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Chiropractic and Mental Health: History and Review of Putative Neurobiological Mechanisms

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Abstract:

The chiropractic profession has a long history of acknowledging the relationship between nervous system function and mental health. This paper reviews the history of chiropractic involvement in mental health issues, chiropractic institutions specializing in the care of mental health problems, and the putative neurobiological mechanisms associated with vertebral subluxation and dysregulation of the autonomic nervous system.

1. Keywords

Chiropractic, history, mental health, vertebral subluxation, manipulation, depression, anxiety, addiction, hospitals, autonomic nervous system, biological oscillators, neuroplasticity, polyvagal theory, neurovisceral integration, heart rate variability, resiliency, adaptability, salutogenesis

2. Introduction

Musculoskeletal conditions are the predominant reason persons seek chiropractic care. The top five reported reasons for attending chiropractic care are low back pain/back pain, neck pain, extremity problems, wellness/maintenance and hip pain. The top five reasons for pediatric cases to attend chiropractic care are musculoskeletal conditions, excessive crying, neurological conditions, gastrointestinal conditions, and ear, nose, and throat conditions **[1]**. Although many chiropractors and those they serve tend to focus on disorders associated with the physical body, abnormal nervous system function may also affect emotional and psychological health. The author completed a brief historical overview of chiropractic and mental health **[2]**. This work represents expansion of that paper, and inclusion of putative neurobiological mechanisms.

3. History

D.D. Palmer founded the chiropractic profession 123 years ago. He described vertebral subluxations as "slightly displaced vertebrae which press against nerves causing impingements, the result being too much or not enough functioning" **[3]**. According to his son, B.J. Palmer, "D.D. Palmer was the first man to discover that insanity was caused by displaced cervical vertebrae, that by replacing them the patient could be restored to normal condition" **[4].** B.J. also described his expert testimony in a case where he stated, "If an atlas is subluxated it makes abnormal the functions of the brain." In answer to the question, "What is to be done in insanity?" he admonished his reader to "Go back to cause. Adjust that and return that brain to its normal capacity and capability" **[5]**. Another pioneer in the field of mental health and chiropractic was attorney and chiropractor Willard Carver. Carver authored the book, Pyscho-Bio-Physiology, and wrote, "Between the Psychology and the Physiology I have built the Biologic bridge that scientifically connects these two very important departments of human experience" **[6]**.

In the 1920s, several inpatient mental health facilities were established where chiropractic adjustments were the dominant clinical service provided. Two of these were located in Davenport, Iowa. In 1922, the Chiropractic Psychopathic Sanitarium was established. The facility was later known as Forest Park Sanitarium. North Dakota Judge A. W. Ponath noted that at the North Dakota state mental hospital, the "cure and discharge rate" ranged from 18-27%, compared to 65% at Forest Park **[7]**. The second facility, Clear View Sanitarium, was established in 1926. In 1951, Clear View was acquired by the Palmer School of Chiropractic. Chiropractor W. Heath Quigley, who directed the sanitarium, described the clinical protocol: "Each day, each patient was examined with the neurocalometer (NCM). If the clinician interpreted the NCM to indicate nerve impingement, the patient was adjusted." Quigley reported that the rooms were "sunny and bright," and that meals included "large servings of fresh vegetables...from a garden" **[8]**. Unfortunately, both institutions closed, (Forest Park in 1959 and Clear View in 1961) in large measure because of third party pay issues. Insurance companies often refused to pay the costs of care. Furthermore, Iowa statutes at the time did not provide for licensing specialized hospitals; only full service medical hospitals were eligible for licensure. Clear View was not licensed as a hospital, and functioned legally as a nursing home **[9]**.

The 1970s saw a renewed interest in chiropractic care and mental health issues. In 1973, Chiropractor Herman S. Schwartz edited a book titled "Mental Health and Chiropractic: A Multidisciplinary Approach." Contributors included Nobel Laureates Rene Dubos and Linus Pauling, and such notables as Scott Haldeman, A.E. Homewood, Joseph Janse, Alexander Lowen, and Thomas Szasz **[10]**. In 1949, Schwartz had published a preliminary report of 350 patients afflicted with a "nervous or mental disorder" and reported that the majority of them showed improvement under chiropractic care **[11]**. Schwartz was active in the ACA Council on Mental Health (formerly Council on Psychotherapy), which survived through the '70s, but no longer exists. In 1983, Quigley authored an article describing a four decades period where "treatment of the mentally ill was a highly motivated discipline within the chiropractic profession" **[12]**. In 1988, Goff wrote a review of the theory and practice of "chiropractic treatment for mental illness" **[13]**. Interest in this field continues. Blanks, Schuster and Dobson **[14]** published the results of a retrospective assessment of subluxation based chiropractic care on self related health, wellness and quality of life. This is, to the authors' knowledge, the largest study of its kind ever undertaken regarding a chiropractic population. After surveying 2,818 respondents in 156 practices, a strong connection was found between persons receiving Network Spinal care (a chiropractic technique) and self reported improvement in health, wellness and quality of life.

A systematic review was published which examined psychological outcomes in randomized controlled trials of spinal manipulation The study concluded that "There was some evidence that spinal manipulation improved psychological outcomes compared with verbal interventions…The clinical implications are that physical treatments, such as spinal manipulation have psychological benefits" **[15]**. Genthner et al **[16]** reported on a series of 15 patients with a history of depression. The Beck Depression Inventory II (BDI-II) was used to

measure the baseline level of depression and any post-chiropractic care changes following orthospinology care, a chiropractic technique focused on correcting misalignments of the craniocervical junction. A paired t-test demonstrated significant improvement in depression test scores. A study evaluating the role of chiropractic care in persons undergoing inpatient addiction care consisted of a three arm randomized clinical trial with two control groups (one receiving usual medical care, and the other placebo controlled). This was a single blind study utilizing subluxation-centered chiropractic care, Torque-Release technique, implemented in a residential addiction care setting. The active group showed a significant decrease in anxiety while the placebo group showed no decrease in anxiety **[17]**. Other articles addressing mental health issues and chiropractic care have been published, ranging from single case reports to randomized clinical trials. Favorable responses were reported in persons with conditions including depression **[18]**, ADHD **[19]**, autism **[20]**, dyslexia and learning disabilities **[21]**. Additionally, published papers report changes in general health measures in chiropractic patients using the RAND-36 and Global Well Being Scale (GWBS) **[22]**, changes in domains of health related quality of life among public safety personnel undergoing chiropractic care **[23]**, and chiropractic care in patients with cancer-related traumatic stress symptoms **[24]**.

4. Salutogenesis

Chiropractic care incorporates a salutogenic approach. Sociologist Aaron Antonovsky coined the term salutogenesis in 1979. It is derived from salus, Latin for health, and genesis, meaning to give birth. Salutogenesis, the study of the origins and creation of health, provides a method to identify an interconnected way to enhance well-being. Salutogenesis provides a framework for a method of practice to promote health **[25]**.

Salutogenic theory goes to the very essence of neurobiology. It has been noted that neurological processes (as well as anatomical structures) are remodeled by sensory input. These processes, collectively termed neuroplasticity, are operative at all levels of the nervous system. Smith **[26]** described the range of these mechanisms: "From the afferent (incoming) activity of peripheral sensory receptors to the efferent (outgoing) activity directed toward neuroendocrine organs, blood vessels, and muscles. Although the selectivity of perception probably makes it impossible to be aware of everything that is happening throughout the body, it is evident that these regulatory processes are essential for one's health, and that they provide the basis for functional salutogenic mechanisms of the brain." Smith further noted, "An organism with a salutogenic brain would experience the world as manageable and coherent ... with a self-perpetuating cycle for enhancing self-confidence and well-being."

5. Stress Responsively

Hans Selye **[27]** pioneered investigations of the biological effects of stress in 1936 with the publication of his paper, "A syndrome produced by diverse noxious agents." Since then, more than 100,000 articles and books have been written on the subject. Selye describes stress as the nonspecific response to any demand. Although many individuals have concluded that stress is inevitably destructive, this view is incorrect. Selye noted, "Stress is not necessarily bad for you. It is also the spice of life, for any emotion, any activity causes stress...the same stress that makes one person sick is an invigorating experience for another...Complete absence of stress is incompatible with life since only a dead man makes no demand on his body or mind." Selye described two types of stress: Dis-stress -- from the Latin "bad," as in dissonance, and Eu-stress from the Greek "true" or "good," as in eutonia. Whether we experience a pleasant or unpleasant result from an event depends upon how our nervous system perceives, processes, and interprets that event. More than 15 years before Selye's historic publication, B.J. Palmer and J.H. Craven **[28]** described a similar concept: concussion of forces. This term refers to the meeting of external invasive forces and internal resistive forces. Just as stress may be destructive or beneficial, concussion of forces may produce or reduce vertebral subluxation. The result is dis-ease or ease. "That which caused the normal cycle to become abnormal was a concussion of forces centering at some point in the spinal column causing a subluxation...tissues do not nor cannot express their normal function." Palmer **[29]** quotes Webster's definition of adaptation: "To make suitable; to fit; or suit; to adjust; alter so as to fit for a new use." More than 60 years later, Selye **[30]** wrote,

"Every living being has a certain innate amount of adaptation energy or vitality." When a concussion of forces is corrective, Palmer **[29]** noted the following changes: "Perversion changed to verification; abuse to proper natural use; abnormal interpretation to normal interpretation; distortion to healthful manifestation; corruption to correction." Although it is unlikely that Selye was familiar with the writings of Palmer and Craven, the similarities are striking: Stress and concussion of forces; eu-stress and ease; dis-stress and disease. The practical application of these concepts requires a working definition of health. The World Health Organization (WHO) **[31]** defines health as "A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." In this context, Selye **[30]** wrote, "The secret of health and happiness lies in successful adjustment to the ever-changing conditions on this globe; the penalties for failure in this great process of adaptation are disease and unhappiness."

6. Putative Neurobiological Mechanisms

6.1. Vertebral Subluxation

In 1906, DD Palmer and BJ Palmer **[32]** defined subluxation as follows: "A (sub)luxation of a joint, to a chiropractor, means pressure on nerves, abnormal functions creating a lesion in some portion of the body, either in its action, or makeup". Lantz **[33]** noted, "Common to all concepts of subluxation are some form of kinesiologic dysfunction and some form of neurologic involvement". Mechanical and degenerative changes associated with vertebral subluxation may result in a variety of neurological consequences:

- **Cord compression and adverse cord tension:** Compression of the spinal cord may result from disc protrusion, ligamentum flavum hypertrophy/corrugation, or osteophytosis. Myelopathy may result in cord pressure and/or pressure which interferes with the arterial supply **[34-39]**.

- **Nerve root compression:** Compromise of the nerve roots may develop following disc protrusion or osteophytosis **[40]**. Spinal nerve roots are exquisitely sensitive to compression **[41-43]**.

- **Local irritation:** This includes irritation of mechanoreceptive and nociceptive fibers within the intervertebral motion segments **[44]**.

- **Vertebral artery compromise:** MacNab advises that osteophytes may cause vertebral artery compression **[45]**.

- **Autonomic dysfunction:** Symptoms associated with the autonomic nervous system have been reported in patients with cervical spine trauma. The Barre'-Lieou syndrome includes blurred vision, tinnitus, vertigo, temporary deafness, and shoulder pain. This phenomenon is also known as the posterior cervical syndrome **[46]** Stimulation of sympathetic nerves has been implicated in the pathogenesis of this syndrome **[47]**.

- **Coherence and oscillatory patterns:** Coherent oscillations are a characteristic of the human brain. **[48]** Furthermore, it has been proposed that synchronization of multiple rhythms is an essential manifestation of living processes **[49]**. Epstein describes wave activity association with Network Spinal care, a chiropractic technique involving light touches to the spine. According to Senzon, Epstein and Lemberger, "The network wave occurs at a higher self-organizational threshold, in the absence of significant adverse mechanical cord tension, and with enhanced self-regulation of the spinal subsystems. With the onset of central pattern generation, modulated through the network wave, reorganizational behavior may emerge in the individual's spine and life as a whole" **[50]**.

6.2. Operational Model of Vertebral Subluxation

The author has proposed an operational model for the assessment of neurological dysregulation associated with vertebral subluxation **[51]**. The four components of this model include:

- **Dysafferentation:** The intervertebral motion segment is richly endowed with nociceptive and

mechanoreceptive structures **[52-57]**. As a consequence, biomechanical dysfunction caused by vertebral subluxation may result in altered nociception and/ or mechanoreception.

- **Dyskinesia:** Dyskinesia refers to distortion or impairment of voluntary movement **[58]**. Spinal motion may be reliably measured using inclinometry **[59]**. Alterations in regional ranges of motion may be associated with vertebral subluxation **[60]**.

- **Dysponesis:** Dysponesis is evidenced by abnormal tonic muscle activity. Dysponesis refers to a reversible physiopathologic state consisting of errors in energy expenditure, which is capable of producing functional disorders. Dysponesis consists mainly of covert errors in action potential output from the motor and premotor areas of the cortex and the consequences of that output. These neurophysiological reactions may result from responses to environmental events, bodily sensations, and emotions. The resulting aberrant muscle activity may be evaluated using surface electrode techniques **[61,62]**. Typically, static surface electromyography (sEMG) with axial loading of the spine is used to evaluate innate responses to gravitational stress **[63]**.

- **Dysautonomia:** The autonomic nervous system regulates the actions of organs, glands, and blood vessels. Acquired dysautonomia may be associated with a broad array of functional abnormalities **[64-70]**. Sympathetic tone may be evaluated by measuring skin temperature differentials using paraspinal infrared thermography **[71]**. Such techniques have been used to monitor changes in neurological function associated with vertebral subluxations **[72]**.

7. Autonomic Dysregulation and Mental Health

Variability in heart rate reflects the vagal and sympathetic function of the autonomic nervous system, and is used as a monitoring tool in clinical conditions characterized by altered autonomic nervous system activity. Spectral analysis of beat-to-beat variability is a simple, non-invasive technique to evaluate autonomic dysfunction. Vertebral subluxations are changes in the position or motion of a vertebra, which result in the interference with nerve function. Vertebral subluxations may result in altered autonomic nervous system activity. Heart rate variability is a reliable and valid tool that may be used to assess the changes in autonomic activity associated with the reduction and correction of vertebral subluxations **[72]**. Recent studies have reported the potential utility of HRV in the evaluation of conditions and states associated with autonomic dysregulation. These include carotid intima media thickness **[73]**, prediction of mortality **[74]**, multiple sclerosis **[75,76]**, eating behavior **[77]**, burnout and depression **[78]**, chronic posttraumatic stress disorder **[79]**, working memory performance **[80]**, dementia **[81]**, inflammation in rheumatoid arthritis **[82]**, insulin resistance and metabolic syndrome **[83]**, type 1 diabetes **[84]**, cardiac autonomic nerve function in obese school-age children **[85]**, cancer prognosis **[86,87]** and cognition **[88,89]**. In the mental health field, associations have been identified between cardiac vagal activity, immunometabolic risk factors, and depression **[90].** Higher Beck Depression Inventory-II (BDI-II) scores were associated with decreased HRV **[91]**. Oh and Chae **[92]** note that HRV may be a crucial marker for mental health. They report that "HRV properties might be related to the degree of optimistic perspectives on life, and suggests that HRV markers of autonomic nervous system function could reflect positive human mind states." Fiskum et al **[93]** state, "Internal psychopathology and dysregulated negative affect are characterized by dysregulation in the autonomic nervous system and reduced heart rate variability (HRV) due to increases in sympathetic activity alongside reduced vagal tone…Higher informational entropy was related to less psychopathology and less negative effect, and may provide an index of the organizational flexibility of the neurovisceral system."

Polyvagal theory (PVT), proposed by Porges **[94]** posits that physiological state limits the range of behavior and psychological experience. Porges notes, "The theory links the evolution of the autonomic nervous system to affective experience, emotional expression, facial gestures, vocal communication, and contingent social behavior. In this way, the theory provides a plausible explanation for the reported covariation between atypical autonomic regulation (eg, reduced vagal and increased

sympathetic influences to the heart) and psychiatric and behavioral disorders that involve difficulties in regulating appropriate social, emotional, and communication behaviors." Sullivan et al **[95]** explain that "PVT links the evolution of the autonomic nervous system to the emergence of prosocial behaviors and posits that the neural platforms supporting social behavior are involved in maintaining health, growth and restoration. This explanatory model which connects neurophysiological patterns of autonomic regulation and expression of emotional and social behavior, is increasingly utilized as a framework for understanding human behavior, stress and illness." The authors describe how PVT is related to self-regulation, resilience, and adaptability. Smith et al **[96]** proposed the neurovisceral integration (NVI) model to explain observed relationships between peripheral physiology, cognitive performance, and emotional and physical health. This model is supported largely from studies examining cardiac vagal control. An expanded model describes the multilevel structure and function of vagal control. Higher levels are associated with cognitive/attentional responses, regulation based on perceptual representation of one's current somatic/visceral state, regulation based on conceptualization of sensory input and past experience, and amplifying, maintaining, or suppressing representations based on current goals. In reviewing the literature concerning HRV and chiropractic care, Kent concluded, "Case reports suggest that favorable changes in heart rate variability may follow reduction or correction of vertebral subluxations. Higher quality studies of larger populations should be conducted. It is biologically plausible that the changes in autonomic nervous system function following reduction or correction of vertebral subluxation may be objectively assessed using heart rate variability" **[72].**

8. Conclusion

Chiropractic care is concerned with the totality of the human experience. Vertebral subluxations may result in autonomic dysregulation, compromising the adaptive capacity of the organism. By analyzing and correcting vertebral subluxations, a patient is placed on a more optimum physiological path, potentially increasing resilience and adaptability. Further research into the effects of vertebral subluxations on mental health, the neurobiological mechanisms involved, and the use of reliable and valid outcomes assessments should be undertaken. It is biologically plausible that vertebral subluxations compromise nervous system function and affect mental health.

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