

Review Article

The Chiropractic Subluxation and Insomnia: Could there be a Connection?

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Abstract

Sleep disorders in general are a common occurrence in today's society, with the most common of these disorders being insomnia. The Statistical Manual of Mental Disorders, Fourth Edition defines insomnia as having difficulty initiating sleep, difficulty maintaining sleep, or difficulty obtaining restorative sleep with associated daytime dysfunction or distress due to that lack of sleep. While precise figures as to the prevalence of insomnia are not known it has been estimated that approximately two thirds of adults will have one or more episodes of insomnia each year and approximately 15% of adults per year will have a serious chronic episode.

Etiology of Insomnia is multifaceted and includes physiological, psychological and environmental factors with the most common treatment being pharmacological intervention. While studies have shown this form of treatment to be effective in increasing sleep time and decreasing sleep latency they carry with them the high risk of dependency and subsequent withdrawal symptoms if the patient elects to cease using them. They are somewhat successful in treating the symptom of insomnia, but not its underlying cause.

While insomnia is a common co-morbidity with chronic pain conditions such as chronic low back and chronic neck pain and chiropractic has been demonstrated to effectively treat such conditions, this paper will not look on the musculoskeletal effects of the chiropractic adjustment, but instead will examine a potential hypothesis as to why traditional subluxation based chiropractic can have on patients suffering from primary insomnia and examine the neuro-physiology behind such theory.

Keywords

- Chiropractic
- Insomnia
- Subluxation
- Sleep apnea

INTRODUCTION

The diagnosis of insomnia falls into two major categories, primary or secondary. Secondary insomnia is the most common, and as its name implies is a result of an alternate disease process such as psychiatric disorders, circadian rhythm disorders, restless leg syndrome, obstructive and central sleep apnea, or other neurological or medical condition. Primary insomnia is in essence a disease of exclusion, and is considered to be psycho-physiological, where the patient will negatively condition themselves into anxiety or panic regarding their ability to achieve and/or maintain sleep. This becomes a learned pattern and the patient will actually develop sleep preventing techniques. Even after achieving sleep the patient may complain of chronic sleep disturbance that cannot be objectively measured on polysomnography [1].

Estimates have shown that as many as two thirds of adults will have one or more episodes of insomnia each year, with an estimated 15% of the adult population suffering from a chronic episode [1]. Why these episodes occur is unclear, however one

leading theory is that circulating chemicals, such as muramyl peptide, in the blood and cerebrospinal fluid act as Sleep-promoting substances and stimulate slow wave sleep [2]. Other authors have demonstrated to potential roles of dopamine and acetylcholine in insomnia [3]. Acetylcholine is located within neurons in the pontine tegmentum and is involved with REM sleep generation. "REM On cells" are cholinergic cells in the lateral pontine and medial medullary reticular areas that innervate the thalamus, hippocampus and hypothalamus. These cells discharge at high rates during REM and show little or no activity during non-REM sleep (NREM) [4]. Volkow et.al. found that just one night without sleep can increase the amount of the chemical dopamine in the human brain. They also noted that in healthy participants, sleep deprivation increased dopamine in two brain structures: the striatum, which is involved in motivation and reward, and the thalamus, which is involved in alertness. The researchers also found that the amount of dopamine in the brain correlated with feelings of fatigue and impaired performance on cognitive tasks [5].

Other researchers have stressed the role of Serotonin (5-HT), found in raphe neurons of the brainstem, hypothesizing that it is strongly involved in sleep onset. This is based on the fact that Insomnia occurs when serotonergic cells of the dorsal raphe are lesioned. MAO Inhibitors (specific for 5-HT) enhance sleep. Also, there is evidence that substances in the biosynthetic pathway of serotonin (such as tryptophan and vitamin B6) may facilitate sleep.

The inhibitory neurotransmitter GABA is released in highest concentrations during NREM sleep. GABAergic neurons are located throughout the brain, including the basal forebrain, hypothalamus, thalamus, brainstem and cortex. Hypnotics, such as benzodiazepines (diazepam or triazolam) and barbiturates (phenobarbital, secobarbital) tend to work by potentiating GABA mediated inhibitory processes. They may shut off neurons in the reticular activating system and inhibit transmission and activity of neurons that project to the cortex and thalamus. Overall, hypnotics do increase total sleep time, decrease sleep latency and decrease the number of awakenings, but they also decrease the amount of time spent in NREM sleep stages 3, 4 and, in some cases, REM sleep, all of which are necessary sleep stages for obtaining the restorative benefits of sleep. There is also evidence that tolerance to these drugs develops fairly quickly (within two weeks) and insomnia and REM rebound are seen upon stopping these drugs. Additional dangers for abuse and dependency have been demonstrated with the newer hypnotics such as zolpidem [6]. While there may be a lack of consensus as to the etiology of insomnia, what is clear is that sleep results from the complex interaction of multiple neurotransmitter systems, as well as the influence of other physiological or psychological states [7].

According to the National Health Interview Survey analysis, over 1.6 million civilian, non-institutionalized adult US citizens use Complementary or Alternative Medicine (CAM) to treat insomnia or trouble sleeping [8]. Among the more widely used CAM is chiropractic.

Chiropractic

The chiropractic concept of the vertebral subluxation has been linked to a singular event. On September 18th, 1895 Daniel David Palmer a magnetic healer who was practicing his profession in Davenport Iowa noted an irregularity in the spine of the janitor of the building that housed his office. Harvey Lillard, a black man who was said to be deaf on that day following a forceful thrust to reduce the irregularity regained his hearing. According to Palmer Mr. Lillard claimed to "hear the wagons on the street," something he could not do prior to receiving the treatment [9]. Palmer would later use Lillard's testimonial in the January, 1897 issue of his advertising newspaper, *The Chiropractor* [10]

DEAF SEVENTEEN YEARS: I was deaf 17 years and I expected to always remain so, for I had doctored a great deal without any benefit. I had long ago made up my mind to not take any more ear treatments, for it did me no good. Last January Dr. Palmer told me that my deafness came from an injury in my spine. This was new to me;

But it is a fact that my back was injured at the time I went deaf. Dr. Palmer treated me on the spine; in two treatments I

could hear quite well. That was eight months ago. My hearing remains good.

HARVEY LILLARD, 320 W. Eleventh St., Davenport, Iowa

The significant point of this historical event is that chiropractic does not have as its origins treatment for low back pain, nor was such a claim made by its founder, who, while lacking formal education was nonetheless highly intelligent for his era. Critics of chiropractic will often recount the less than formal scientific education of Palmer including his various occupations as beekeeper, farmer, school teacher, and *grocery* store owner in order to detract from the fact that even though only having completed the eighth grade he had already studied Greek, Latin, and higher mathematics [11]. Although an avid reader of books on spiritualism and Theosophy, Keating notes that "D.D. Palmer was also a self-taught student of biology, and had acquired quite a collection of animal bones, a forerunner of the later human osteological collection which would become so well known within and outside the profession" [12].

For most of the last 100 years traditional medicine has viewed chiropractic as "unscientific," yet as Coburn and Biggs have pointed out "While chiropractic has gained in acceptance and recognition it has sacrificed many of its earlier claims to be an alternative healing art and to some degree chiropractic has become 'medicalized'. But medicine has also been forced to make concessions. Despite total medical opposition, chiropractic survives. The recent successes of chiropractic tend to confirm our earlier thesis of the beginnings of the decline of medical dominance and to show that medicine, while dominant, was never hegemonous [13].

The success of chiropractic in recent years has fueled increased interest in the potential link between the chiropractic adjustment and a reduction or elimination of symptoms [14]. While very few randomized clinical trials of chiropractic adjustments as a treatment of non-spinal conditions exists there have been a plethora of anecdotal reports of chiropractic benefiting patients [15 -21]. There have even been calls for randomized clinical trials (RCT) of chiropractic and insomnia in traditional sleep journals [22]. The literature reports benefits for other non-spinal conditions such as multiple sclerosis [23], asthma [24,25] and ADHD [26] among other non-spinal conditions. In a widely reported 2007 pilot study conducted at Rush University Hypertension Center, George Bakris, MD and Marshall Dickholtz, Sr., DC reported their findings related to the manual correction of mal-alignment of the Atlas vertebrae and the resulting reduced arterial pressure. In their study the authors stated; "We conclude that restoration of Atlas alignment is associated with marked and sustained reductions in BP similar to the use of two-drug combination therapy" [27]. While there is evidence of the successful alleviation of symptoms, it must be remembered that the purpose of the spinal adjustment is correction of the vertebral subluxation and not the treatment of these various disorders.

The Vertebral Subluxation

The vertebral Subluxation is a biomechanical spine derangement thought to produce clinically significant effects by disturbing neurological function [28]. The mechanism by which

the vertebral subluxation has a negative physiological effect on body, including the brain and brain chemistry is believed to involve a multi-component clinical phenomenon that can be located by spinal analysis and “adjusted” by chiropractic procedures. Koren has described the subluxation as; “Any variance from normal in the biomechanics of spinal joint function, such as hypomobility (fixation), hypermobility, compensation reaction, loss of joint play, or loss of the central axis of motion”, all of which constitutes kinesiopathology. As a result, spinal cord nerve roots, spinal nerves, ganglia, other nerve fibers, and meninges are impinged upon, compressed, or otherwise irritated, causing disharmony in the body as a whole” [29]. Among those who has best described the various models of the vertebral subluxation hypothesis is Gatterman [30], who along with others suggests that the chiropractic subluxation takes into consideration a broader patho-physiological and clinical perspective than just a mechanical displacement. There are however reservations in some quarters both in and outside of chiropractic as to the veracity of this basic principle of chiropractic [31], despite well documented research and clinical results [32-34].

Chiropractic and the Endocrine System

Researchers have long known that sleep disorders are common in patients with neurodegenerative diseases and manifest early in the disease process [35], this maybe one of the reasons more researchers are taking into account the effect that changes in the ANS can have on varied physiological situations or on the cause and effect of some pathological conditions, including insomnia [36]. The probability of the vertebral subluxation having a negative influence on bodily function and the chiropractic adjustment having a positive effect on a person’s health is not the giant leap that most in orthodox medicine seem to believe it is [37]. Research at the A.T. Still Institute showed that spinal lesions resulted in pathological changes in the blood, urine, and tissue fluids. Spinal lesions of the atlas and axis (C1& C2) were associated with abnormal function of the pituitary which resulted in abnormal hormone secretions [38]. With few exceptions, hormone deficiency or hormone excess is the result of pathologic manifestations in the neural pathways that supply the hypothalamus [39]. One of the more widely accepted theories of how a chiropractic adjustment can affect brain chemistry is that adjustments activate receptors in the spine, resulting in alteration in neuronal afferent input to the brain [40,41]. For example, afferent mechanoreceptors travel up the cord to the cerebellum and thalamus, affecting thalamic summation and integration and cortical representation. Hyman has theorized that the correlations of the structures of the upper cervical spine and their relationship with the central nervous system cause can aberrant nerve impulses to the brain, thus the correcting vertebral subluxation complexes in the upper cervical spine by chiropractic adjustment will lead to a reduction of these aberrant nerve impulses to the brain [42,43].

Afferent–efferent integration and central command of efferent activity is managed by the brain via the purported Central Autonomic Network (CAN). The central autonomic network (CAN) is an integral component of an internal regulation system through which the brain controls visceromotor, neuroendocrine, pain, and behavioral responses essential for survival. It includes

the insular cortex, amygdala, hypothalamus, periaqueductal gray matter, parabrachial complex, nucleus of the tractus solitarius, and ventrolateral medulla. Inputs to the CAN are multiple, including viscerosensory inputs relayed on the nucleus of the tractus solitarius and humoral inputs relayed through the circumventricular organs. The CAN controls preganglionic sympathetic and parasympathetic, neuroendocrine, respiratory, and sphincter motoneurons [44]. Afferent (visceral) sensations are carried via cranial, sacral (parasympathetic), and thoracolumbar (sympathetic) nervous pathways to the nucleus tractus solitarius (NTS) in the medulla. This nucleus then transfers information to the parabrachial nucleus (PBN) in the pons, which then relays signals to the thalamus, hypothalamus, amygdala, and insula [45]. From this it is plausible to hypothesize how the vertebral subluxation with its aberrant nerve impulses can negatively influence the endocrine system leading to its dysfunction and the chemical imbalances seen in primary insomnia.

While this paper falls far short of validating of chiropractic and its role in the treatment of primary insomnia, it does demonstrate that there is a plausible explanation for the results that have reported in the literature [15-21]. While controlled trials of chiropractic and non-musculoskeletal conditions has been called for from both the chiropractic and medical professions alike, it remains that most chiropractic research and their funds have been geared toward low back pain [46]. This unfortunate circumstance is mainly a result of the chiropractic profession itself, while in its attempts to gain recognition from the scientific community has all but abandoned its original premise [13].

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