Case Study

Improvement of a Functional Movement Disorder in a Patient Receiving Network Spinal Analysis and Somato Respiratory Integration Care: A Case Report

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Abstract

Introduction: A 36 year-old female presented to a wellness based chiropractic clinic suffering from uncontrollable hyperkinesia, featuring myoclonic jerks and tics. A neurologist made the diagnosis of a functional (nonorganic) movement disorder and referred the patient to a psychiatrist for treatment of a suspected psychogenic movement disorder. She chose not to see a psychiatrist and instead began chiropractic care.

Methods: Network Spinal Analysis (NSA) and Somato Respiratory Integration (SRI) care was delivered over a period of twenty weeks. The patient was evaluated for indicators of Adverse Mechanical Cord Tension (AMCT), including vertebral subluxation and spinal defense patterns, according to the NSA protocol. Spinal and neural integrity (SNI) was assessed through static and motion palpation, postural and neurological assessments, and surface electromyography.

Results: Significant improvements in SNI were achieved, as were other wellness based outcomes of NSA and SRI care as reported by the patient. These improvements coincided with the steady improvement of all signs and symptoms of a FMD, with a complete resolution of all hyperkinetic movement, myoclonic jerks, and tics by 20 weeks of care.

Conclusion: NSA and SRI care was found to be of promise for restoring neurological function in a patient with a FMD. The findings in this case could support further research into the relationships between SNI, vertebral subluxation, and FMD's.

Key words: *Chiropractic, Network Spinal Analysis, Somato-Respiratory Integration, Functional Movement Disorder, Spinal and Neural Integrity, Vertebral Subluxation*

Introduction

Functional movement disorders (FMD's) account for over 16% of patients referred to neurology clinics.[1,2] A FMD is described as abnormal movement or positioning of the body due to the nervous system not working properly, but not due to any underlying neurological disease. FMD's often cause major challenges in terms of diagnosis and treatment due to the absence of pathophysiological understanding.[2] 'Psychogenic' suggests that there is an entirely psychological explanation for these symptoms, with a historical emphasis on causation by emotional trauma.[3]

FMD patients may experience a range of distressing and disabling symptoms, including: tremors, tics, myoclonus, dystonia, Parkinsonism, and gait disorders.[1,3,4] Common treatments include psychotherapy, behavioral therapy, physical and occupational therapy, and pharmacological treatment. Usually a combination of therapies is used and a team approach is recommended.[2,4,5]

Some FMD's have been shown to respond to pharmacological treatment of underlying depression and anxiety.[6] Tics have been shown to improve with counseling and behavioral therapies; while hyperkinetic movement disorders are becoming increasingly managed with pharmacological treatment focused on the basal ganglia, including dopamine receptor-blocking drugs and monoamine-depleting drugs.[7]

A longitudinal study of 228 PMD patients between 1990 and 2003 found that 56.6% patients showed an improvement in symptoms within 2 to 14 years, 21.3% remained unchanged, and 22.1% became worse.[4] Predictors for a favorable outcome have been attributed to the elimination of stressors, stress management, good physical health, psychological support, and positive social life perceptions. A favorable prognosis has also been associated with compliance with the prescribed treatment plan and the patient's perception of effective treatment.[4]

Subluxation centered chiropractic care may offer an important contribution to the management of patients with FMD's by improving neurological function.

Case Report

Presentation

A 36 year old Caucasian female presented with a chief complaint of uncontrollable body shakes (hyperkinesia) with tics and myoclonic jerks that began, according to the patient, following an Alexander Technique session approximately 5 months prior. She reported high work stress during the time of the initial onset. There had been no improvement in her symptoms during this time, and at the commencement of care the patient was unable to work. Secondary complaints were anxiety and chronic neck pain, which increased with the onset of the involuntary body movements.

Aggravating factors were anything that required physical effort or mental focus, including: work, exercise, Tai Chi, stretching, and meditation. Alleviating factors were things that did not require any mental or physical focus, such as resting and gentle walking.

She consulted her medical doctor who immediately referred her to a neurologist. No physical or neurological cause was found upon neurological exam, and there was no neural imaging conducted. The neurologist made a diagnosis of a functional (nonorganic) movement disorder and referred the patient to a psychiatrist for a suspected psychogenic movement disorder (PMD). The patient chose not to see a psychiatrist and began chiropractic care instead. She did not follow up with the neurologist at any stage.

Network Spinal Analysis (NSA)

NSA care is an evidence based chiropractic and wellness modality. It is applied through specific low force contacts made at specific points along the spine. Through these contacts, called a Network adjustment or a spinal entrainment, a dynamic spinal wave phenomenon is initiated that is believed to lead to a higher brain awareness of the body (somatic awareness) and its external and internal environment, particularly the spine.[8,9] Research, through mathematic modeling of this reorganizational spinal wave phenomenon, has demonstrated an increase in the organization of the central nervous system.[10-14] NSA is exclusively practiced by chiropractors in relationship to the identification and self-regulation of spinal tension and vertebral subluxation patterns.[9]

NSA care is applied through three increasing Levels of Care that are associated with new emerging properties within the spine and nervous system.[9] Level 1 and early Level 2 of care were used exclusively in this case presentation. Low force NSA contacts were applied on specific spinal segments with an upward traction of the connective tissue in either a flexion/extension or a lateral bending direction. All spinal entrainment contacts were made with the patient prone and with a brief duration of one second or less for Level 1, and with sustained duration contacts of up to two minutes for early Level 2.

Somato Respiratory Integration (SRI)

SRI is a system of exercises which link enhanced somatic awareness with respiration and movement.[15,16] SRI promotes a person's ability to focus attention on gross and subtle body movements, self-directed breathing, and awareness of tension in the body. SRI exercises help a person dissipate energy stored as tension, enhance structural flexibility, and increase the experience of safety within the body.[16]

There are twelve SRI exercises associated with 12 Stages of Healing.[16] The first two SRI exercises (stage 1 and stage 2) were used exclusively in this case presentation. Stage 1 SRI exercise involves three different body areas with attention focused on one body area at a time. The hands are placed palm over palm, facing down with both hands overlying each SRI position. SRI position #1 is over the breastbone on the upper chest, SRI position #2 is at the bottom of the ribs over the xiphoid process, and SRI position #3 is over the umbilicus. The stage 2 SRI exercise involves focusing one's attention on two body areas, with one hand overlying one area and the other hand overlying another area while alternating breathing between the two areas.[16]

Spinal and Neural Integrity

The Epstein Model of Spinal and Neural Integrity (SNI) is one of the models upon which NSA care is based.[17] SNI, which is based on the theory of Panjabi,[18] suggests that there are three spinal stability subsystems which regulate a dynamic state called spinal and neural integrity. These subsystems are the passive, active, and neural control subsystems.

The passive subsystem is composed of the vertebrae, ligaments and spinal discs. Tension in this subsystem suggests that the small inter-segmental muscles of the spine are acting in defense, as the individual is locked in a protective physiology. The active subsystem is composed of the spinal muscles and tendons, especially the long muscles of the spine. Tension in the spinal muscles is thought to relate to adaptation to stress, including emotional tension. The neural control subsystem is composed of the spinal cord, nerve roots and peripheral nerves, as well as the attachment of the meninges to the vertebral segments.

An additional subsystem, the emotional subsystem, is proposed by Epstein to be associated with the range of motion and tension within any tissue of the body, including the elements of the passive, active, and neural control subsystems.[17] The emotional motor system is reported to influence the threshold of excitability at every spinal level.[19] The ability or inability to perceive, process and verbalize a body sense or emotion is believed to be linked to this system.[17] Although chiropractors utilizing NSA care do not assess the emotional subsystem directly, they consider its implication in spinal and neural integrity.

The concept of Adverse Mechanical Cord Tension (AMCT), introduced by the neurosurgeon Alf Breig, is associated with lengthening in flexion/extension or lateral bending of the spinal cord and the neural control subsystem.[20] NSA care evaluates this neurologic parameter through heel tension resistance to flexion/extension of the Achilles tendons and/or eversion resistance to lateral bending of the Achilles tendons. AMCT is proposed to be associated with stress physiology and expressed by an individual as a defense posture.[21]

Treatment protocols

The patient was placed on an initial program of NSA and SRI care beginning at 3 visits per week for 8 weeks. Stage 1 SRI exercises were used on each visit before NSA care was applied. The patient was evaluated for indicators of AMCT according to the NSA protocol (Figure 1). Spinal levels addressed with NSA care throughout the initial eight weeks, but not on every visit were: Occiput, C1, C2, C3, C5, C6, C7, bilateral sacrum, left ilium and coccyx.

The patient's care was then reduced to two visits per week for a further twelve weeks. SRI exercises for stages 1 and 2 were used at the beginning of each visit, before NSA care was applied. Spinal levels addressed with NSA care during this period, but not on every visit, were Occiput, C1 – C7, T1, T2, bilateral sacrum, left ilium, and coccyx.

Assessment and periodic re-assessment of spinal and neural integrity was measured according to spinal stability subsystem findings, and was recorded at the initial exam, at 8 weeks, and at 20 weeks of care (Tables 1, 2, and 3).

Assessment protocols and initial findings

The passive subsystem was assessed through static and motion palpation in the sitting and prone positions, and graded on a scale of 1 – 5 (Table 1). Passive system tension was noted on initial exam from C7 to T4 and from T7 to L1 with restricted spinal motion, segmental fixation, and lack of compliance in these areas. No visible respiration was seen through these spinal levels when resting in the prone position. Static palpation and visual observation in the sitting and prone positions revealed a significant increase in the thoracic kyphosis and a large left lateral curvature from T7 to L1 and then a smaller right lateral curvature from T2 to T6.

The active subsystem was assessed using computerized surface electromyography (sEMG) exam (Table 2). sEMG exams were done using a Myovision 3G static system with a 25-500 Hz Bandpass filter and handheld scanning probes set to display data between 1 and 200 microvolts. Scanning probes were placed in an electroconductive solution before each measurement and readings were taken with the patient in the standing position at two spinal levels simultaneously, inferiorly from C2 to S1, with a grounding probe placed at every third spinal level. Surface electromyography with attached electrodes has been shown to exhibit very good to excellent test-retest reliability.[22,23] All sEMG exams were repeated by the same trained clinician with over 1000 sEMG exams to date. Initial sEMG assessment revealed abnormally low readings at T7, T10, T12, L4, and S1, suggesting muscle fatigue and a lack of spinal stability in these areas[24,25] High sEMG readings were found at C2, C4, C7, T1, T3, T6, and T9, indicating high active subsystem tension at these spinal levels (Figure 2).

The neural control subsystem was assessed through evaluation of the Achilles' tendons in both flexion/extension and eversion motion with the patient lying in the prone position, and graded on a scale of 1 – 5 (Table 3). Initial assessment found high neural control subsystem tension bilaterally in both directions.

At the start of care there was a temporary significant increase in the patients' hyperkinesia during SRI with a violent jerking reaction when she focused her attention on SRI position #3. The patient reported that she felt no connection to her body in this position, and became agitated and distressed when focusing on this area. There was a significant decrease in her hyperkinesia and an immediate improvement of all FMD symptoms when she focused her attention on SRI position #1. SRI position #2 appeared to be neutral, causing neither an increase nor decrease in her FMD symptoms.

The overall clinical impression of this patient was extreme stress physiology expressed as defense posture with little functional evidence of spinal and neural integrity.

Results

After 8 weeks of care there was a significant reduction in passive system tension from C7 – T4 and from T7 – L1 with greater compliance and range of motion in flexion/extension and lateral bending directions. There was also visible respiration observed through both of these spinal regions while the patient was lying prone. sEMG exam showed a significant increase in the muscle activity from T10 to S1 (Figure 2). While this increase in muscle activity could be viewed as an increase in active system tension, it was in the area that was surrounding the large left lateral spinal curvature, which was previously underactive due to muscle fatigue. Therefore, this was tracked as a potential reorganizational spinal response indicating an increase in spinal stability. Active system tension was reduced from C2 to T5. Neural Control system tension was reduced through the Achilles tendons bilaterally in flexion/extension and lateral bending directions.

The patient reported feeling more connected to her body in SRI position #3 and was able to focus her attention on this area for a few seconds at a time without any tics or myoclonic jerks occurring. The patient reported feeling more relaxed in her body and spine, more ease and depth in her breathing, less anxiousness, increased positive feelings about herself, and

generally feeling more at peace. There was a significant improvement in the patients FMD symptoms with fewer and less intense myoclonic jerks and tics.

At 20 weeks of care there was a further reduction in the passive subsystem tension with greater segmental compliance from C7 to T4 and T7 to L1 in static palpation, and a greater range of motion in both flexion/extension and lateral bending with motion palpation. Respiration was visibly moving through the patient's entire spine from sacrum to occiput while lying in the prone position. There was a visible reduction in the thoracic kyphosis in the standing, sitting and prone positions, but little to no change was evident in the lateral curvatures of the spine from visual analysis. sEMG exam showed an improved balance and symmetry throughout the entire spine in a pattern that was more consistent with and supportive of the lateral curvatures of the spine, suggesting a reorganizational spinal response (Figure 2). Neural control subsystem tension was significantly reduced through flexion/extension and lateral bending of the Achilles tendons bilaterally, indicating a reduction in stress physiology and defense posture.

The patient was able to focus her attention on SRI position #3 for an indefinite time period with no signs or symptoms of a FMD occurring. She returned to work and reported significant improvements in the associated symptoms of anxiety and chronic neck pain. By 20 weeks of care a high degree of spinal and neural integrity was evident. This correlated with the complete resolution of all signs and symptoms of a FMD. This improvement was still evident more than twelve months later.

Discussion

The emotional impact of prolonged stress has been shown to increase the sympathetic response associated with anxiety and vigilance.[26] AMCT, which is proposed to be associated with stress physiology and expressed by an individual as a defense posture, is associated with a loss of critical self-perception and self-regulatory processes due to dissociation of higher brain centers. This is believed to be the same mechanism through which vertebral subluxations and spinal defense patterns are maintained in the body.[18]

The patient reported feeling more connected to her body and spine within 8 weeks of care, indicating a heightened somatic awareness. This is an essential component of healing and wellness which may, in part, account for the self-reported improvement of NSA clients.[27] NSA care has been demonstrated to have a strong correlative effect (twice that of lifestyle modification) as a predictor of increased quality of life and wellness lifestyle choices.[28] The increase in positive wellness based perceptions as reported by the patient, including feeling more at peace in her body, less anxious, and more positive feelings towards herself, may have also been contributing factors to the improvement in her condition.

SRI can provide a person with a means of dispelling fear and encouraging trust in their body-mind, while promoting greater internal peace or ease.[29] In SRI, it is recognized that some areas of the body may have greater somatic awareness or connection than others and may be referred to as a place of 'peace'.[16] During the course of care, this place of peace (found at SRI position #1) was used repeatedly to support a change in the patient's physiology, strengthen the body-mind connection, and promote an internal shift from defense towards safety.

Overall, the combined changes in the patient's physiology, heightened somatic awareness, reduction of AMCT and improved spinal and neural integrity, may account for the improvement of the FMD in this case. The authors recognize that the patient was in good overall physical health, eliminated the stressors in her life by stopping work in order to focus on her well-being, and received care in an environment where she felt safe, trusted the clinicians, and had positive expectations in the wellness based outcomes. These factors also need to be considered as likely contributing factors to the positive outcome in this case.

It is important to note that NSA and SRI care was not applied as a treatment for a FMD, the signs and symptoms of a FMD, or the associated symptoms of anxiety and neck pain in this case. NSA and SRI care was applied in this case for the purpose of improving spinal and neural integrity and to promote a shift in the patients' physiology toward greater internal peace and safety.

Conclusion

During a 20 week course of chiropractic care, utilizing NSA and SRI, a patient showed a complete resolution of all signs and symptoms of a FMD. The patient also reported improvements in her secondary complaints of anxiety and chronic neck pain. These improvements coincided with greater spinal and neural integrity and other wellness based outcomes of NSA and SRI care. Chiropractic care was found, in this case, to be of promise for restoring neurological function in one patient with a FMD. The findings in this case could support further research into the relationships between SNI, vertebral subluxation, and FMD's.

Acknowledgements

The authors would like to thank Dr. Karen Feeley for her assistance with this paper, and Dr.'s Simon Senzon and Dan Lemberger for their editorial assistance.

Conflict of interest

The authors declare that they have no conflicts.

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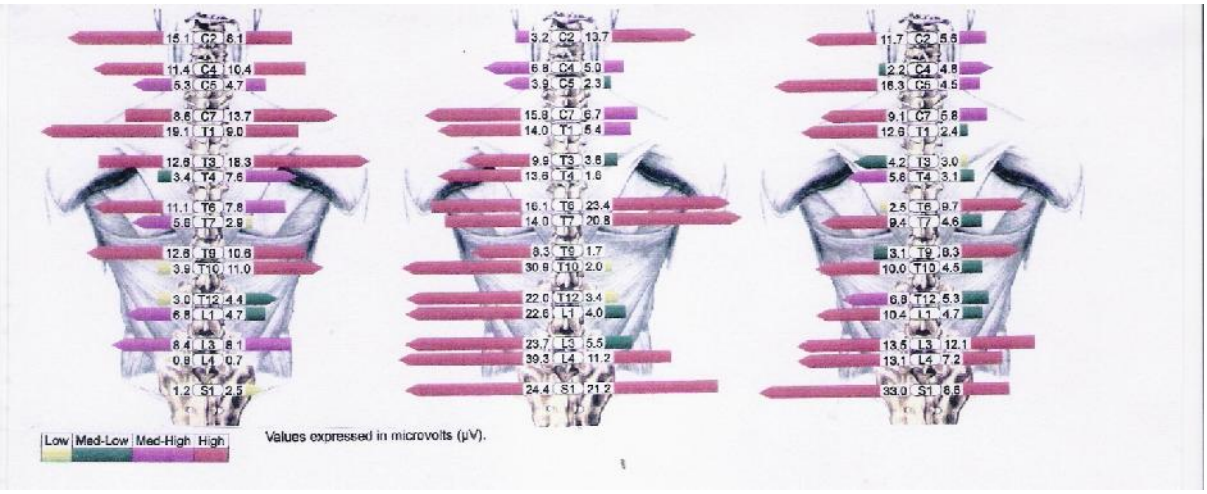
Figures & Tables

Figure 1: NSA indicators of Adverse Mechanical Cord Tension
Certain musculoskeletal changes are considered to be indicators of the effects of AMCT. This is a list of these indicators and the spinal phenomena with which they are associated. These include both observational and palpation findings. For the significance and priority of the adjustment protocol, refer to The Theoretical Basis and Clinical Application of NSA Care (Epstein 2004).

Indicator	**Segmental Level Assessed**
Short Leg	Unilateral cord tension
Cervical Syndrome Test	Tension in cervical spinal cord
Leg Crossover	sacral or pelvic distortion
Ankle Eversion Stress	Lateral flexion spinal tension
Flexion/Extension Heel Tension	Flexion/extension spinal tension
Z-flick	C2, C3 lateral bending spinal tension
Leg Adduction Stress	C2, C3 spinal cord tension
Leg Abduction Stress	C5, coccyx flex/ext. spinal tension
Palpation (motion, static, muscular)	all vertebral segments
Sacrotuberous ligament tension	lateral bending sacrum
Postural analysis	all vertebral segments
Flexibility (Range of Motion)	all vertebral segments

**Positive indicators contributing to the location and/or characterization of vertebral segments for entrainment are assessed pre and post entrainment to determine efficacy of the force applied

Figure 2. Surface EMG assessment at the start of treatment, 8 weeks and 20 weeks



Initial assessment 8 week re-assessment 20 week re-assessment

Table 1 – Passive Subsystem Assessment

Spinal levels	Initial	8 weeks	20 weeks
Upper Cervical C1 – C2	2	2	1
Mid Cervical C3 – C4	3	2	1
Lower Cervical C5 – C7	4	3	2
Upper Thoracic T1 – T4	5	3	2
Mid Thoracic T5 – T8	5	3	2
Lower Thoracic T9 – T12	5	4	3
Upper Lumbar L1 – L3	4	3	2
Lower Lumbar L4 – S1	3	2	2

Tension Scale: 1 – Low; 2 – Med-Low; 3 – Medium; 4 – Med-High; 5 - High

Table 2 – Active Subsystem Assessment

sEMG DATA	Initial		8 week		20week	
Spinal level	Left	Right	Left	Right	Left	Right
C2	15.1	8.1	3.2	13.7	11.7	5.6
C4	11.4	10.4	6.8	5.0	2.2	4.8
C5	5.3	4.7	3.9	2.3	16.3	4.5
C7	8.6	13.7	15.8	6.7	9.1	5.8
T1	19.1	9.0	14.0	5.4	12.6	2.4
T3	12.6	18.3	9.9	3.6	4.2	3.0
T4	3.4	7.6	13.6	1.6	5.8	3.1
T6	11.1	7.8	16.1	23.4	2.5	9.7
T7	5.6	2.9	14.0	20.8	9.4	4.6
T9	12.6	10.6	8.3	1.7	3.1	8.3
T10	3.9	11.0	30.9	2.0	10.0	4.5
T12	3.0	4.4	22.0	3.4	6.8	5.3
L1	6.8	4.7	22.6	4.0	10.4	4.7
L3	8.4	8.1	23.7	5.5	13.5	12.1
L4	0.8	0.7	39.1	11.2	13.1	7.2
S1	1.2	2.5	24.4	21.2	33.0	8.6
Total	128.9	124.5	268.3	131.5	163.7	94.2
Total	253.4		399.8		257.9	

Values expressed in microvolts (µv)

Table 3 – Neural Control Subsystem Assessment

Exam Dates	**Initial**		**8 week**		**20week**	
Achilles Tendon	Left	Right	Left	Right	Left	Right
Heel Tension (Flexion/Extension)	5	4	3	3	2	3
Ankle Eversion Stress	5	5	4	3	3	2

Tension Scale: 1 – Low; 2 – Med-Low; 3 – Medium; 4 – Med-High; 5 - High