

## Measurement of Outcomes for patients with centralizing vs. non-centralizing neck pain

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**Objective:** The purpose of this study is to determine whether individuals with neck pain who demonstrate centralization of symptoms have more favorable outcome than individuals who do not demonstrate centralization.

**Methods:** Eleven subjects with neck pain were evaluated and treated by two physical therapists certified in Mechanical Diagnosis and Therapy (MDT). Eleven physical therapy patients underwent a routine initial evaluation and were treated 2-3x per week using MDT principles and other physical therapy interventions. The Neck Disability Index (NDI) tool was administered at the initial examination, approximately 2 weeks following the initial examination, each subsequent re-evaluation, and at discharge from the study to measure changes in functional outcomes for each subject. Patients continued with treatments until they were discharged or removed from the study. Four subjects were referred back to their physician by treating physical therapist secondary to non-centralization and worsening of symptoms.

**Results:** Of the 11 subjects, 6 demonstrated centralization (CEN) and 5 demonstrated non-centralization (NC). At initial evaluation, the average NDI score for the CEN group was 51.0 (SD +/- 19.4) and 56.4 (SD +/- 17.6) for the NC group. For the CEN group, the average change in NDI score between initial evaluation and discharge was 41.2 (SD +/- 13.2 and 12.2 (SD +/- 13.0) for the NC group. The correlation coefficient of CEN and change in NDI score was .772 and was statistically significant (P=0.005).

**Conclusions:** In this limited sample, people with neck pain demonstrated more favorable outcomes when the CEN phenomenon was observed. Future research on CEN should be investigated with a larger sample size and with a greater number of clinicians trained in the MDT approach.

**Keywords:** Centralization, MDT, cervical radiculopathy, NDI

### Introduction:

Individuals with neck pain constitute the second largest outpatient population in physical therapy.<sup>1</sup> Approximately 50-70% of the population has experienced neck pain in the past 6 months.<sup>2,3</sup> Neck pain commonly arises insidiously and is generally multifactorial in nature.<sup>4</sup> Individuals may experience localized or peripheralized symptoms that radiate away from the spine into the back, arm, or hand, known as cervical radiculopathy. Influencing factors of neck pain may include poor posture, muscle sprains, injuries resulting from sporting or occupational activities, or psychological factors such as anxiety or

depression.<sup>5,6</sup>

Currently, a variety of treatments are used to decrease pain and increase function, but few studies demonstrate which interventions promote the best functional outcomes for individuals with neck pain.<sup>7-9</sup> A common principle of treatment used by physical therapists for management of spinal pain is Mechanical Diagnosis and Therapy (MDT).<sup>7</sup> Cervical radiculopathy is the clinical description of pain and neurological symptoms resulting from any type of condition that irritates a nerve in the cervical spine (neck). Individuals who demonstrate cervical radiculopathy may present with

peripheralization.

Peripheralization is defined as the process at which symptoms remain at the distal segment and decrease with therapeutic loading strategies. According to the patient's response to repeated end range spinal loading movements, MDT classifies patients into 3 syndromes: dysfunction, derangement or postural syndrome.<sup>10</sup> The most prevalent classification is the derangement syndrome, defined as an internal articular displacement that causes a disturbance in the joint and produces pain.<sup>11</sup> Symptomatic and mechanical changes may occur with therapeutic loading strategies. Performance of movements that reduce the internal articular displacement can result in a decrease, abolition, or centralization (CEN) of symptoms as well as improvement in range of motion and function. Directional preference is the phenomenon of preference for postures/movements that decrease, abolish, or centralize symptoms and often improve a limitation of movement.<sup>12</sup> The patient's directional preference guides the prescription of specific exercises for treatment. CEN, a form of directional preference, is characterized by spinal pain and referred symptoms that are progressively abolished in a distal to proximal direction in response to therapeutic loading strategies.<sup>13</sup> Additionally, patients can exhibit non-centralization (NC) in which the symptoms remain at the distal segment and the symptoms do not move with therapeutic loading strategies. Improvement of function is assessed through the phenomenon of 'CEN' of symptoms reported by the patient.<sup>7</sup>

The hypothesis for this study was that CEN would be associated with better

functional outcomes compared to NC; centralizing symptoms indicate better outcomes than non-centralizing symptoms using the MDT approach in patients with low back pain (LBP).<sup>12-18</sup> Edmond and colleagues found individuals with neck pain who presented with CEN or a directional preference demonstrated improvements in functional outcomes<sup>14</sup>; however, research is limited for a direct correlation between CEN and physical therapy outcomes in the cervical spine. Therefore, the purpose of this study is to establish the relationship between CEN on physical therapy outcomes in individuals with neck pain managed with a MDT approach.

## **Methods**

### *Study Design*

The design of this study is a retrospective chart review with the raters blinded to the subjects participating in the study. The dependent variables were the scores from the NDI and whether individuals demonstrated CEN or NC. Independent variables included the treating physical therapists and treatment time.

### *Subjects*

The subjects included 11 physical therapy patients who presented with neck pain and were evaluated and treated at a physical therapist owned private practice and a hospital based outpatient facility in western New York State. This study was approved by the institutional review boards for protection of human subjects at the Catholic Health System of Buffalo, NY and Daemen College.

### **Inclusion Criteria**

Participating patients were included if they presented with the following: (1) They were at least 18 years of age, (2) were currently experiencing neck pain at the time of the physical therapy referral or, (3) they

presented with neck pain and presented with symptoms indicating cervical radiculopathy.

### **Exclusion Criteria**

Patients were excluded if they presented with any of the following: (1) pregnancy, (2) history of spinal surgery, a progressive disease process, psychological illness, (3) were experiencing symptoms relative to cervical instability and/or vertebrobasilar insufficiency, (5) individuals who are unable to understand English or, (6) if they were engaged in litigation related to their neck pain. Also, (7) individuals who were insured through workers compensation or no fault insurance were also excluded from the study.

### *Physical Therapists*

Examinations, MDT interventions, and any other interventions were performed by Dr. Terrance Rose PT, MS, DPT, FAAOMPT, Cert. MDT and Dr. Ronald J. Schenk, PT, PhD, OCS, FAAOMPT, Dip. MDT. Both physical therapists either attained certification or diplomacy in MDT. Clare and colleagues determined there is reliability of physical therapists, with these levels of training, to classify patients when using the MDT system.<sup>3,10</sup> Additionally, clinicians with a certification or diplomacy are reliable at detecting CEN.<sup>3,18-21</sup>

### *Outcomes Instrument*

Neck pain can be assessed using a variety of different standardized outcomes<sup>22</sup>; However, the Neck Disability Index (NDI) is a widely utilized, researched, and validated instrument for assessing disability in patients with neck pain. Other questionnaires are limited in peer-reviewed research supporting their reliability, validity, consistency, and/or responsiveness.<sup>22-29</sup>

The NDI is a self-rated questionnaire with moderate test-retest reliability, and the NDI measures improvement in neck pain

and overall patient function.<sup>24</sup> Although there are conflicting results in research for the NDI reliability, there is significant support for the NDI to confirm its efficiency and validity and it was chosen over the others.<sup>22-25,28,29</sup> The NDI reliability is the most questioned part of the outcome measure, although there has been research supporting both high reliability and only moderate reliability.<sup>22</sup> Macdermid and colleagues<sup>22</sup> stated that most of the discrepancy is due to not considering acute versus chronic status; acute reliability appears generally lower and more varied than chronic reliability.

The NDI contains seven items related to activities of daily living, two items related to pain, and one item related to the ability to read (concentration). Scoring ranges from 0, representing no disability, to a maximum score of 50 (0-100% disability). The minimal detectable change (MDC), a noticeable change in patient symptoms, varies<sup>22,30-32</sup> but Macdermid et al,<sup>22</sup> through a systematic review, determined that MDC should be a 5 point change (or 10% disability).

### *Physical Examination*

Prior to physical examination, individuals signed an informed consent form to agree to participate in the study. Once subjects agreed to participate in the study, each subject filled out the NDI prior to the initial physical therapy exam.

The initial examination followed MDT principles and included, but was not limited to the following: a subjective and an objective examination. During the subjective examination, a past/present medical history was gathered to determine if the individual currently presented with any pathologies (e.g. spinal surgery, progressive disease process, etc.) that excluded him/her from participating in the study.

Following the subjective exam, the

**Table 1 Initial NDI Score Among the CEN and NC groups**

Group	N	Mean	Std. Deviation
NC	5	56.4	17.6
CEN	6	51.0	19.4

Note: NC = Non-centralization; CEN = Centralization.

physical therapist conducted the objective portion of examination. The objective examination included special tests to rule out vertebrobasilar insufficiency and cervical instability and then standard MDT principles, such as postural observation, range of motion, neurological examination, and repeated movements. A home exercise program that included but was not limited to therapeutic loading strategies and postural correction were given to each subject based on their symptomatic response. Patients who did not demonstrate CEN at the initial examination were assessed for CEN at each subsequent visit.

*Treatment*

Following the initial evaluation, patients returned to the clinic for physical therapy intervention as determined by their individualized plan of care (average 2 visits per week), and then individuals were discharged, either self or by the physical therapist, that concluded their participation in the study. At the beginning of each session, subjects were reassessed and asked to note changes in pain. After, subjects were taken through their designed plan of care. Physical Therapy sessions included any/all of the following: postural correction,

therapeutic loading exercises, manual spinal mobilization including thrust manipulation as determined by patient's mechanical response, and physical agents as needed. Direction of movement and force progression were determined by patient's symptomatic response and MDT principles. At the end of each session, subjects were mechanically reassessed and asked to note changes in their pain prior to leaving.

Subjects continued therapy until they were discharged by the clinician or were referred back to their physician by the treating physical therapist secondary to worsening of symptoms. The NDI questionnaires were administered at the initial examination, approximately 2 weeks following the initial examination, each subsequent re-evaluation, and at discharge from the study.

*Data Analysis*

Data related to change in NDI score and whether or not a subject presented with CEN was analyzed using Statistical Package for the Social Sciences 19 (SPSS). Descriptive statistics were used to calculate mean and standard deviation for initial NDI scores (Table 1) and change in NDI score between evaluation and discharge (Table 2).

**Table 2 Change in NDI Score between CEN and NC groups**

Group	N	Mean	Std. Deviation
NC	5	12.2	13.0
CEN	6	41.2	13.2

Note: NC = Non-centralization; CEN = Centralization.

**Table 3 Correlation between Change in NDI Score and CEN and NC groups**

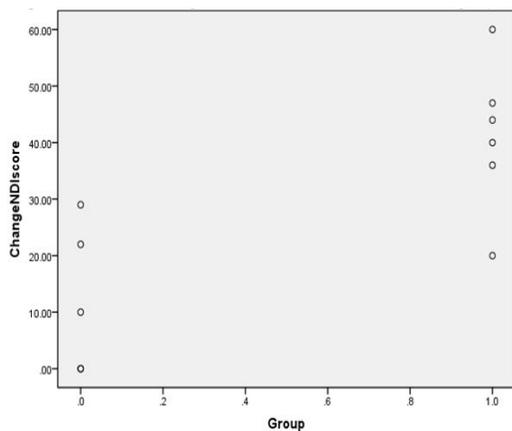
Pearson Correlation	.772**
Sig. (2-tailed)	.005
N	11

\*\* . Correlation is significant at the 0.01 level (2-tailed).

A point bi-serial correlation, or a Pearson Correlation in SPSS, was calculated to test for associations between change in NDI score and CEN/NC (Table 3). NDI scores were collected and are presented in % disability rather than raw score.

**Results**

Eleven subjects consented to participate and completed the study from three physical therapy clinics in western New York. Four subjects were referred back to their physician by the treating physical therapist secondary to worsening of symptoms); the data from these subjects were not included in the analysis. Out of the 11 subjects whose data was analyzed, 6 subjects presented with CEN and 5 subjects presented with NC. At initial evaluation, the average NDI score for the CEN group was 51.0 (SD +/- 19.4) and 56.4 (SD +/- 17.6) for the NC group.



Note: 0 = Non-centralization; 1 = Centralization.

**Figure 1 Difference in change of NDI score between the NC and CEN groups.**

Table 1 depicts mean and standard deviation for initial NDI scores. For the CEN group, the average change in NDI score between initial evaluation and discharge was 41.2 (SD +/- 13.2 and 12.2 (SD +/- 13.0) for the NC group. Table 2 depicts change in NDI score between evaluation and discharge, and Figure 1 further analyzes the difference in change of NDI score between groups, depicting each subject as a data point according to their respective group. The correlation coefficient of CEN and change in NDI score was .772 and was statistically significant (P=0.005). Table 3 depicts the correlation coefficient.

**Discussion**

Sterling et al<sup>33</sup> found that higher initial NDI scores indicated a poor outcome 6 months following injury. While our study did not compare the initial score ranges of our participants, this research by Sterling et al<sup>33</sup> provides a generalized expectation for a NDI score and a patient’s prognosis. This patient group also involved victims of whiplash injuries, while we used patients with or without cervical radiculopathy. Fritz et al<sup>34</sup> focused on patients with cervical radiculopathy, who had improved NDI scores at 4 weeks, with continued improvement at 6 month and 12 month post-treatment. Our study did not include follow-up assessments with the NDI to track improvement. Although traction was added to general exercises in the Fritz et al<sup>34</sup> study, which was not part of our study, a correlation can be made to continued improvement in NDI scores when

substantial initial improvement was present. In addition to initial improvements having better results, patient prognosis also is improved based on patient belief. Bishop et al<sup>35</sup> found improved NDI score with manipulation when the patient believed that manipulation would help. Manipulation was included in our study if the clinician believed it was necessary after a progression of forces. The research by Bishop et al<sup>35</sup> demonstrates that if a patient fits inclusion criteria and believes that they will improve with this treatment, manipulation should be incorporated but will not be as effective if the patient is reluctant or pessimistic about manipulation.

Three studies examined the effects of spinal manipulation alone compared to spinal manipulation and another intervention. Spinal thrust manipulation included the MDT system of force progression and was included in our study for both groups if the clinician believed it was necessary. Bronfort et al<sup>36</sup> determined that spinal manipulation and strengthening is more beneficial than spinal manipulation alone, and Boyles et al<sup>37</sup> determined no significant difference with the addition of cervical thrust manipulation to manual therapy in comparison to manual therapy alone, while Masaracchio et al<sup>38</sup> determined that thoracic spine thrust manipulation with cervical spine mobilization and interventions is more beneficial than cervical spine non-thrust mobilization. In addition, subjects in the above studies who were treated with multiple interventions rather than one intervention (e.g. manipulation alone), were associated with better outcomes. In our study, subjects received McKenzie principles with other interventions.

Klaber-Moffett et al<sup>7</sup> compared McKenzie to a cognitive behavioral approach to physical therapy, while Kjellman and Oberg<sup>8</sup> compared a control group, a general exercise group (consisting

of range of motion, strengthening, and endurance exercises), and a McKenzie group. Individuals treated with McKenzie have a higher satisfaction<sup>7</sup> and required fewer additional health care visits,<sup>7,8</sup> in addition individuals presented with a greater short-term reduction in pain intensity<sup>7</sup>; however, the subjects in the McKenzie group were not classified as demonstrating DP and/or CEN. Werneke and colleagues<sup>13</sup> classified subjects according to their symptom presentation and determined that NC was associated worse discharge pain for patients with cervical impairments but was not associated with functional outcomes, while our study did not examine pain outcome; however, our study determined that the NC group had worse functional outcomes than the CEN group. Similar to our study, Edmond and colleagues<sup>14</sup> examined functional and pain outcomes of individuals treated with McKenzie and determined that CEN and/or DP groups obtained better improvements in functional outcomes than NC; however, different assessment tools were used to determine functional outcomes and our study examined the functional outcomes of individuals presenting with either CEN or NC.

#### Limitations/Future Research

There were several limitations in this study that should be considered when interpreting our results. It is a retrospective chart review, therefore all confounding variables were not evaluated because they were not recorded by the examiners at the time of the study. Also, data were collected at 3 clinics in the same geographic area, which presents a risk for selection bias. Additionally, the length of the informed consent (8 pages) subjects were required to read and sign prior to the study significantly limited the number of willing participants and should be condensed for future research.

Despite these limitations, our study

provides sufficient evidence for considering CEN as a key indicator for better functional outcomes for individuals who present with mechanical neck pain. Boissonnault and colleagues<sup>1</sup> determined individuals whose symptom duration are greater than 6 months demonstrate significantly less functional improvement<sup>1</sup>; therefore, future research should focus on examining the chronicity of symptoms in relation to CEN and functional outcomes. Other considerations may include: gender, age, severity of injury, and type of disc derangement to determine if these factors play a significant role in improving functional outcomes for individuals with mechanical neck pain.

### Conclusion

CEN is correlated with better outcomes compared to NC; therefore, subjects with neck pain who demonstrate CEN are more likely to attain better functional outcomes than subjects who do not demonstrate CEN.

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