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CLINICALEVIDENCE

Chiropractic cranial treatment model and neuroplasticity in a post stroke 72-year-old male: A case report

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Abstract: This case report discusses an elderly male patient suffering from post stroke disabilities who sought chiropractic interdisciplinary care and neuro-rehabilitation to facilitate neuroplasticity and recovery of prior muscle function, improve ease of activities of daily living, and his return to work. Of interest is the concept that neurological function can recover even in the presence of anatomical structural pathology, such as brain damage or infarct secondary to stroke.

The successful rehabilitation of this stroke patient gives both the clinician and general population hope that neuroplasticity can take place in all age groups, particularly the elderly. Theoretically this type of treatment may also be used in wellness health care protocols to prevent neuro-degeneration of brain tissue. Further research should be performed to determine if there might be specific subsets of elderly patients suffering post stroke symptomatology that might have greater neuroplasticity stimulated with chiropractic and neuro-rehabilitative care.

Indexing Terms: Chiropractic, neural plasticity, stroke, sacro-occipital technique.

Introduction

As part of an interdisciplinary team, chiropractic methodologies offer unique conservative care opportunities to patients rehabilitating from disabilities secondary to stroke. (1) '*Stroke is a dramatic event and is associated with potentially severe consequences, including disability, mortality, and social costs. Stroke may occur at any age; however, most strokes occur in individuals aged 65 years and older.*' (2) In 2008, mortality from stroke was the fourth leading cause of death in the United States, and stroke was a leading cause of long-term severe disability. Nearly half of older stroke survivors experience moderate to severe disability. In 2008, care for stroke survivors cost an estimated $18.8 billion in the United States, and lost productivity and premature mortality cost an additional $15.5 billion. However, consistent with findings in the previous report, there were disparities in stroke prevalence identified by age, race/ethnicity, and level of education. (3, 4) Typical risk factors for stroke include older age, male gender, diabetes mellitus, systolic blood pressure, and current smoking. (5)

> *… patients with post-stroke disabilities can be rehabilitated using SOT methods'*

Approximately one-third of patients with stroke exhibit persistent disability after the initial cerebrovascular episode, with motor impairments accounting for most post stroke disability. (6)

The rate of primary disability in patients after stroke is 3.2 per 10000 population but only 20% of previously working patients return to work. (7)

After ischemic stroke, attempts to limit brain injury with clot-dissolving drugs that can be given immediately following a stroke have met with great success but are limited due to the short window for success. Another promising option for post stroke treatment may well be to promote recovery of function in people affected by stroke. '*Following stroke, there is a heightened critical period of plasticity that appears to be receptive to exogenous interventions (e.g., delivery of growth factors) designed to enhance neuroplasticity processes important for recovery*.' An emerging concept is that combinational therapies to stimulate neuroplasticity appear much more effective than single interventions in improving stroke recovery, reinforcing the potential of an interdisciplinary approach to stroke rehabilitation. (4, 7)

This case report discusses an elderly male patient suffering from post stroke disabilities who sought chiropractic interdisciplinary care and neuro-rehabilitation to facilitate neuroplasticity and recovery of prior muscle function, improve ease of activities of daily living, and his return to work. Of interest is the concept that neurological function can recover even in the presence of anatomical structural pathology, such as brain damage or infarct secondary to stroke.

Case History

Patient is a 72-year-old male suffering from a left middle cerebral artery infarct in the brain. Ultimate cause of blood clot was heart atrium thickening from mitral valve prolapse (from rheumatic fever as a child). The heart went into fibrillation, which then released a clot from the heart atrium wall. Post stroke, the patient was placed on Coumadin. Due to the stroke the patient suffered right hemiparesis with slight loss of swallow reflex and some slurred speech due to loss of tongue dexterity. Patient was admitted to the hospital immediately post-stroke and then later sent to a rehabilitation hospital setting for approximately four months. Hospital rehabilitation (in-patient and out-patient) included standard physical therapy, occupational therapy and speech therapy for four months. Upon discharge from all 'traditional' medical rehabilitation care patient did not have full strength back in his right leg and his right arm and hand were still very weak and unstable. The patient felt he still had room to improve and sought care at our office. Chiropractic care began at his release from the rehabilitative hospital at 4 months post-stroke and treatments were administered at a minimum three times per week, up until release to work at nine months (five months of chiropractic care).

Methods/Intervention

Evaluation included traditional orthopedic and neurological examination tests such as evaluating ranges of motion in the spine and all limbs, cranial nerve testing, gait patterns, and strength testing. Evaluation also includes a complete sacro occipital technique (SOT) chiropractic exam inclusive of all SOT diagnostic indicators. (8, 9, 10, 11)

When the patient initiated care at this office, which was at the four-month mark, videos were taken of the patient doing simple activities of daily living such as walking, writing and speaking before treatment was rendered. Follow up videos were then also taken intermittently for the purpose of doctor evaluation and documentation of any progress to assist with formulating future treatment plans. Following 5 months of care and his release to work, the patient continued with supportive care 12 during the following 18 years. CT scans were completed initially upon hospital admittance, and follow-up studies were performed intermittently to monitor brain health. No changes were seen in size or quality of the infarct, even eighteen years post stroke.

After assessing the spine, cranium and extremities, chiropractic treatment was administered using SOT and SOT cranial protocols (8, 9, 10, 11) along with a combination of

neurorehabilitation exercises that were performed in-office and at home. Neurorehabilitation exercises and homework included the following:

1. Limb exercises of flexion and extension, starting with the normal limb and proceeding to the injured/paralyzed limb work immediately afterward.
2. Cross crawl exercises in either standing, or crawling positions, or aided while in a supine position.
3. Activities that would target weakness in function to help increase stability. These exercises would be performed simultaneously during SOT chiropractic and cranial treatments as well as to help monitor and guide the patient for their home rehabilitative activities.

SOT care included orthopedic blocking (13) and SOT cranial manipulations (14) in the supine, prone and sitting positions as well as standing via a tilt table. Goals of chiropractic orthopedic blocking were to strengthen sacroiliac biomechanical and neurological stability in all positions including the paralyzed leg. Goals of SOT cranial manipulation were to keep sphenoid moving in all ranges of motion during all biomechanical body positions described above. (15, 16) SOT cranial range of motion specific to the sphenoid bone was assessed and corrected in each various body position. A tilt treatment table was used to increase normal posture and weight-bearing stimulation in gradual increments from supine to standing and prone to standing. As described above, neuro-rehabilitation exercises were performed simultaneously along with these treatments.

Nutritional supplementation was also recommended to stimulate circulation to brain tissue and help support pituitary and adrenal gland function via Chinese herbology and vitamin therapy. The patient was analyzed through urine, saliva and blood testing for clinical deficiencies of pituitary and adrenal function. Brain neurotransmitter function was also tested through urine analysis and all deficiencies or imbalances were appropriately treated. Clinical research has illustrated that most stroke patients tend to have a deficiency of adrenal function and serotonin levels. (17, 18) During the 18 years of supportive care (12) the patient was retested approximately every two to three months to monitor levels and supplementation to maintain optimal balance as much as possible.

Results

The addition of chiropractic care to the patient's treatment plan appeared to clearly increase his overall health. Following care he began to progress to the point that he could return to work and was fully stable and functional without any limitations. Prior to instituting chiropractic cranial care his condition was determined to have stabilized and no further improvement was anticipated. He has continued chiropractic treatment weekly to biweekly up until the present day, with the goal of sustaining his functional health particularly as he enters into his ninth decade of life.

CT scans were taken at various times during the eighteen years of care. Of significance, the comparison of the scan taken at 72 years old with the one taken at 90 years old (Figure 1) showed no change in size or quality of the infarct. This patient, up to eighteen years post-stroke, was able to return to a functional activity of daily living, including the ability to return to his original occupation; this has been documented through video and examination results The patient was notified by his doctors four months post stroke that he was not expected to return to work given the extent of brain injury and resulting debilitation. Prior to having a stroke, the patient had worked as an architect in New York City, commuting 40 miles by car and/or by train from New Jersey. In exactly nine months post stroke he returned to work, and worked at his prior levels until he retired at the age of 86, fourteen years post stroke. He was proudly able to retire with a perfect attendance award given by his company.

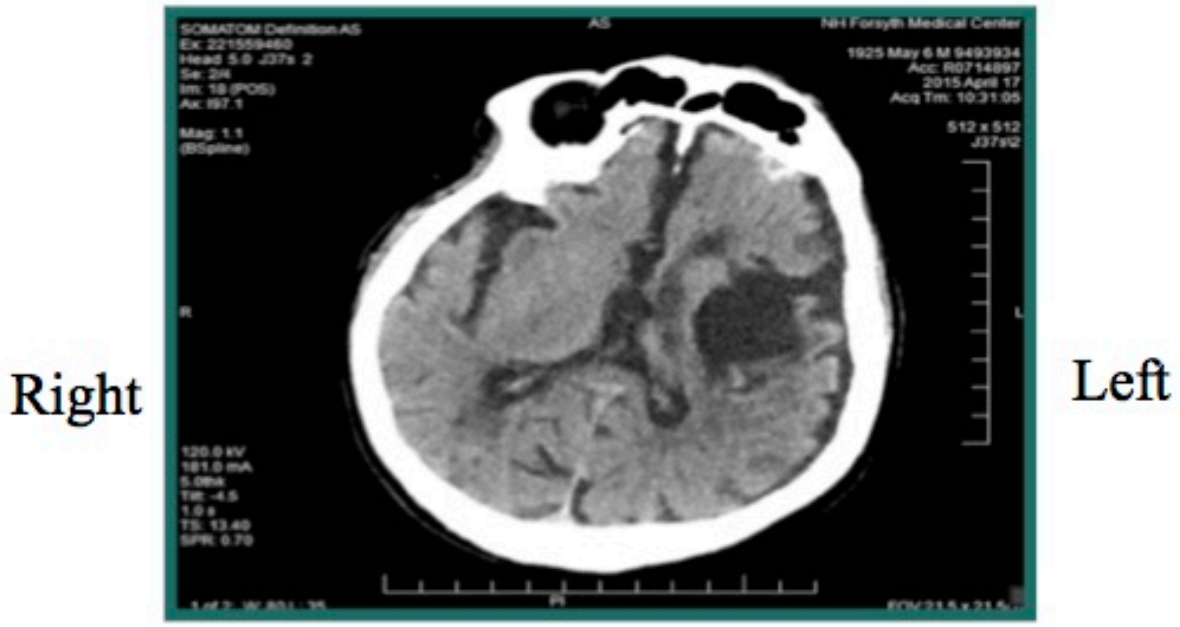

Figure 1. Eighteen years post stroke no change in the size and quality of the infarction yet patient is fully functional.

Rehabilitation from stroke can be challenging, and delay or lack of recovery can even lead to suicide. 2 Ultimately the primary goals of post-stroke rehabilitation are driven by the activity and quality of life needs of individual patients. (6)

Neuroplasticity is the '*brain's ability to reorganize itself by forming new neural connections throughout life. Neuroplasticity allows the neurons (nerve cells) in the brain to compensate for injury and disease and to adjust their activities in response to new situations or to changes in their environment.*' (19) The term neuroplasticity gained prominence in the latter half of the 20th century, when Livingston 20 discussed how many aspects of the brain could become changeable (or 'plastic') even into adulthood. (21)

Two categories of neuroplasticity (functional and structural) are discussed in neuroscience. Functional neuroplasticity relates to the brain's ability to rewire itself, which is involved in processing functions in undamaged areas (like speech or body movement). The second category, structural neuroplasticity, relates to the brains ability to alter the physical structure in response to learning new information, skills or habits. The functional category can be divided into two subcategories of neuromechanical and neurochemical. The neuromechanical form of treatment used in this case had its focus on biomechanical stimulation by balancing of the spine and cranium. The improved structural neuroplasticity theoretically may have "cross talk" non-synaptic communication (22) that also facilitates local functional neuroplasticity.

In conjunction with chiropractic (sacro occipital technique) and cranial care, specific neuro-rehabilitative exercises were used to aid the patient's recovery. (23) This combination of therapies helped the patient develop motor skill learning with a repeated sequence to facilitate altered cortical activation and neuroplasticity. (24)

Since care was not begun until four months post stroke, after being released from the hospital, it is unclear what type of further recovery could have been attained with care that had started sooner. However '*motor recovery plateaus within months after stroke are being challenged by*

advances in novel motor-learning-based rehabilitation therapies. Initial intervention studies provide evidence that long-term exercise can mediate central nervous system plasticity.' (24, 25)

While many studies have described the functional effects of neuroplasticity for the rehabilitative recovery from stroke, understanding of how this plasticity occurs is still not understood. One biological mechanism being studied addresses the neurochemical aspect of neuroplasticity and how exercise, brain-derived neurotrophic factor (BDNF), and genetics play roles in stroke rehabilitation. (25) Other studies further investigating genetics are suggesting that gene expression may be modified post stroke through the role of epigenetic mechanisms possibly stimulated through chiropractic care and exercise. (26)

Chiropractic care theoretically can facilitate neuroplastic activity post-stroke by promoting neuroplastic 'positive changes' with a post-stroke patient by increasing learning and inhibiting 'negative changes' which can be maladaptive, such as pain. (27, 28) Cranial care is rendered to theoretically facilitating sphenoid bone motion to create appropriate biomechanical stimulation to the pituitary gland affecting hormonal balance as well as stimulation of circulation and CSF flow to all brain tissue with the goal of aiding neuroplasticity.

To some stroke may be considered a form of traumatic brain trauma more commonly related to vascular phenomena. Remeta and Blum discuss the use of SOT chiropractic and cranial care, rehabilitative exercises, and nutritional modification for the treatment of patients suffering from traumatic brain trauma. (29, 30) Other studies also discuss the use of SOT chiropractic and cranial care for patients suffering from head trauma with a successful resolution. One involves a female whose condition improved six months post trauma (31) and another case where care had been rendered to a male patient (ongoing over ten years) as a means to reduce any further deterioration of his condition. (32)

This patient's case is particularly compelling because pre and post CAT scan studies revealed middle cerebral artery infarct and left parietal lobe damage that was present initially post-stroke and remained unchanged eighteen years later even though he had regained full motor function. This case also illustrates how neuroplasticity can occur even in the adult injured brain, giving hope and the possibility of recovering function following a stroke. The injured patient must understand recovery involves a high amount of commitment, time, and devotion to tedious repetitious home rehabilitative exercises. Also treatment frequency and duration (1-3 hour treatment session 3–4 times per week) along with the cost of care as a means to optimize rehabilitation and recovery can represent obstacles for some patients.

Limitations for this study relate to the inability of ruling out possible placebo or ideomotor effects. Regression to the mean is something to consider, presuming the patient would recover independent of the care rendered. It is of importance to note the patient had a loss of function for the four months following his stroke and that improvement of function, activities of daily living, and ability to return to work all occurred following the institution of chiropractic cranial care and neuro-rehabilitative exercises.

Conclusion

This case study presents a stroke patient with a middle cerebral artery infarct and left parietal lobe damage evident on various radiological studies, and the effects of the stroke in his clinical presentation. The successful rehabilitation of this stroke patient gives both the clinician and general population hope that neuroplasticity can take place in all age groups, particularly the elderly. Theoretically this type of treatment may also be used in wellness health care protocols to prevent neuro-degeneration of brain tissue. Further research should be performed to determine if there might be specific subsets of elderly patients suffering post stroke symptomatology that might have greater neuroplasticity stimulated with chiropractic and neuro-rehabilitative care.

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