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Spinal Manipulation and Seizure Management—Can Spinal Manipulation Be an Adjunct Therapy for Managing Seizures in Humans or Domestic Animals?

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Abbreviations

AED	**Antiepileptic drug**
ANS	**Autonomic nervous system**
SMT	**Spinal manipulative therapy**

Abstract

Seizures and epilepsy are commonly observed in veterinary patients and are the direct result of many different causes, including but not limited to congenital disease, metabolic derangements, and traumatic injury. Treatment protocols in human medicine vary from standard treatments such as avoiding known triggers, anticonvulsant medications, vagal nerve stimulation, and surgical resection of seizure foci to more holistic approaches including acupuncture, dietary adjustment, nutritional supplements, and reflexology. Spinal manipulative therapy (SMT), or chiropractic adjustments, has also been suggested as possible adjunctive treatment for seizures in refractory human epileptics. To the authors' knowledge, there are no published reports of SMT as a therapy for seizures in domestic animals. The purpose of this paper is to review the use of SMT as an adjunctive treatment for seizures in humans and to open the consideration of its use as a potential additional therapy for seizures in domestic animals.

Introduction

A seizure is defined in the *Handbook of Veterinary Neurology* as a sudden, transient, abnormal phenomenon of a motor, sensory, autonomic, or psychic nature resulting from a transient dysfunction of part or all of the brain (1). The Epilepsy Foundation describes it as a sudden surge of electrical activity in the brain (2). Epilepsy is one of the most common chronic neurological diseases treated in general veterinary practice, with a calculated prevalence between 0.062 and 0.075% in dogs (3). There is a 2% prevalence in the human population of the United States (4).

Epilepsy can be the result of many etiologies, including but not limited to toxin exposure, congenital malformation, metabolic disease, traumatic brain injury, neoplasia, infectious or inflammatory disease, or idiopathic (5–7). Certain dog breeds may be predisposed; epidemiological studies have shown a higher percentage of prevalence in the Labrador retriever (3.01%), Belgian shepherd (9.4%), and Petit Basset Griffon Vendeen (8.9%) (6).

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Current treatment protocols include treating underlying metabolic causes, avoiding triggers in reflexive seizures, and removing exposure toxin in reactive seizures (1, 6, 8–11). In addition, a backbone of seizure therapy is the use of antiepileptic drugs (AEDs). When seizures persist despite standard therapies, adjunctive treatments are pursued. Described adjunctive therapies include acupuncture (12–15), dietary changes (16–22), herbal or supplement therapies (23–25), and vagal nerve stimulation (26–30). To the authors' knowledge, the use of spinal manipulative therapy (SMT) has not yet been described in veterinary medicine as a therapy for seizures.

What Is Spinal Manipulative Therapy?

As described by the National Institutes of Health, SMT or chiropractic science is the relationship between the anatomical spine and the function of the nervous system (31). The primary function of SMT is correcting the correlation between the musculoskeletal and the nervous systems as affected by hypomobility of a joint complex (a motion unit). A motion unit comprises adjacent bones and the intra-articular and periarticular components surrounding the joint (a) (32–34).

Subluxation is a term that the chiropractic profession has used for over a century to describe a motion unit that is not working within its neuroanatomical parameters. The word subluxation has been used to describe a biomechanical relationship between adjoining vertebrae, and the complex neuroanatomical cascade that may affect the patient (34, 36, 37). As this definition has brought inter-professional confusion, the authors prefer using *hypomobility*. A hypomobile unit is treated by providing an adjustment once the specific joint has been identified. An adjustment is defined as a high velocity, low amplitude thrust into a specific osseous segmental contact point with a specific vector and anatomical range of motion to the hypomobile unit (b) (32–37).

Sequela to a hypomobile unit may include kinesiopathology, neuropathology, myopathology, histopathology, biochemical changes, connective tissue pathology, and vascular alterations (32, 33, 39, 40). Hypomobile motion units provide a source of aberrant input, such as nociception arising from peripheral receptors. The use of SMT is known to is known to relieve pain, decrease stress markers, and stimulate the autonomic nervous system (ANS) (41–46). Through these actions it is thought to decrease seizure activity (4, 41, 43, 47–50). In human medicine, there are no peer-reviewed clinical trials of which the authors are aware that specifically seek to determine if SMT is an efficacious therapy for seizures. The existing publications are individual case reports suggesting the adjunctive use of SMT to reduce the frequency and severity of seizures in people with refractory epilepsy (51–53).

Pain Relief as a Cause of Decreased Seizure Activity

Spinal manipulative therapy provides a safe, effective, and non-invasive procedure to relieve sources of pain or discomfort in humans, horses, and dogs (32, 36, 42–45, 49). This technique has been used to improve the mobility of hypomobile units, help break up adhesions, address synovial fold entrapment or extrapment, allow for improved range of motion, and ultimately improve afferent input to the CNS (32, 33, 54–57). It is postulated that seizure reduction may occur through pain relief and stimulation of receptors in the cranial cervical spine (4,41,47). Meniscoid adhesions, articular hypomobility, and compensatory hypermobility in this spinal cord region can cause hyperexcitation of periarticular mechanoreceptors and nociceptors, resulting in inappropriate CNS facilitation/stimulation and possibly seizure potentiation (4, 52). Correcting vertebral hypomobility in the cranial cervical spine through SMT causes an alteration and a reduction of these abnormal neuronal impulses as they enter the brain (4). From an anatomic standpoint, the location of the sympathetic ganglia and the presence of a high concentration of mechanoreceptors in the cervical spinal cord are possible explanations for adjustments in this area resulting in improvement in seizure activity (51).

Stress Reduction as a Cause of Decreased Seizure Activity

Spinal manipulative therapy affects cortisol levels, neurotransmitters, and nerve growth factors; as a result, it can affect visceral functions, pain modulation, and regulation of proinflammatory cytokines (46, 58–66). The technique has been shown to decrease biochemical markers correlated to stress (67). Stress is often considered a precipitant or trigger for seizures across species. It has been reported that between 21 to 39.1% of seizures in dogs were triggered by stress or a stressful event (9, 11). This trigger has been shown to broadly affect neuronal circuits involving wide cortical regions, neurotransmitter production, and overall neuronal plasticity with its required gene expression (65, 68–70). Acute and chronic stresses can increase seizure susceptibility and duration (10, 11, 68, 70). Furthermore, chronic stress can cause increased activity within neural connections in many areas of the cortex, affecting neurotransmitters and some pathways leading to epilepsy and autonomic and gene expression changes

(68,70). The use of SMT in humans and animals has been shown to improve quality of life and minimize stress (32, 33, 43, 71, 72). Since stress is commonly a trigger for seizures in domestic animals, it would follow that reducing stress may modulate seizure activity.

Stimulation of the ANS and Decreased Seizure Activity

In addition to reducing regional pain by affecting muscular tone and joint function, SMT has also been shown to affect the ANS (39, 44, 46, 73–75). The ANS consists of the sympathetic and parasympathetic nervous systems; these parts of the nervous system maintain a symbiotic working relationship helping to provide precise tissue and organ function (76). Since SMT is associated with the improvement of hypomobile motion unit(s), removing the related insult (aberrant afferent input) would help to improve and modulate the activity of the ANS and its effects on the hypothalamic-pituitary-adrenal axis (46, 58–66). Facilitation of the CNS originating from aberrant peripheral mechanoreceptors and nociceptors leads to a loss of central integration and modulation at the spinal cord, brainstem, and higher centers. This neurological imbalance leads to what has been described as *neuronal ischemia*. These ischemic neurons are thought to go into a state of *neuronal hibernation*, during which they lose function and therefore cannot modulate at different levels of the neuro-axis. Spinal manipulative therapy is postulated to reduce this hyperafferency and thus reduce the loss of neuronal function and perhaps lessen the likelihood of seizure activity (4, 52, 62).

Summary

Spinal manipulative therapy increases the motion of hypomobile units, providing afferent stimulation to the spinal cord and suprasegmental regions such as the brainstem, cerebellum, and cerebral cortices. This input is necessary for appropriate overall function and ANS modulation (44, 45, 77, 78). It is possible that these actions could reduce seizure activity and that SMT could be considered an adjunct therapy for seizures. Future research and appropriate clinical trials would be needed to evaluate the effectiveness of SMT in helping to reduce seizure activity in domestic animals.

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