

Correlation of Intensity of Pain, Functional Disability and Deep Neck Flexor Endurance in Individual with Chronic Non-Specific Neck Pain: An Observational Study

Niyati Desai¹, Aarzo Minnat Ansari²

^{1,2}Assistant Professor, Shrimad Rajchandra College of Physiotherapy, Uka Tarsadia University, Bardoli-Mahuva Road, Tarsadi, 394350. Dist: Surat, Gujarat, India.

Corresponding Author: Aarzo Minnat Ansari

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ABSTRACT

Background: Musculoskeletal deficits of the craniocervical region play an important role in causing various cervical disorders. Cervical disorders and neck pain are almost as prevalent as low back pain and like low back pain; in most of the cases it is difficult to determine the actual cause of neck pain hence it is regarded as “non-specific neck pain”. This study was conducted to determine the correlation between deep neck flexor endurance, the intensity of pain, and functional disability in individuals with chronic non-specific neck pain.

Materials and methods: A cross-sectional observational study was conducted on twenty individuals with chronic non-specific neck pain. Numerical Pain Rating Scale (NPRS), Neck Disability Index (NDI), and Craniocervical Flexion Test (CCFT) were used to measure neck pain intensity, neck disability, and deep neck flexor endurance respectively. The correlation was found using the Pearson Correlation Coefficient test.

Result: The results showed that there was a positive correlation found between NPRS and NDI, and CCFT has negative correlations with NPRS and NDI respectively.

Conclusion: The findings suggest that the lesser deep neck flexor endurance corresponded to greater neck pain intensity and disability.

Keywords: cervical spine, neck disability index, neck pain, craniocervical flexion test, deep neck flexors endurance, correlation.

INTRODUCTION

It has been stated that all the living species with spinal curvatures will experience spinal pain in their lifetime. Hence, neck pain is anticipated to be one of the common musculoskeletal ailments after low back pain with a mean point prevalence of 7.6% (range 5.9–38.7%) and mean lifetime prevalence of 48.5% (range 14.2–71.0%)^(1,2). Prevalence of neck pain increases with age and most commonly affects women across the fifth decade of life⁽³⁻⁷⁾. Rates of recurrence and chronicity are high in neck pain conditions^(8,9). Acute neck pain resolves within a few days or weeks however, may become chronic in around 10% of people⁽¹⁰⁾. Neck dysfunction usually causes pain, a low level of disability^(10,11) accompanied by substantial consequences on everyday life that result in immense use of healthcare resources⁽¹³⁻¹⁵⁾. Cervical disorders and neck pain are nearly as common as low back pain and like low back pain; in most of instances, it is difficult to determine the actual cause of neck pain hence regarded as “non-specific neck pain”^(16,17). International Association for the Study of Pain (IASP) defines neck pain⁽¹⁸⁾ as pain perceived as arising from anywhere within the region bounded superiorly by the superior nuchal line, inferiorly by an imaginary transverse line through the tip of

the first thoracic spinous process and laterally by sagittal planes tangential to the lateral borders of the neck. On the basis of duration, another classification proposed by IASP is: Acute neck pain generally lasts less than 7 days, subacute neck pain lasts more than 7 days but less than 3 months, and chronic neck pain has a duration of 3 months or more (19).

From the literature, it seems that muscular dysfunction in the cervical spine refers to changes in structure (20-24) and function (25-27). Moreover, the following deficiencies have been observed in people affected by neck pain: reduction in maximal strength, in the accuracy of head position throughout dynamic movements and repositioning, in the efficiency of contraction, and in muscle endurance (28).

A low-load craniocervical flexion test (CCFT) is clinically used to investigate the anatomical action of the deep cervical flexors, in particular the longus colli and longus capitis muscles. This clinical test is typically used to evaluate the person's ability to perform and hold a precise upper cervical flexion motion without flexion of the mid and lower cervical spine (29).

Self-reported disability and other outcome measures are an important part of patient assessment and provide crucial clinical information to the clinician. The Neck Disability Index (NDI) is a 10-item questionnaire that measures a patient's self-reported neck pain-related disability. The NDI is the most widely used, translated, and oldest questionnaire for neck pain. It has been shown to have high "test-retest" reliability. The NDI has also been shown to be valid when comparing it to other pain and disability measures. Questions include activities of daily living, such as: personal care, lifting, reading, work, driving, sleeping, recreational activities, pain intensity, concentration and headache (30).

This paper describes the relationship between neck pain intensity, deep neck flexors endurance and neck disability in individuals with chronic non-specific neck pain.

MATERIALS AND METHODS

Individuals between the ages of 25 and 53 years (31) diagnosed with chronic non-specific neck pain were recruited in the present study. Exclusion criteria were: any structural bony abnormalities, degenerative disorders around the cervical spine, any history of cervical fracture and trauma. Written informed consent was obtained from all the participants before participating in the study. The institutional Ethical committee of Uka Tarsadia University granted the ethical approval for this study.

Procedure

A total of 53 individuals with neck pain were screened at the orthopaedic department of Shree Sardar Smarak Hospital, Station Road, Bardoli 394601, Surat, Gujarat, for the study as per the inclusion and exclusion criteria. 33 participants were excluded as they did not fulfil inclusion criteria or not willing to participate. A total of 20 individuals (11 men, 9 women; mean \pm SD age, 36.7 \pm 10.05 years) with the diagnosis of chronic non-specific neck pain were included in the study. Individuals was briefly explained about the study with detailed idea of evaluation and procedure.

Neck pain Intensity

A Numerical Rating Scale (NRS) was used to measure an individual's level of pain. Individuals were asked to indicate the intensity of pain by using an 11-point scale ranging from 0 ("no pain") to 10 ("worst pain imaginable"). Pain relief was measured with a numerical scale. The reported reliability of NRS is ICC= 0.8530 and validity is $r = 0.84731$ (32,33).

Neck disability

The Neck Disability Index (NDI) was used to assess neck disability. It is a self-reported measure that contains 10 items, 7 related to activities of daily living, 2 related to pain, and 1 related to concentration. Each item is scored from 0 to 5, with higher scores corresponding to greater disability. The NDI has been shown to have a high degree of

test-retest reliability and strong construct validity (34) as well as internal consistency (35-38). Research has found the test-retest reliability of the NDI to be moderate (ICC of 0.68) (39,40) and the internal consistency to be high (alpha = 0.80– 0.92) (41).

Deep neck flexors endurance

An inflatable air-filled pressure biofeedback sensor (Stabilizer; Chattanooga Group, Hixon, TX) was used to assess the performance of the deep neck flexors of the cervical spine. The sensor is placed behind the neck and is inflated to 20 mm Hg, which is sufficient to fill the space between the testing surface and the neck, without pushing the neck into a lordosis. The pressure sensor is used to monitor the slight flattening of the cervical lordosis that occurs with the contraction of the deep neck flexors- particularly the longus colli muscle- and registers the muscular effort and associated small movement of the cervical spine as an increase in pressure. Any unwanted head lift or general cervical flexion results in a decrease in pressure.

The CCFT is performed with the subject supine. The subject performs a gentle head-nodding action of craniocervical flexion (an action indicating yes) for 5 incremental stages of increasing range (2 mm Hg each stage), each stage being held for 10 seconds. A suggested ideal controlled performance of the deep cervical flexors should increase the pressure to 30 mm Hg (an increase of 10 mm Hg). The linear relationship between the incremental pressure targets of the CCFT and the craniocervical flexion range of motion has been demonstrated, supporting the clinical use of this test (42).

The pressure that the subject can achieve and hold in a steady manner for 10 seconds is called the activation pressure score (43). The tonic capacity of the deep neck flexors is assessed by monitoring the subject’s ability to sustain the upper cervical flexion position at the achievable pressure in a present task of attempting 10 repetitions of 10-set holds. The holding capacity is judged by the number of successful 10- set holds

the subject can achieve (Performance Pressure Index). Loss of pressure of greater than 20% of the target (usually 2 mm Hg of pressure) is regarded as a failure, and the number of repetitions to that point is used in the calculation of the holding capacity. The holding capacity is presented as a Performance Pressure Index (PPI), which is calculated by multiplying the target pressure achieved (AS) by the number of successful repetitions. For example, if a subject can achieve an increase in pressure of 8 mm Hg with the upper cervical flexion action (AS) and repeat this performance 10 times, the subject will receive a PPI of 80. A study found an intraexaminer reliability (ICC) of 0.78 and an interexaminer (ICC) of 0.54 for the PPI, intraexaminer reliability of 0.78, and an interexaminer of 0.57 for the AS (38).

STATISTICAL ANALYSIS AND RESULTS

Statistical analysis was carried out using SPSS Version 22.0 software. Pearson correlation coefficient test was used to find the correlation. Confidence interval was set at 95% and any value <0.05 was considered as significant and <0.001 as highly significant.

The Mean±SD of NPRS, NDI, AS, PPI and HS of all the individuals are mentioned in Table 1. Table 2 summarizes the percentage of subjects in each group who achieved each of the pressure levels (22,24,26,28, or 30 mm Hg) as their highest-pressure score during the CCFT.

Table 1: Mean±SD values of NPRS, NDI, AS, PPI, HS of all the participants

Outcome measures	Mean±SD
NPRS	5.01±1.41
NDI	12.85±6.43
AS (mmHg)	7.3±1.86
PPI (mmHg)	41.3±17.12
HS (mmHg)	27.3±1.86

Table 2: Highest Activation Score value successfully achieved by the participants

Pressure Level (mmHg)	Number of Subjects Able to Achieve Target Pressure (%)
22	0(0%)
24	2(10%)
26	7(35%)
28	7(35%)
30	4(20%)

Correlation between NPRS, NDI and CCFT

In the present study, participants exhibited moderate intensity of pain (5.01 ± 1.41) (Table 1). Pearson correlation coefficient test showed that the NPRS has a positive correlation with NDI ($r=0.69$, $p=0.0001$) and negative correlation with the variables of CCFT (AS, PPI and HS) ($r=-0.33$, $p=0.0088$). Hence, we can state that higher

intensity of neck pain corresponds to higher functional disability and lower deep neck flexors endurance.

Moreover, a negative correlation was found between the NDI and the variables of CCFT (AS, PPI and HS), which implies that individuals with high NDI score showed lower deep neck flexors endurance (Table 3).

Table 3: Illustrate Pearson Correlation between NPRS, NDI and the variables of CCFT (AS, PPI, HS).

	Numerical Pain Rating Sale	Neck Disability Index	Activation Score	Performance Pressure Index	Highest Activation Score
Numerical pain	1				
Neck Disability Index	.833**	1			
Activation score	-.798**	-.912**	1		
Performance Pressure Index	-.852**	-.924**	.899**	1	
Highest Activation Score	-.798**	-.912**	1.000**	.899**	1

** Correlation is significant at the 0.01 level

DISCUSSION

The present study showed that individuals with chronic non-specific pain demonstrated moderate pain intensity with mild to moderate functional disability. Additionally, NPRS has a positive correlation with NDI, which is obvious to accept that intensity of pain is proportional to functional disability. This finding was consisted with the findings of previous study done by Sergio Parazza et al (44), in which positive correlation was found between neck pain intensity and disability.

The study intended to find the correlation of deep neck flexor endurance with neck pain intensity and disability. Deep neck flexors endurance was assessed by making individuals perform craniocervical flexion with pressure biofeedback placed behind the neck. Craniocervical flexion represents the action of the longus capitis in synergy with the longus colli, which causes a reduction of the cervical lordosis (45,46,47). The pressure biofeedback unit, which was placed behind the neck, monitored the flattening of the cervical spine as the deep neck flexors were activated. The results of our study revealed that 90% of the participants had a highest activation score between 26mmhg to 30

mmHg. Our results are in contrast with the study done by G Jull (48) in which individuals with neck pain of whiplash and insidious origin demonstrated larger pressure shortfalls at all stages of the CCFT. Similarly, Thomas Tai Wing Chiu et al (49) found poor contractile capacity of the deep neck flexors in individuals with chronic neck pain, particularly in the last 3 levels of the test. There are three possible justifications for our results: one reason could be chronic subjects did not have fear of movements or catastrophization; second possibility; participants in our study have a moderate intensity of pain (5.01 ± 1.41) and mild to moderate functional disability (12.85 ± 6.43), the third could be activation of superficial neck muscle while performing CCFT.

There are some limitations of our study. Firstly, we recognize that the sample size was small, and there was a lack of control group. Secondly, only patients with chronic non-specific neck pain were included. Hence, our results cannot be extrapolated to the acute and sub-acute group of neck pain. With relation to results of the present study, while making treatment strategies for chronic nonspecific neck pain patients, an

association of pain intensity, functional disability and endurance of deep neck flexors need to be considered.

CONCLUSION

The findings suggest that lower deep neck flexors endurance corresponds to greater neck pain intensity and disability. Furthermore, significant correlation was found between intensity of pain, functional disability and deep neck flexor endurance in individual with chronic non-specific neck pain.

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