in liver enzymes.<sup>13</sup>

#### *Chiropractic Techniques: Activator Adjusting Instrument (AAI)*

One of the founders of Activator Methods Chiropractic Technique, Dr. Fuhr, defines the Activator Adjusting Instrument (AAI) as a patented, handheld adjusting device designed to generate reproducible and controlled impulsive force, displacement and acceleration, with specific lines of correction in order to eliminate the enormous variability inherent in the practice of chiropractic and manual adjusting. The AAI can generate 3 to 28 pounds of force in 2 to 4 milliseconds, which is equivalent to the acceleration of 1.79m/ms.<sup>15</sup> This is five to ten times faster than the stretch reflex of the intrinsic muscles of the spine.<sup>15</sup> Therefore, muscle affected by the instrument receive the force before being able to respond and less force is required to produce results.<sup>15</sup>

Using a mechanical tool to apply a force to the spine allows the segmental contact to be more specific and consistently generates the same amount of force with each application.<sup>16</sup> It is understood that the force rebalances the arthrokinetic reflex, affects afferent pathways interrupting pain signal transmission, changes muscle tone, reduces sympathetic activity, and increases mobility of the addressed segments.<sup>15</sup>

There are currently five different AAI models that have been modified since 1968, and the National Institutes of Health funded a grant in 1985 to determine the AAI's safety and effects.<sup>17</sup> Results from the multiple studies, including one measuring the amount of vertebral movement in human cadavers and another measuring vertebral movement in live human subjects with the application of an AAI adjustment demonstrate that the AAI produces enough kinetic energy to cause relative vertebral movement but not enough motion to cause injury.<sup>17</sup> There has also been research conducted to evaluate natural resonant frequencies of the soft and hard tissues of the spine to determine which mechanical vibrations mimic the natural resonance of the tissue. While some frequencies can cause tissue damage, the results of these studies support the hypothesis that resonant frequencies support healing when conducted through tissues.<sup>17</sup> If the

frequency is similarly matched to the tissues, less force is required for the same amount of change in the tissue.<sup>17</sup>

The AAI II has been used by veterinarians and animal chiropractors and research has shown that this instrument is capable of introducing up to 72N of force into the body whereas manual adjusting can vary from 40N when adjusting the cervical spine to 400N when adjusting the lumbar spine on the average human patient.<sup>17</sup> One of the important differences between manual versus instrument-assisted techniques is the speed of the thrust.<sup>17</sup> The AAI II can deliver an impulse in 0.1 to 5 milliseconds whereas manual adjusting ranges from 30 to 150 milliseconds, allowing the body time for respond and potentially compensate for the force.<sup>15,17</sup>

The AAI has a specific chiropractic technique protocol associated with it that has been thoroughly researched, similar to the instrument itself. However, it utilizes changes in prone leg lengths during active motions in what is called "isolation testing" and passive challenges, called "stress testing" and "pressure testing," that the practitioner applies to the patient to determine dysfunctional biomechanics, or subluxation, and the proper line of correction respectively in the spine and extremities.<sup>17</sup> At this point, Activator Methods Chiropractic Technique (AMCT) does not have an animal protocol; therefore animal chiropractors utilize the benefits of the Activator Adjusting Instrument after analyzing the patient through other means.

#### *Patient Care Plan with Nutritional Interventions*

In this case study, the care plan included that the canine be re-evaluated in two weeks and that he be given ¼ of a B complex vitamin tablet once daily and 100g (1/32 tsp) of L-phenylalanine once daily.

The canine began receiving B complex vitamin the day after physical examination and initial care. However, there were shipping delays that prevented the owner from giving L-phenylalanine right away.

#### *B Complex Vitamin and L Phenylalanine*

Classifying the type of tremor exhibited by a patient can be difficult because there are overlaps in symptomatology and no definitive diagnostic testing.<sup>18</sup> Even some of the most researched tremors, like essential tremor and Parkinson's disease, may present a diagnostic challenge due to similarities in clinical signs.<sup>4</sup> Once tremors are classified, prescription treatments can vary. Currently, the gold standard of treatment for Parkinson's disease is levodopa or carbidopa, but other medications and vitamins like dopamine agonists and anticholinergic agents are also used.<sup>18</sup> Other tremors including essential and cerebellar tremors, do not have an established treatment protocol, but some tremor patients have benefited from combined treatments with pyridoxine, or B<sub>6</sub> vitamin.<sup>5,18,19</sup>

Vitamin B<sub>6</sub> is used in processes of neurotransmitter synthesis and myelin formation, which are both essential for effective afferent and efferent transmission between the brain and rest of the body.<sup>5</sup> Through early research, it appears that oral doses of B Vitamins are safe when taken in doses less than the

recommended daily allowance (RDA), although more research is needed.<sup>5</sup> Stern conducted a study in the late 1930's with multiple sclerosis patients displaying tremors and results showed that patients given 30mg of thiamin (B<sub>1</sub>) intraspinally experienced transient improvement in neurological responses. Stern concluded that B vitamin improved the neurologic functions of the degenerated peripheral nerve myelin sheaths.<sup>20</sup> Klenner and others believe that B vitamins are metabolic reagents and have protective qualities<sup>20</sup> that may be beneficial in tremor treatments.<sup>5</sup> In this case study, it is possible that administration of a B complex vitamin assisted or expedited the healing process by working in combination with chiropractic treatment.

Dopamine and dopamine precursors, such as L-phenylalanine, can be converted to L-dopa, norepinephrine and epinephrine by the body to support brain function and help control Parkinson's disease tremors.<sup>21</sup> Dopamine precursors should not be taken long-term due to the development of adverse and unpredictable fluctuations in motor response.<sup>21</sup> Dyskinesia is thought to be caused by the pulsatile stimulation of dopamine receptors due to an imbalance in the neurotransmitter system.<sup>21</sup> Dopamine is a neurotransmitter believed to have an important role in the activation of direct and indirect pathways of transmission of the nervous system and controls the neurons projecting to the movement and coordination centers in the brain.<sup>4,5,8,21</sup>

Increased activity of these central nervous system neurons results in inhibition of the motor nucleus and suspected Parkinsonian syndrome.<sup>21</sup> However, other tremor classifications may develop when dopamine precursors such as levodopa or L-phenylalanine are present without dopamine.<sup>21</sup> The result is excessive inhibition of neurons and overstimulation of the striatum and cortical motor areas of the brain contributing to the development of kinetic tremors.<sup>21</sup>

### *Outcome*

Three days after initial care the owner reported "wonderful improvement" in the canine, stating that he stood up and walked twice on the second day following treatment with "very minimal shaking."

Two weeks after the initial evaluation, the now 5-week-old canine was re-evaluated by the doctor. He was 8.09 lbs and all physical examinations were within normal limits except he exhibited greenish discharge from his right eye and right nostril. Only one testicle was palpable, and rectal temperature measured 101° F. The puppy did not exhibit any tremors. The owner had given the puppy daily doses of B complex vitamin over the course of 13 days and L-phenylalanine over 9days/doses.

Chiropractic evaluation revealed right dorsal atlas (C1), C4 body left, T13 posterior left, and sacral base posterior. Again, the doctor performed low light laser therapy using an Erchonia PL5000 with a dual head device set at 635nm for 2 minutes at the base of the skull prior to adjusting the above listed segments with an Activator Adjusting Instrument.

The revised plan was to wean the puppy off of L-phenylalanine and continue to report his progress. The puppy

was released from care, but the animal chiropractor advised the owner to call if symptoms returned.

## **Discussion**

### *Tremors*

Canines and humans show similar tremor symptomatology<sup>1</sup> and research will increase understanding of the condition's pathophysiology to help diagnose and treat tremors in both species.

Tremors are the most common movement disorder encountered in human clinical practice<sup>2,18,23</sup> and symptoms range from nearly asymptomatic to disabling.<sup>24</sup> All normal persons have a low-amplitude, high-frequency physiologic tremor, which is not recognized as a diagnostic or pathological finding.<sup>18</sup> A pathological tremor is an involuntary rhythmic oscillatory movement affecting one or more limbs<sup>2,18,21,24</sup> and can be caused by a normal muscular or postural process.<sup>21</sup> However, a visible tremor is more often a sign of a pathological process.<sup>21</sup>

### *Classification of Tremors*

Classifying tremors can be difficult in practice because there are numerous overlapping and variable categories without definitive blood, laboratory or genetic tests.<sup>4,5,6,18</sup> The process of diagnosing a tremor is largely dependent on the history and physical examination<sup>4,5,6,18</sup> but brain single-photon emission computed tomography, or SPECT, may be used in difficult cases, especially to evaluate the dopaminergic pathways in the brain if Parkinson's disease is suspected.<sup>4,18</sup> When evaluating and categorizing a patient with a tremor, it is necessary to consider the inciting condition, topographic or anatomic location and distribution, frequency, pattern, occurrence, amplitude, rhythm, physiologic and psychologic influences and response to treatment.<sup>18,23</sup>

The two main categories of a tremor are action and resting.<sup>4,18</sup> These categories are not exclusive and may share symptomatology.<sup>4,18</sup> Resting tremors occur when the body or part is relaxed and supported and is typically worsened by mental engagement, emotional stress or moving another body part but is improved with voluntary motion.<sup>4,18,24</sup> Action tremors are present when the patient performs any voluntary motion.<sup>4,18</sup>

### *Parkinson's tremors or Parkinson's disease*

The most well-known condition characterized by a resting tremor is the Parkinsonian tremor, or Parkinson's disease.<sup>18</sup> It has been found that these tremors are characteristically in the distal extremities and may reappear during the rapid eye movement (REM) phase of sleep even though they are classified as resting tremors.<sup>24</sup> These tremors are caused by an alternating contraction of antagonistic muscles, suggesting that the descending corticospinal pathway from the somatomotor cortex is involved.<sup>24</sup>

Typically, Parkinson's disease is diagnosed in people over 50-years-old, and the National Institute of Neurological Disorders and Stroke (NINDS) estimates that there are about 50,000 new

cases diagnosed every year.<sup>5</sup> Although it is rare to diagnose Parkinson's disease in a person under 40-years-old, Ulbricht states that this population accounts for about 5-10% of the diagnoses.<sup>5</sup> The current research reports that Parkinson's disease develops caused when substantia nigra cells become dysfunctional and die, and patients develop symptomatology when about 60-80% of these cells are dead.<sup>5,6,8</sup> Substantia nigra cells produce dopamine, an inhibitory neurotransmitter, that carries messages to other parts of the brain including the striatum as discussed previously and influences movement and coordination.<sup>4,5,8,22</sup> When these cells die, there is not enough inhibition for the messengers to sustain normal organized brain communication, which hyper-excites neurological transmission to the corticospinal tract in the spinal cord, causing difficulty initiating and controlling movements.<sup>5,8,22</sup>

Since there is no definitive diagnostic test to determine tremor type, clinicians must often prescribe a treatment plan and monitor the patient response, a method called a diagnostic-therapeutic trial.<sup>4</sup> Specifically in the case of Parkinsonian tremors, treatment commonly includes anticholinergic agents, dopamine agonists, and levodopa, and positive outcomes using these agents for treatment have been well documented.<sup>4</sup> In this case study, the patient was given L-phenylalanine, a dopamine precursor, that the body converts to neurotransmitters to support brain function.<sup>22</sup>

While a resting tremor is one of the diagnostic criteria for Parkinson's disease, most patients also present with action tremors.<sup>4,18,24</sup> Parkinsonism includes additional symptomatology in addition to resting tremors such as bradykinesia, rigidity, postural instability, micrographia, and shuffling gait.<sup>18,22</sup> It is currently thought to be caused by a blockage or reduction in dopamine release,<sup>18,22</sup> brainstem infarction or multiple system atrophy, but the research remains inconclusive.<sup>18</sup> Canines present similarly with overlapping symptoms, so this diagnosis, more commonly recorded as multiple system degeneration in canines, cannot be completely ruled out.<sup>1</sup>

#### *Action Tremor Classification*

Action tremors can be further classified into postural, kinetic and intentional tremors, and all of these classifications involve issues with voluntary muscular contractions.<sup>4,18,21</sup> Postural tremors in both humans and canines<sup>1</sup> occur with voluntary stability against gravity such as when standing.<sup>18,21</sup> Kinetic tremors become apparent during any voluntary motion.<sup>18,21</sup> Intention tremors are a subcategory of kinetic tremors because they occur during voluntary movement, but amplify with target proximity, and these tremors may also be referred to as position-specific or task-specific tremors.<sup>18,21</sup> Action tremors may have different etiologies; therefore, the categories are further classified into essential, physiologic, cerebellar, dystonic, or drug-induced tremors.<sup>18,21</sup>

There are common characteristics between the various tremor syndromes, and depending on the age of the patient, they may make the diagnosis difficult.<sup>5</sup> Cerebellar tremors typically involve the ipsilateral, or same side, of the body to the location of the lesion and can be apparent during cerebellar function tests, such as the finger-to-nose test or heel-to-shin test.<sup>18</sup>

Cerebellar tremors are categorized as both postural and intention tremors and usually do not appear with resting tremors because this part of the brain is involved in both static and dynamic movements.<sup>2,24</sup> Typically they present with oscillations perpendicular to the direction of movement and can coexist with ataxia, hypotonia, and fatigue.<sup>22,24</sup> Physiologically, tremors are believed to appear when the cerebellum loses modulating control of motions and makes inappropriate corrections within the motor cortex.<sup>24</sup> Common causes of cerebellar tremors are multiple sclerosis, Friedreich's ataxia, spinocerebellar degeneration and cerebellar infarction.<sup>23</sup>

An essential tremor is seen in posture and movement and is usually symmetrical in the hands, wrists, lower extremities, head and heard in the voice, possibly due to hearing loss or olfactory deficits.<sup>7,18,21</sup> It also displays a genetic component, is sporadic, variable, can be associated with other neurological conditions and alcohol tends to reduce symptomatology.<sup>7,18,21,24</sup> Hubbard states that essential tremors may be due to a functional abnormality within the central nervous system.<sup>7</sup> Diagnostic criteria for essential tremor includes symptoms commonly in the hands and arms or head independently, has an unusual course, a history of drug or toxin-exposure, and the tremor is orthostatic or occupational.<sup>21</sup> There have been imaging studies that show changes in neuron metabolism within the cerebellum and involved pathways.<sup>21</sup>

An orthostatic tremor is rare and is typically seen in the middle aged or elderly person.<sup>23</sup> Characteristically, the person is unsteady upon standing and has tremors when walking, however, does not have tremors when sitting or lying down.<sup>22</sup> Although tremors occur when walking, the patient is still able to ambulate normally with a wide base and a ripple of muscle activity.<sup>23</sup> This presentation is also seen in canines, especially in giant breeds such as Great Danes.<sup>1</sup>

A psychogenic tremor is typically inconsistent and has been seen to abruptly appear, remit and can have an atypical combination of rest and intention tremors with varying amplitude, frequency and distribution which suggests that there is a functional issue more than a structural one within the nervous system.<sup>18,21,23</sup> Onset of a psychogenic tremor is commonly due to a stressful event.<sup>23</sup> It also has been seen to become extinct upon distraction.<sup>18</sup> A similar canine intention tremor is called an idiopathic generalized tremor syndrome because of the young age of the canine, the unremarkable neurological exam, and if in combination with orthostatic tremors, they are absent when the canine is asleep.<sup>1</sup>

Since this canine displayed kinetic tremors in his extremities that were absent at rest, the etiology is unknown, and was a Great Dane breed, it is likely that his tremors were orthostatic with possibly some overlap into other classifications such as idiopathic generalized tremor syndrome.<sup>1</sup>

#### *Childhood Tremors*

Tremors are not clearly understood and childhood tremors are no exception.<sup>18</sup> In childhood, tremors make up 10-20% of the pediatric movement disorders.<sup>21</sup> There are a variety of conditions that are thought to be the cause, including genetic conditions such as spinal muscular atrophy, Huntington

disease, mitochondrial diseases and fragile X syndrome or others like brain tumors, hydrocephalus, prescription medications and nutritional deficiencies, especially vitamin B.<sup>2,18</sup>

Uddin acknowledges the presence of a posttraumatic tremor that may have been caused from a head trauma, and states that the most disabling are kinetic tremors.<sup>2</sup> The cause of intention tremors have been studied, and it may be due to damage of the dentatorubrothalamic pathways in the midbrain as a result of head injuries.<sup>2</sup> Another study determined that even a mild head trauma may still cause a tremor, and found that 45% of children with severe head injuries had a significant tremor with residual neurological deficits.<sup>2</sup>

Yates reports that the birthing process is a very traumatic event, especially during breech deliveries because of the manipulative strain on the neck region.<sup>25</sup> Yates revealed that severe bruising, distortional traumas, hemorrhages and tears in the cervical ligaments, and destruction of the spinal cord was present in breech presentation babies.<sup>25</sup>

In this case report, the canine was vaginally birthed in a breech presentation which may have caused enough of a trauma to his upper cervical spine and spinal cord to cause his tremors, although this explanation is theoretically based on the current knowledge and understanding of human and animal anatomy, physiology, and pathophysiology.

It can be difficult to diagnose tremors in children due to their developmental stage and inability to perform the action asked of them.<sup>21</sup> In regards to this case study, the owner is crucial in the history, symptomatology patterns and descriptions, just as parents are for children.

### *Neurophysiology of Tremor*

A tremor occurs when there is an imbalance between agonist and antagonist muscles from a disruption in afferent and efferent information.<sup>21</sup> Afferent information is from the sensations of the body and provides proprioceptive and muscle stretch input to the motor system in the brain. The brain can then integrate and modify the information into efferent, or output, information transmitted to the body.<sup>21</sup> An abnormality affecting the hind-brain, midbrain, forebrain or peripheral impairment can cause an interruption leading to neuronal activation and tremors.<sup>21</sup>

### *Common Treatments for Tremors*

Besides prescription medications, Vitamin B<sub>6</sub> has been researched to improve tremor symptoms.<sup>5</sup> Vitamin B<sub>6</sub> is necessary to synthesize neurotransmitters and myelin formation.<sup>5</sup> A deficiency of B<sub>6</sub> can lead to central nervous system miscommunication and symptoms because of its involvement in the peripheral nerves, skin, mucous membranes and blood cells.<sup>5</sup>

With Parkinson's disease, it is understood that there is a lack of dopamine, and therefore a common prescription treatment is dopaminergic replacement therapy, dopamine agonists, levodopa, a dopamine precursor is commonly prescribed.<sup>6</sup>

The Great Dane canine in this case report was given L-phenylalanine as a dopamine precursor to support the central nervous system and B complex vitamin to aid in neurotransmitter and myelin synthesis. Since neither of these were exclusively used it is unsure which led to an improvement in the canine's tremors or if it was a combination with the additional treatments.

### *Low Level Laser Therapy*

Low level laser therapy is still being investigated to fully understand the mechanisms and pathophysiology of treatment.<sup>14</sup> However, LLLT appears to have an effect on photons and is absorbed by photoacceptors or chromophores inside the body.<sup>14</sup> Photobiological processes within these cells are stimulated, chemical reactions and cellular responses can be engaged, mostly within the mitochondria, and can stimulate energy production and metabolism.<sup>14</sup> The increase in cell response stimulates cell processes necessary for healing such as ATP, RNA and protein synthesis.<sup>14</sup>

Cox can also be stimulated inside cells by LLLT and is able to bind to more oxygen, increasing enzymatic activity within mitochondria.<sup>14</sup> In order to bind to oxygen, nitric oxide (NO) must be released and this increase in extracellular NO concentration stimulates vasodilation of local tissue vessels, increasing blood flow and therefore healing to the area.<sup>14</sup>

All of these changes support cell proliferation and aid in healing tissues including nerves, tendons, cartilage, bones, and organs through the reduction of swelling, inflammation, and consequently pain.<sup>14</sup>

Due to current research and the canine's immediate positive response to the combination of LLLT and a chiropractic adjustment, it is likely one or the combination facilitated healing. And the improvement is especially noted within his upper cervical spine since he received both modalities in this location and the current understanding of anatomy and physiology supports this hypothesis.

### *Chiropractic Treatment for Tremors*

Chiropractic focuses on the relationship between structure and function of the nervous system and while there is still a need for more scientific evidence and research regarding chiropractic as a treatment for tremors, there are anecdotal reports that suggest a positive relationship.<sup>5</sup>

Upper cervical chiropractic care has been practiced on patients with tremors since Palmer first reported it in 1934.<sup>6</sup> Palmer delivered a specific manual upper cervical adjustment on a knee-chest table that was successful in reducing tremor-symptoms.<sup>6</sup> A later study of a 60-year-old man with Parkinson's disease received upper cervical chiropractic management and after 4 weeks of care, the patient reported an improvement to his emotional state, range of motion, balance, mental clarity, handwriting and ambulation.<sup>6</sup>

Hubbard published a case report on a 39-year-old woman with an essential tremor and migraine undergoing chiropractic care.<sup>7</sup> The result was that her tremors were no longer constant and the frequency of her migraine headaches had diminished

significantly after 4-months of chiropractic care.<sup>7</sup>

Bova's study of an 81-year-old man with Parkinson's disease signs and symptoms received chiropractic care along with other modalities.<sup>8</sup> At the end of 2 months, the patient reported improvements to his activities of daily living, well-being, writing, and posture.<sup>8</sup> Chiropractic treatment was given with the patient in an erect posture which stimulated the afferent pathways up to the cortex, cerebellum, and vestibulospinal tract of the brain.<sup>8</sup>

In this case report, the chiropractic adjustment likely supported the Great Dane canine's overall healing and consequently the elimination of his kinetic tremors.

#### *What is Subluxation?*

Chiropractors use the term 'subluxation' to describe a specific location of adjacent joints within either the spine or extremity that are fixated or not optimally functioning due to a structural imbalance.<sup>3</sup> Intervertebral articulations are complicated by the synovial joints, symphysis and compound syndesmosis encapsulated with their associated mechanoreceptors and nociceptors overlying the osseous vertebral components.<sup>11</sup> Osseous subluxations are typically compensated with surrounding soft tissue and neuronal changes which can alter the afferent activity to the central nervous system.<sup>3</sup>

If subluxations are not caught early, they have the potential to progress into more serious conditions and/or symptoms. A subluxation typically has an initiating cause which is an inability to adapt to physical, emotional, or mental macro or micro trauma that can develop into segmental hyper or hypomobility, or kinesiopathology.<sup>3</sup> It is hypothesized that due to adhesions and therefore hypomobility between adjacent segments, the segments above and below this level will become hypermobile to locally compensate and maintain overall functionality of the body.<sup>3</sup>

If the subluxation remains, neuropathy can directly or indirectly result with a facilitation response that stimulates the nerve and its correlating end organ, skin, glands, vasomotor activity, somatoautonomic reflexes, internal viscera, etc.<sup>3</sup> After a prolonged period of time, the body will naturally adapt to this over-stimulation and the issue will become a chronic inhibition of the nerve, leading to dysfunction of the nerve and innervating tissues sometimes manifesting as a variety of symptoms.<sup>3</sup>

The degree of a patient's symptomatology does not necessarily correlate with the degree of subluxation or pathology and it is even possible that the altered quality of intervertebral motion, not the quantity, is more important in nervous system and body function due to the proposed coupled motions of the involved segments.<sup>11</sup> While structure plays an important role in the body, Buckminster Fuller presented the possibility that all systems of the body, including osseous, ligamentous and muscular, also influence function.<sup>17</sup>

There are numerous theoretical causes of subluxation with the most common being macro and micro traumas, potentially birth, especially if breeched,<sup>24</sup> or repetitive motions and

postures, excess loading to the spine and joints, tissue and/or muscle failure, and prolonged static postures.<sup>11</sup>

With the Great Dane canine, it is uncertain the exact mechanism of injury or cause of his subluxations, however his breech birth may have been a contributing factor.

#### *Mechanics of Chiropractic and Manipulative Therapies*

By researching and knowing the anatomy and physiology of a body, certain treatment methods are logical and the physiological mechanism can be understood. There are sensory receptors within the neck that transmit information to the brain and spinal cord that may influence nervous system and an alteration of these structures may cause functional imbalances.<sup>25</sup>

#### *Diagnosing Subluxation*

Chiropractic and manual therapy practitioners commonly evaluate the spine through static and motion palpation, recording muscle tone changes and pain responses,<sup>26</sup> plain films, leg length inequality, neurological tests, orthopedic tests and range of motion.<sup>17</sup>

While these are evaluation methods for the human spine, they can also be applied to the animal model. Static palpation has been shown to have poor inter-examiner reliability and motion palpation to be clinically acceptable inter-examiner reliability.<sup>15</sup> Therefore, a combination of evaluation methods will provide the doctor with adequate information towards their diagnosis.

#### *Chiropractic Treatment Physiology*

The vertebral column is enveloped in nerve fibers contributing to the afferent pathways leading into the spinal cord and brain.<sup>27</sup> They provide sensory information to the central nervous system to monitor, control, and influence all of the body's systems.<sup>27</sup>

A vertebral subluxation with surrounding muscular and ligamentous compensations may influence nerve function and lead to symptomatology.<sup>11</sup> However, this is hypothesized based on the current knowledge of animal and human anatomy and physiology.

Chiropractic adjustments high in velocity and low in amplitude change mechanoreceptor activity and provide sensory input into the central nervous system while reducing adhesions between adjacent spinal vertebra.<sup>16,28</sup> By altering the nervous system and breaking fixations, the body can effectively communicate within itself, heal itself and balance homeostasis.

#### *Activator Adjusting Instrument (AAI)*

The Activator Adjusting Instrument (AAI) is used by over 50% of chiropractic physicians in the United States, 14% in Europe, and over 70% in Australia and New Zealand.<sup>16</sup> Research has determined that manual and instrument-assisted adjusting is equally beneficial,<sup>29</sup> but the speed of the adjustment has greater influence over the central nervous

system responses when compared to overall force.<sup>11</sup>

The AAI has been shown to successfully treat cervical disorders<sup>16</sup> as well as a variety of others such as lumbar disc herniation with neuropathy, hypertension and anxiety, otitis media, whiplash-type neck injuries, cervical disc protrusions and many others.<sup>30</sup> Additional research is needed to evaluate the AAI's effects on tremor symptomatology.

### *Animal Chiropractic*

Animal chiropractic research is important for human and animal wellness. Unfortunately, there have not been as many animal chiropractic case reports. But with veterinarian contributions, chiropractic can evolve and grow in education, quality of care, and public knowledge.<sup>10</sup>

Spinal manipulation has been performed on animals for centuries, but veterinarians and chiropractors have only recently started working together to improve the practice, guidelines and education for both professions.<sup>3,10</sup>

Veterinarians typically hold a structural perspective that a subluxation is a partial dislocation, whereas chiropractors view subluxation from a more functional point of view, stating that vertebral misalignments interrupt the normal biomechanical and neurological functions of the body.<sup>3,10</sup> In reality, structure needs function and vice versa. There is not one without the other. While animals and humans are different, the species are overall very similar and further research is essential to understand all vertebrates.<sup>26</sup>

### *Effectiveness of Chiropractic Adjustments*

The Great Dane canine in this case report revealed an immediate response after LLLT and an adjustment, prior to receiving any B complex vitamin or L-phenylalanine. This suggests that LLLT with the chiropractic adjustment may be a beneficial method for canine intention tremors. However, there were no control subjects and the canine also received two treatments during the initial examination, both at the base of his skull, so a definitive positive correlation cannot be determined. Due to the similarities of canine and human tremors as well as responses to various treatments, it is suggested that humans experiencing tremors can benefit from chiropractic adjustments in combination with LLLT and/or nutritional supplementation of L-phenylalanine and B complex vitamin.

### **Conclusion**

This case report demonstrates many limitations. One is that it is a single case and does not have a control. Therefore, it is difficult to significantly prove and explain the results of the study. Secondly, there were multiple treatments given to the patient so it is unclear if and how effective each treatment was or if the combination provided the most support. Overall, this case suggests that a combination of LLLT and chiropractic management with nutritional supplementation may support the treatment of canine intention tremors. There is a significant need for additional animal chiropractic research to determine the independent effects of each treatment method in this case study: chiropractic adjustments or spinal manipulation

therapy, low level light therapy, L-phenylalanine, and B complex vitamin.

Researching the independent treatment effects will increase the current knowledge of tremors and may establish a gold standard treatment for intention tremors in both the canine and human patients.

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