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CLINICAL EVIDENCE

Changes in post-chemotherapy neurological deficits after chiropractic care: A case report

Alice Cade, Wilson Fisher-Van der Veen and Carissa Te Wharau

Abstract:

Objective The objective of this case study is to report changes to ongoing neurological deficits experienced post-chemotherapy after chiropractic care.

Clinical Features A 20-year-old female presented with a five-year history of chemotherapy-induced neurological deficits. She received twelve months of intravenous chemotherapy for osteosarcoma treatment. Post chemotherapy, she reported paraesthesia in her hands and feet, which was more severe in the left arm. She also reported decreased sensation in the left leg from the mid femur to the foot as well as the right foot. At age sixteen, she was also diagnosed with depression and anxiety.

Intervention The patient was placed on a combination of chiropractic techniques, upper cervical specific and diversified, for three months. The patient was placed on a care plan consisting of twice a week for the first three weeks before a progress examination was performed. The main area that was adjusted throughout this care plan was C1.

Outcomes At the progress examination on the sixth visit, the patient stated that she had experienced an improvement in mobility, strength, mood, independence, sleep, and digestion. Upper and lower limb dermatomes had improved sensation, and muscle strength was increased. Cerebellar function, eye movements, and hearing had all returned to normal. All cervical range of motion was improved, as were her RAND-36 scores.

Conclusion This case report details changes in neurological symptoms post-chemotherapy after chiropractic care. This case report aims to be a building block for further research investigating any potential link between regular chiropractic care and improved neurological function post-chemotherapy.

Indexing terms: Chiropractic; Paraesthesia; Osteosarcoma; Anxiety disorders; Depression; Antineoplastic Agents.

Introduction

Chemotherapy agents are used in the standard treatments of many types of cancer; however, these drugs have been reported to exhibit neurotoxic adverse effects. (Wang et al., 2021) The effects of chemotherapy on the nervous system vary depending on the individual compound, specific physical and chemical properties of the drug used and its single or cumulative doses. (Zajaczkowska et al., 2019)

'... this case report demonstrates the role of chiropractic to support younger patients undergoing chemotherapy for osteosarcoma.'

The current chemotherapy treatment regime for osteosarcoma consists of methotrexate, doxorubicin and cisplatin. (Ferrari & Serra, 2015) Chemotherapy-induced neurological deficits can affect both the peripheral and

central nervous systems. (Wang et al., 2021) Central neurotoxicity can cause difficulty in initiating or maintaining voluntary physical and cognitive activities. Approximately 75% of patients will experience cognitive impairments during chemotherapy, and 35% will continue to experience cognitive difficulties in the months to years following treatment. (Wang et al., 2021)

One of the most common adverse effects of chemotherapy is chemotherapy-induced peripheral neuropathy (CIPN). Clinically CIPN presents as neurological deficits in sensory, motor, or autonomic functions. (Zajaczkowska et al., 2019) Sensory symptoms are most common and often involve the distal parts of the limbs as a typical glove-and-stocking neuropathy. Symptoms may include numbness, tingling, neuropathic pain, decreased vibration, pinprick sensitivity and increased sensibility to hot or cold temperatures. (Wang et al., 2021) Motor deficits may vary from weakness, hyporeflexia, gait and balance disturbances. Less common are autonomic symptoms such as orthostatic hypotension, hearing loss, and constipation. Long term symptoms of CIPN could involve depression, ataxia and insomnia. (Nurgali et al., 2018) The prevalence of CIPN is drug-dependent and ranges from 19% to more than 85%. (Zajaczkowska et al., 2019) Prevalence decreases over time, with 68.1% reporting CIPN within one month after the completion of chemotherapy, 60% at three months, and 30% at six months or more. (Bao et al., 2016)

There are currently no effective treatment strategies for CINP. (Colvin, 2019) However, it has been suggested that non-pharmacological approaches may be useful. Complementary and alternative medicine (CAM) is described as an intervention or practise that is not considered standard medical care. (French et al., 2013) CAM can be used in conjunction with standard medicine or in place of standard medicine. CAM intervention involves but is not limited to acupuncture, osteopathy, massage, and chiropractic. (Mior et al., 2019) The most common reasons people choose CAM include medical, cultural, social beliefs that align more with CAM. CAM can be more financially accessible to the person and consist of a more natural approach. (Debas et al., 2006) Lastly, people choose CAM because they have tried standard medicine and hadn't seen any improvements in their condition. (Debas et al., 2006) Common reasons for CAM usage are insufficient control of neuropathic pain and perceived lack of efficacy of conventional pain medications. (Debas et al., 2006)

Chiropractic is the largest and most regulated CAM profession utilized in the world today. (Meeker & Haldeman, 2002) The main focus of chiropractic care is to detect and facilitate the correction of vertebral subluxation to restore optimal function of the spine and nervous system. (Haavik, 2014) A vertebral subluxation is described as a self-perpetuating, dysfunctional area in the spine that negatively impacts the nervous system, health and wellbeing. (Haavik, 2014) People choose to visit a chiropractor for many different reasons. The most common reason a person received chiropractic care was for their musculoskeletal condition, with the remaining people visiting to receive wellness care and help improve their quality of life. (French et al., 2013) In this case study the patient chose to receive chiropractic care to see if chiropractic care could change her CIPN and in turn would improve her quality of life as the CIPN was making activities of everyday life hard to perform.

There are many different chiropractic techniques utilized worldwide. All chiropractic techniques have their benefits, and all can help people meet their goals of care. Technique choice ultimately comes down to efficacy, safety, and patient presentation. The technique chosen for this patient was upper cervical specific (UCS). UCS is a style of manual chiropractic adjusting, which adjusts using a specific toggle table. Rather than focusing on the entire spine the primary focus is placed on the top two vertebrae of the spine, C1 and C2. (Woodfield et al., 2015) Diversified technique was used in the rest of her spine. Diversified technique is the most common manual chiropractic technique used worldwide. (Clijsters et al., 2014) It is a manual technique that focuses on addressing vertebral subluxations throughout the whole spine. (Painter, 2003)

The improvements in neurological deficit signs and, as well as quality of life are discussed in this study. The purpose of this study is to detail the real-life patient experience of a 20-year-old female who experienced significant relief in neurological deficits post-chemotherapy after three months of regular chiropractic care.

Clinical features

A 20-year-old female presented to the chiropractic centre with a five-year history of chemotherapy-induced neurological deficits after surgery in 2016 to remove an osteosarcoma in her left femur. A thorough health history was taken, and the patient reported she had been experiencing numbness and tingling in her hands and feet, which started after twelve months of intravenous chemotherapy.

The patient experienced decreased sensation in both hands and forearms throughout the day, with a cold sensation in her left arm along the C5-C7 dermatomes and she described '*pins and needles*' in her hands at night, which was more severe in the left arm. In the lower extremities, she experienced a decrease in sensation in the left leg from the mid femur to the foot as well as the right foot. The patient also reported experiencing chemotherapy-induced visual and hearing disturbances. Further questions revealed, at age sixteen, she was diagnosed with depression and anxiety, gabapentin, and citalopram were prescribed to help with this.

Sensory examination revealed decreased sensation in all digits bilaterally. The lower limbs showed decreased sensation L1-5 on the left and L4-S1 right. Left upper limb strength was 4/5 but normal on the right. She was unable to perform left knee extension against resistance, potentially due to her previous surgery, and bilateral hallux extension was 4/5. All muscle stretch reflexes were rated 0/4 in the upper and lower limbs.

On standing, she had a left lean, but her gait was normal. Cerebellar testing showed a significant sway in part two of Romberg's test, and she was unable to perform tandem gait or tandem Romberg's. Examination of cranial nerves revealed decreased sensation on the left cheek to pain, nystagmus on left gaze, superior gaze paralysis bilaterally and left-sided hearing loss.

Analysis for vertebral subluxation was performed via a spinal examination conducted by the same chiropractic intern at all nine visits. There were multiple vertebral subluxation indicators used by the chiropractor, including Derifield, leg-length reactivity with cervical syndrome, muscle tone, bone tone, heat, muscle testing, oedema, point tenderness, vertebral motion palpation, and joint play of each vertebral segment. These are commonly used vertebral subluxation findings used by chiropractors. (Eriksen & Rochester, 2007) The primary levels of subluxations found were at C1, R ilium, T4, C6 and occiput. The patient had full spinal x-rays taken on the 24th of May 2021, which revealed no significant findings.

Subjective measures used for quality of life and physical functioning improvement were collected using the RAND-36 questionnaire (Hays & Morales, 2001) on the initial visit and the sixth visit. (Appendix)

Intervention

The patient received chiropractic care over nine weeks at a frequency of one visit per week for nine weeks using a combination of UCS and Diversified technique. (Clijsters et al., 2014) The patient was adjusted at one spinal segment, C1, for the first eight visits. Other potential vertebral subluxations identified at the initial consultation and were the right ilium, T3, C6, and occiput.

The only other segment that was adjusted throughout her care plan was a PL sacrum on the ninth visit. Her progress was assessed at visit six after receiving two adjustments a week for three weeks. After the progress on the sixth visit, she showed marked improvements in her subjective

quality of life, balance, coordination, and neurological deficits. Her improvements led to a decrease in frequency of visits from twice a week to one time a week as a result.

Outcomes

At the progress examination on the sixth visit, the patient stated that she had experienced an improvement in mobility, strength, mood, independence, sleep and digestion. The upper limb sensory examination revealed an increase in sensation in all digits bilaterally. Left upper limb strength had improved from 4/5 to 5/5. The lower limb sensory examination showed an increase in sensation along L1-L2 and L5 on the left and L5-S1 on the right. She was still unable to perform left knee extension against resistance, and bilateral hallux extension was 4/5.

She no longer had a left lean when standing, gait was normal and cerebellar testing showed an improvement in part two of Romberg's test, and she was able to perform tandem gait, which was normal. Examination of cranial nerves revealed decreased sensation on the left cheek to pain. H-test was normal with no nystagmus or superior gaze paralysis, and the suggested left sided sensorineural deafness was no longer present.

Cervical range of motion improved from 50 to 65 degrees in extension, 20 to 35 degrees in lateral flexion, and 70 to 80 degrees bilaterally in rotation. Active left knee extension improved from zero to 40 degrees with no pain. The primary levels of subluxation for the spinal examination were still found to be at C1, sacrum, T4, T8 and L2. The patient decided to continue with chiropractic care with the frequency decreased to one visit per week.

A RAND-36 subjective questionnaire regarding her quality of life was filled out at the initial consultation on the 18th of May 2021 and then once again at the progress examination on the 7th of July 2021. See appendix 1 for data plus normative data for New Zealanders. (Scott et al., 1999) This measure was used to see if the patient was noticing any improvements in their quality of life after receiving chiropractic care.

The questionnaire assesses eight quality of life factors. The first measure is physical functioning which at the initial consultation was 30, and at her progress evaluation this improved to 75. Role limitations due to physical and emotional health were 0 and 6 respectively at the initial and at the progress jumped to 25 and 40. Energy/Fatigue at the initial was 45 and improved to 70 by the progress. Emotional wellbeing also rose from 52 to 68. Social functioning jumped from 37.5 to 75 and pain improved from 45 to 55. With all these improvements however, the patient's general health measure on the RAND-36 did drop slightly from 45 to 40. Overall, these comparisons do seem to show great improvements in how she perceived her functioning, as seven of the eight quality of life measures rose throughout this three-week period of chiropractic care.

Discussion

This report documents the improved post-chemotherapy neurological deficits and quality of life in a 20-year-old female after three months of chiropractic care that was provided with the purpose of correcting vertebral subluxations.

Complementary and alternative medicine (CAM) therapies, including chiropractic have become more popular among patients diagnosed with chronic neurological disorders. (Brunelli & Gorson, 2004) Common reasons for CAM usage are insufficient to control neuropathic pain and perceived lack of efficacy of conventional pain medications. (Debas et al., 2006) Chronic pain is a brain-based issue, which is defined as pain that has been present for three or more months that serves no function. (Davis et al., 2017) Chronic pain is prevalent worldwide and affects up to 35% of people, (Davis et al., 2017) it can be a result of dysfunction caused by many factors including,

injury, dysfunctional sensory motor integration, stress, and maladaptive neurological responses. (Simons et al., 2014)

Current research suggests that areas of spinal dysfunction represent a state of altered input from the body to the brain. This altered input may be responsible for ongoing maladaptive neurological changes that could lead to pain and dysfunction. Clearly, appropriate sensorimotor integration is essential for many aspects of daily life. (Haavik Taylor et al., 2010) A well-functioning sensory and motor system allows us to reach out and grasp an object, detect and turn towards a stimulus, or respond to potential threats from the environment. (Chen et al., 2009)

Chiropractic adjustments impact afferent neurological input, resulting in more improved sensorimotor integration. (Haavik & Murphy, 2012) It is possible that for this patient, her CIPN negatively affected afferent input from her body to her brain, altering her sensorimotor integration and contributing to her symptomatology. Previous studies have found improvements in peripheral neuropathy, physical functioning and paraesthesia after receiving chiropractic care. (Herman & Pitts, 2018; Russell & Doyle, 2018) It is entirely possible that with chiropractic care, this patient's sensorimotor integration improved, leading to her improved function and quality of life.

Another possible mechanism that may have affected her symptomatology is that chiropractic care has been shown to help proprioception and balance. (Haavik & Murphy, 2012; Haavik Taylor, Holt, & Murphy, 2010; Haavik Taylor & Murphy, 2008; Holt, Haavik, & Elley, 2012; Yang, Lee, & Kim, 2015). Research has shown that adjusting the spine can lead to better proprioceptive processing or a more accurate understanding of where the limbs are in space. (Haavik & Murphy, 2012) Other research has shown that in both healthy and brain-damaged individuals, chiropractic care can improve muscle strength and activation, and feed-forward activation of postural muscles. (Christiansen et al., 2018; Holt et al., 2021, 2019; Holt, Haavik, Lee, Murphy, & Elley, 2016). Taken together, it is possible that the chiropractic care this patient received may have been instrumental in her improvements in posture, strength, and sensory changes.

The changes in QoL she experienced may have been affected by chiropractic care as well. Anxiety, depression, sleeping difficulties, energy levels, fatigue, chronic pain and significant health challenges are some contributing factors that affect QoL. (Alcantara et al., 2020; Heydarnejad et al., 2012; Russell & Glucina, 2018) However, studies have shown an improvement in QoL in patients receiving chiropractic care, although their chief complaint was for a musculoskeletal condition. (Jones et al., 2018; Russell et al., 2016; Russell & Glucina, 2018) There is, potentially, a link between chiropractic care and improved QOL, but more research is needed to clearly delineate this relationship.

The information in this case report is limited by several factors, firstly being a single case study, there is no control over external factors and natural progression of healing. The patient also introduced dietary and lifestyle changes throughout chiropractic care that may have contributed to her symptomatic changes, improved function, and improved quality of life.

Conclusion

This case study documents three months of chiropractic intervention given to a 20-year-old woman who had neurological deficits following chemotherapy treatment for osteosarcoma five years previously.

While no causative link can be made with a single case, there is a reasonable rationale described for how chiropractic care may have affected this patient. However, there is a need for further research to understand how chiropractic care could influence the changes described in this case report. This case is a building block to future research and contributes to the growing pool of literature on this topic.

Carissa Te Wharau
BSc (Chiro)
NZCC

Wilson Fisher-Van der Veen
BSc (Chiro)
NZCC

Alice Cade
BSc (physiol), BSc (chiro), DICCP, MHSc.
Lecturer and Intern Mentor
NZCC
dralicecade@gmail.com

Informed consent to chiropractic care and for the reporting of clinical details of this case are held by the New Zealand College of Chiropractic Clinic.

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Appendix
RAND-36 subjective questionnaire regarding Quality of Life

Domain	**Initial Examination**	**1st Progress**	**New Zealand Normative**
Physical Functioning	30	75	86
Role Limitation due to Physical Health	0	25	80.7
Role Limitation due to Emotional Health	6	40	85
Energy/Fatigue	45	70	65
Emotional Wellbeing	52	68	78
Social Functioning	37.5	75	86.6
Pain	45	55	77.9
General Health	45	40	73.8

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