

Performance Based Assessment and its Association with Pain and Disability in Patients with Chronic Neck Pain

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ABSTRACT

Background

The neck, also known as the cervical region, is a complex area of the body that house important organs such as blood vessels, nerves, and the spinal cord. It is divided into several compartments, each with a unique organ or function. One of the most common and debilitating musculoskeletal disorders, chronic neck pain (CNP) is defined as discomfort that lasts longer than three months and has a longer expected recovery period. The most prevalent kind of neck pain is non-specific chronic neck discomfort, which affects two-thirds of those who work at a desktop at some point in their lives. People's quality of life and productivity at work are both impacted by neck pain, which is a major public health concern.

Patients with chronic neck discomfort report pain as their main symptom, although the degree of functional impairment is not always correlated with the intensity of pain. Therefore, impairment and functional performance should be considered in addition to pain intensity when evaluating chronic neck pain. Self-reported methods like the Visual Analog Scale (VAS) or Numeric Pain Rating Scale (NPRS) are frequently used to quantify pain intensity.

Patients with chronic neck discomfort report pain as their main symptom, although the degree of functional impairment is not always correlated with the intensity of pain. Therefore, impairment and functional performance should be considered in addition to pain intensity when evaluating chronic neck pain. Self-reported methods like the Visual Analog Scale (VAS) or Numeric Pain Rating Scale (NPRS) are frequently used to quantify pain intensity. The Neck Disability Index (NDI) is the most widely used outcome measure in the assessment of chronic neck pain. Functional evaluation capacity is established in order to measure functional performance.

Consequently, there might be differences between what patients report and what they are physically able to do. As a result, the current study will concentrate on how patients perceive themselves using a self-reported questionnaire and how their actual performance is evaluated using a functional performance questionnaire.

Aim and Objectives

The aim of the study was to determine Physical performance assessment in patients with chronic neck pain. The objective was to correlate physical performance measure with pain and disability in patients with chronic neck pain.

Methodology

100 Participants were recruited based on inclusion criteria from various hospitals, clinics and OPDs of Vadodara. He/she was explained about the study and informed consent was taken. Then the participants were asked to fill up the questionnaire of Neck Disability index (NDI), Numerical Pain rating Scale (NPRS) and were asked to fill the demographic details. Then the Participants were asked to perform certain tests

(Functional Capacity Evaluation scale) and how the participant performs, scoring was be done accordingly by the therapist.

Results

Descriptive analysis was done to analyse the demographic and Sociodemographic variables. Shapiro-Wilk test was used to determine Normality of data. To determine the correlation between FCE with NPRS and NDI Spearman's or Pearsons correlation will be used based on normality of data distribution. ($p < 0.05$). A strong negative correlation was obtained between NDI, NPRS with FEC (Repetitive Side Reaching Test, Repetitive Overhead Reaching Test, Static Over Head work Test, Two Hand Carrying Test)

Conclusion

Overall, the present study demonstrates that several functional capacity measures are negatively associated with pain and disability in individuals with neck pain. The strongest and most consistent findings were observed for the two-hand carrying test, which demonstrated significant negative correlations with resting pain, activity-related pain, and NDI. Repetitive side reaching, repetitive overhead reaching, static overhead work, and right hand waist-to-overhead lifting also demonstrated significant negative relationships with selected pain or disability measures.

Keywords: Chronic Neck Pain, Neck Disability Index, Disability, Pain, Functional Evaluation Capacity.

INTRODUCTION

The neck, also known as the cervical region, is a complicated part of the body that contains important organs like blood vessels, nerves, and the spinal cord. It is separated into a number of compartments, each of which has a distinct organ or function.¹ The seven vertebrae (C1 C7) that make up the cervical spine support the head and enable a variety of head movements.^(1,2)

One of the most prevalent and incapacitating musculoskeletal disorders, chronic neck pain (CNP) is defined as discomfort that lasts longer than three months and has a longer anticipated recovery period Beltran-Alacreu et al.³ The most prevalent kind of neck pain is non-specific chronic neck discomfort, which affects two-thirds of those who work at a desktop at some point in their lives (Beltran-Alacreu et al., 2018).³

The impact of neck pain on social issues for families, employment, health systems, and economies was documented by the International Neck Pain Task Force.³ In the general population of developed nations, neck pain is more common in women than in males, with prevalence ranging from 30% to 50%. (Hogg-Johnson and others, 2010).⁴

With over 291 diseases examined, neck discomfort was the fourth most common disability in 2010, affecting 33.6 million people globally. The most prevalent type of neck pain is non specific chronic pain, which affects almost two-thirds of people at some point in their lives and has a mechanical or postural foundation.⁵

People's quality of life and productivity at work are both impacted by neck pain, which is a major public health concern. The cervical region of the neck is the site of neck discomfort, which can be modest at times (intermittent) or severe over time (chronic). An individual's capacity to carry out tasks or maintain productivity at work is greatly impacted by this persistent form of neck pain.⁵

According to the Global Burden of Disease study, there will be a 32.5% increase in neck pain incidence globally between 2020 and 2050. While neck pain will affect people of all ages, its prevalence will be highest in rural areas with poor access to healthcare services, as well as among people who work manually or informally.⁵

Rural communities are at increased risk of neck pain due to limited access to timely healthcare, inadequate knowledge of ergonomic principles, and prolonged physical activities such as heavy manual and agricultural

work. Studies indicate that women and older adults experience a higher prevalence and severity of neck pain than men and younger individuals. Sociodemographic factors, poor working conditions, and lack of ergonomic interventions further contribute to this problem. Musculoskeletal disorders affect approximately 51% of older adults in rural areas, particularly those involved in manual labor and agriculture, with a notable burden among women and individuals over 60 years of age (Jing X et al., 2021).⁶

Chronic neck pain and disability may result from repetitive trauma, heavy lifting, prolonged postures, and repetitive movements, particularly when ergonomic education and preventive interventions are inadequate.⁷ Neck pain can significantly affect daily activities, sleep, self-care, leisure activities, and work-related tasks such as farming and household activities.⁸ Persistent pain may also contribute to fatigue, stress, reduced concentration, lower productivity, and decreased quality of life.⁹ Working adults and students who remain in static or awkward postures for prolonged periods are particularly vulnerable. Muscle fatigue and impaired blood supply associated with sustained activation of motor units may contribute to the development of neck pain. Although many acute episodes resolve within 4–6 weeks, chronic neck pain can produce substantial functional limitations and impose a burden on both individuals and healthcare systems. Neck pain may be broadly classified as traumatic or non-traumatic.⁽¹⁰⁻¹⁴⁾

Patients with chronic neck pain commonly report pain as the primary symptom; however, pain intensity does not always correspond to the level of functional disability. Therefore, assessment should include pain intensity, disability, impairment, and functional performance. VAS and NPRS are commonly used to measure pain intensity, while the Neck Disability Index (NDI) is one of the most widely used and reliable measures of neck-related disability.⁽¹⁵⁻¹⁶⁾

Other patient-reported outcome measures include the NPQ, NPDS, CNFDS, NBQ, PSFS, CNPQ, and WDQ. However, self-reported measures may be influenced by psychological factors such as anxiety, depression, fear of movement, and pain catastrophizing, potentially creating a difference between perceived disability and actual physical ability.⁽¹⁵⁻¹⁶⁾

Functional Capacity Evaluation (FCE) provides a performance-based assessment of an individual's ability to perform physical and work-related tasks.¹⁶ It is useful in work rehabilitation, disability assessment, medico-legal evaluation, and return-to-work recommendations.⁽¹⁵⁻¹⁶⁾ Therefore, combining self-reported measures such as NPRS and NDI with performance-based FCE assessment provides a more comprehensive evaluation of chronic neck pain by comparing the patient's perceived disability with their actual functional capacity.

Outcome measures the effectiveness of the treatment. Majority of the outcome measures used in day to day life practice for treating chronic neck pain are patient reported outcome measure like NDI, which measures patients perception not performance. But the best way to evaluate is by using performance based outcome measure. So the present study will compare the perception and the performance of patients with chronic neck pain i.e comparison of Patient reported outcome measure (NDI) with Functional performance measurement (FEC). This will help in determining whether the perception matches the performance of an individual with chronic neck pain. So the aim of the study was to determine Physical performance assessment in patients with chronic neck pain. The objective was to determine the correlation of physical performance measure with pain and disability in patients with chronic neck pain.

METHODOLOGY

It was a cross-sectional study design with a sample size of 100 collected through convenient sampling from various Hospital, Clinics of Vadodara, Gujarat, India.

The inclusion criteria included Participants with neck pain with more than 3 months diagnosed by the orthopaedic surgeon.

Age:20-60years.

Both male and female.

Participants diagnosed with any chronic neck pain conditions with no contraindication with flexion, extension, side flexion or rotation movement as decided by the orthopaedic surgeon.

Non-Specific Neck Pain.

Presence of Headache associated with Neck Pain, Cervicogenic Headache. (Improvement in Headache following improvement in cervical Lesion, Worsening of Headache following restriction of cervical ROM, Temporal Relationship Between Headache and Cervical Lesion).¹⁷ Herniated disk

Degenerative Joint condition.

Facet Joint arthropathy

Spinal Stenosis

Cervical Radiculopathy.

The exclusion criteria included participants

Not willing to participate.

Acute neck conditions

Any congenital deformity of head/neck (Torticollis, CV junction anomalies) on observation.

Any recent injury to any upper limb in the past 3 months.

Restriction in upper limb Range of motion.

Any congenital deformity of upper limb on observation.

Having contraindication in movements of neck as decided by the orthopaedic surgeon.

The outcome measure included NDI, NPRS AND FCE.

Procedure

After obtaining approval from the ethical committee of the concerned Institution, Participants were recruited from various hospitals and out patient's clinics of Vadodara diagnosed with any chronic Neck pain listed in the inclusion criteria was included in the study. He/she was explained about the study and informed consent was taken. Then the participants were asked to fill up the questionnaire of Neck Disability index (NDI), Numerical Pain rating Scale (NPRS) and were asked to fill the demographic details. Then the Participants were asked to perform certain tests (Functional Capacity Evaluation scale) and how the participant performs, scoring was be done accordingly by the therapist. NDI scale is available in both English and Gujarati language. The advantage of this would be that participant will be reading the questionnaire and filling up the responses. If the participants are illiterate then the therapist will read it and ask the response from the participant.

FUNCTIONAL CAPACITY EVALUATION TEST FOR CHRONIC NECK PAIN ^(16,18)

Repetitive Side Reaching Test

Objective:

Fast repetitive movements of the upper extremity.

Materials: 30 small objects in bowls, shelf or table of maximal wing span apart, positioned at mid thoracic height.

Procedure: Sitting with bowls apart at maximal wing span. Remove marbles horizontally at table height from left to right with left arm as fast as possible (and vica versa). Time needed to remove 30 marbles is scored (s) for both the hands.

Right Hand Left Hand (Sec) (Sec)

Repetitive Over Head Reaching Test

Objective: Fast repetitive movements of the upper extremity.

Materials:

20 marbles and two bowls with a 14-cm diameter positioned at crown height and at table height.

Procedure:

Standing in front of the bowls and moving the marbles as fast as possible from table height to crown height. Time needed to remove 20 marbles is scored (s) for both the hands. RIGHT HAND LEFT HAND (SEC) (SEC)

Static Over Head Work Test

Objective: Static holding time of shoulder and neck musculature.

Same as Repetitive side Reaching Test but the test is performed in standing position with 1 Kg weight in Hand.

Two Hand Carrying Test

Objective: Carry weight receptacle in two-handed manner at waist level.

Materials: PROCEDURE: Weights of 1.0, 2.0, 4.0 kg and more. Begin with suitable weight, carry it from wait to crown height 4-5 time. Then gradually increase it. Maximum time limit is within 90 s.

Forward Static Neck Bend Test Sitting

Objective: Sitting with 20–45 degrees neck flexion at table height.

Materials: Marbles 30 in 2 boxes at Maximal wing span.

Procedure: Sitting with 20–45 degrees neck flexion and putting marbles from 1 box to another. Here maximum duration the patient can sit in this position is determined. 24

Waist to over Head Lift Test

Same as two hand carrying test but here weights are lifted individually from each Hand.

Neck Strength Test

Objective:

MMT of Neck Flexors Procedure

PATIENTSPOSITION Supine Lying. Instructions ask the patient to lift the head up by looking at the roof. If

the head is lifted up fully then grade 3. Then apply resistance is applied at the forehead minimal or maximal. If the patient is able to do only partial range it will be 2.

All the scales used in the present study have good psychometric properties.^(19,20,21)

DATA ANALYSIS

Data analysis will be done using Microsoft excel and SPSS Version 23.0.

95% Confidence interval will be taken $p < 0.05$.

Descriptive analysis was done to analyse the demographic and Sociodemographic variables.

Shapiro-Wilk test was used to determine Normality of data which showed skewed distribution. So to determine the correlation between FCE with NPRS and NDI Spearman's correlation was used based.

RESULTS

A total of 100 Samples were collected.

The demographic and Sociodemographic characteristics of participants are mentioned in table 1.

Table 1: Demographic and Socio- Demographic characteristics of Participants

Variables		N (%)	Mean $\pm$ SD
Gender	Males	43 (43)	
	Females	57 (57)	
Age	21-30	15(15)	
	31-40	19(19)	
	41-50	20(20)	
	51-60	46(46)	
	<18.5	7(7)	
	18.5-24.9	35(35)	
	25-29.9	50(50)	
BMI	>30	8(8)	
	Working	42(42)	
Occupation	Non- Working	58(58)	
Duration (months)			4.40 $\pm$ 3.50

(N- No of Participants, SD- Standard deviation, BMI- Body mass Index, % Frequency, Duration= Months,)

Variables		N (%)	Mean $\pm$ SD
Marital Status	Married	78(78)	
	Unmarried	22(22)	
Educational Level	Literate	93(93)	
	Illiterate	7(7)	
	Rural	20(20)	

Residence	Urban	80(80)	
	Present	78(78)	
Forward Head Posture	Absent	22(22)	
Pain localized or Radiating	Localized	63(63)	
	Radiating	37(37)	
Hand Dominance	Right	89(89)	
	Left	11(11)	
	Right	15(40)	
Location of Radiation	Left	14(37)	
	Bilateral	8(23)	
	Till Shoulder	10(27)	
	Till Elbow	9(24)	
Extent of Radiation	Till Wrist	10(27)	
	Till Fingers	8(22)	

(N- No of Participants, SD- Standard deviation, % Frequency)

Table 2: Different Chronic neck pain Conditions and no of Participants in each condition

Condition	Frequency	Percentage
Herniated Disk	20	20
Degenerative Joint Condition	44	44
Facet Joint Arthropathy	11	11
Cervical Canal Stenosis	7	7
Non-Specific Neck Pain	14	14
Cervicogenic Headache	4	4

Table 3: Different Chronic neck pain Conditions and no of Participants in each condition (Radiating Pain)

Condition	Frequency	Percentage
Herniated Disk	15	42
Degenerative Joint Condition	8	21
Facet Joint Arthropathy	5	13
Cervical Canal Stenosis	9	24
Non-Specific Neck Pain	0	0
Cervicogenic Headache	0	0

Table 4: Analysis of Outcome Measure

Variables	Min	Max	Mean + SD
NPRS (Rest)	0	5	3.45+ 2.10
NPRS (On Activity)	1	10	7.10 + 1.10
NDI	2	43	21.45 + 10.84

Table 5: Analysis of Outcome Measure Functional Evaluation Capacity

Sr.No	Test	Scoring	Min	Max	Mean SD
1	Repetitive Side Reaching Test	1. Right To Left (S)	16	80	40.80 $\pm$ 16.06

		2. Left To Right (S)	16	66	40.14 $\pm$ 14.11
2	Repetitive Overhead Reaching Test	1. Right Hand (S)	15	80	40.06 $\pm$ 12.61
		2. Left Hand (S)	15	85	43.72 $\pm$ 16.91
3	Static Over Head work Test	1.Right To Left (S)	20	100	47.17 $\pm$ 13.31
		2.Left To Right (S)	22	105	45.45 $\pm$ 10.71
4	Two Hand Carrying Test	Both The Hands (Kg)	0	10	4.07 $\pm$ 2.11
5	Waist To over head Lift	1. Right Hand (S)	10	110	51.10 $\pm$ 12.10
		2. Left Hand (S)	12	120	55.56 $\pm$ 13.31
6	Forward Static Neck Bend Test	Position Maintained in Sec	30	180	67.19 $\pm$ 16.90
7	MMT Cervical Flexors		3	5	4.1

Table 6: Association between FEC with NPRS (Rest), Activity and NDI

Sr.No	Test	Scoring	NPRS (Rest)	NPRS (Activity)	NDI
1	Repetitive Side Reaching Test	1. Right To Left (S)	CC- (-0.21)	CC- (-0.87)	CC- (-0.72)
			p- (0.44)	p- (0.04)*	p- (0.03)*
		2. Left To Right (S)	CC- (-0.10)	CC- (-0.35)	CC- (-0.55)
			p- (0.76)	p- (0.76)	p- (0.12)
2	Repetitive Overhead Reaching Test	1. Right Hand (S)	CC- (-0.43)	CC- (-0.80)	CC- (-0.71)
			p- (0.51)	p- (0.01)*	p- (0.04)*
		2. Left Hand (S)	CC-(-0.37)	CC- (-0.51)	CC- (-0.60)
			p- (0.54)	p- (0.71)	p- (0.14)
3	Static Over Head work Test	1.Right To Left (S)	CC-(-0.67)	CC- (-0.61)	CC- (-0.77)
			p- (0.34)	p- (0.03)*	p- (0.01)*
		2.Left To Right (S)	CC- (-0.78)	CC- (-0.54)	CC- (-0.41)
			p- (0.04)*	p- (0.412)*	p- (0.627)*
4	Two Hand Carrying Test	Both The Hands (Kg)	CC- (-0.83)	CC- (-0.77)	CC- (-0.78)
			p- (0.01)*	p- (0.03)*	p- (0.04)*
5	Waist To over head Lift	1. Right Hand (S)	CC-(-0.34)	CC- (-0.55)	CC- (-0.35)
			p- (0.98)	p- (0.01)	p- (0.77)
		2. Left Hand (S)	CC-(-0.38)	CC-(-0.67)	CC- (-0.10)
			p- (0.12)	p- (-0.55)	p- (-0.55)
6	Forward Static Neck Bend Test	Position Maintained in Sec	CC-(-0.43)	CC- (-0.32)	CC- (-43)
			p- (0.67)	p- (0.78)	p- (0.88)
7	MMT Cervical Flexors		CC-(-0.13)	CC-(-0.25)	CC-(-0.33)
			p- (0.88)	p- (0.76)	p- (0.67)

DISCUSSION

The present study aimed to examine performance based assessment in patients with chronic neck pain and its

association with pain and disability. Pain was measured by NPRS and disability through NDI (Neck Disability Index). Pain was taken at rest and during activity.

The present study investigated the relationship between functional capacity and self-reported pain and disability in individuals with neck pain. Functional capacity was assessed using a battery of performance-based tests consisting of repetitive side reaching, repetitive overhead reaching, static overhead work, two-hand carrying, waist-to-overhead lifting, forward static neck bending, and manual muscle testing of the cervical flexors. These functional measures were correlated with pain intensity at rest and during activity using the Numeric Pain Rating Scale (NPRS), and with neck-related disability using the Neck Disability Index (NDI).

The overall findings demonstrated predominantly negative correlations between functional performance and NPRS/NDI scores. This indicates that participants who demonstrated better performance on several functional tasks tended to report lower pain and disability. However, statistically significant associations were observed only for selected functional tests. This finding suggests that performance-based functional capacity and patient-reported pain and disability represent related, but distinct, dimensions of neck-pain assessment.

The distinction between patient-reported outcomes and performance-based functional assessment is important. Reesink et al.¹⁶ developed a functional capacity evaluation methodology specifically for work-related neck disorders and emphasized that FCE provides information regarding actual functional performance, whereas self-reported measures and clinical examination provide different perspectives on the patient's condition. Their proposed neck FCE included tasks involving reaching, overhead work, carrying, lifting, sustained neck flexion, and cervical strength, with the tests selected to represent occupational risk factors such as repetitive movements, awkward postures, forceful movements, and static muscular contractions.

Repetitive Side Reaching

The right-to-left repetitive side reaching test demonstrated a strong negative correlation with activity-related NPRS ($r = -0.87$, $p = 0.04$) and NDI ($r = -0.72$, $p = 0.03$). This indicates that better performance during repetitive side reaching was associated with lower activity-related pain and lower neck-related disability. In contrast, the correlation with resting NPRS was weak and not statistically significant ($r = -0.21$, $p = 0.44$).

One possible explanation is that repetitive reaching is a task-dependent physical demand, and therefore may be more closely associated with pain experienced during activity than with pain experienced at rest. Repetitive upper-limb movement requires coordinated stabilization of the cervical spine and shoulder girdle, and individuals with greater pain or disability may have reduced tolerance for repetitive work-related activity.

The left-to-right repetitive side reaching test did not demonstrate statistically significant correlations with resting NPRS, activity NPRS, or NDI. Although a moderate negative relationship was observed with NDI ($r = -0.55$), the association was not statistically significant ($p = 0.12$). The difference between the two directions may reflect task-specific performance variability, asymmetry, or the relatively small sample size. Therefore, directional differences should be interpreted cautiously.

Repetitive Overhead Reaching

The right-hand repetitive overhead reaching test demonstrated a strong negative correlation with activity NPRS ($r = -0.80$, $p = 0.01$) and a strong negative correlation with NDI ($r = -0.71$, $p = 0.04$). These findings suggest that participants with better overhead-reaching performance tended to experience less pain during activity and lower disability.

This finding is consistent with the functional rationale of the neck FCE proposed by Reesink et al., in which repetitive overhead reaching was included to represent work activities involving repetitive movements and elevated upper-limb positions. The authors developed the test as a modification of an existing dynamic bending test to reproduce occupationally relevant reaching demands.

The absence of a significant relationship between right-hand overhead reaching and resting NPRS ($r = -0.43$, $p = 0.51$) again suggests that functional performance may be more closely related to pain provoked by activity than to pain experienced at rest.

The left-hand overhead reaching test did not demonstrate statistically significant correlations with NPRS or NDI. Although moderate negative correlations were observed, they did not reach statistical significance. This discrepancy between the right- and left-hand tests may reflect individual differences in upper-limb dominance, coordination, task familiarity, or asymmetrical symptoms. However, these explanations cannot be confirmed from correlation analysis alone.

Static Overhead Work

The right-to-left static overhead work test demonstrated statistically significant negative correlations with activity NPRS ($r = -0.61$, $p = 0.03$) and NDI ($r = -0.77$, $p = 0.01$). This indicates that greater tolerance for sustained overhead work was associated with lower activity-related pain and disability.

The static overhead work test requires the participant to maintain the upper limbs around crown height while performing a manipulation task. Reesink et al¹⁶. included this task because occupational overhead work involves sustained muscular activity of the neck and shoulder region. Thus, individuals with greater pain or disability may demonstrate reduced tolerance for sustained overhead work because of increased symptoms, muscular fatigue, or reduced functional endurance.

Interestingly, the left-to-right static overhead work test demonstrated a significant negative correlation with resting NPRS ($r = -0.78$, $p = 0.04$), but not with activity NPRS or NDI. The inconsistent findings between movement directions indicate that the relationship between a specific FCE task and patient-reported outcomes may be influenced by task characteristics and individual performance variability.

Two-Hand Carrying

The **two-hand carrying test demonstrated the most consistent findings in the present study**. Significant negative correlations were observed with resting NPRS ($r = -0.83$, $p = 0.01$), activity NPRS ($r = -0.77$, $p = 0.03$), and NDI ($r = -0.78$, $p = 0.04$).

These results indicate that greater carrying capacity was associated with lower pain at rest, lower pain during activity, and lower neck-related disability. The strength and consistency of these correlations suggest that two-handed carrying may represent a particularly relevant functional task in relation to overall symptom burden in this sample.

The finding may be explained by the physical demands involved in carrying. Carrying requires sustained force production and stabilization of the upper limbs, shoulder girdle, trunk, and cervical region. The neck FCE methodology was specifically developed around occupational risk factors including **forceful movements and static contractions**, making carrying an appropriate functional task for assessing work-related capacity.

Nevertheless, the correlation should not be interpreted as evidence that reduced carrying capacity causes greater neck pain. It only indicates that the two variables were associated in the study sample.

Waist-To-Overhead Lifting

The right-hand waist-to-overhead lifting test showed a statistically significant negative correlation with activity NPRS ($r = -0.55$, $p = 0.01$), indicating that greater lifting performance was associated with lower activity-related pain. However, no significant relationship was found with resting NPRS or NDI.

This finding may indicate that dynamic lifting capacity is more closely related to **pain provoked during physical activity** than to overall perceived disability. The waist-to-overhead lifting task requires the participant to move a load repeatedly between waist and crown height, thereby increasing the physical

demand on the upper extremity and neck–shoulder complex. The original neck-FCE methodology included overhead lifting as a work-related performance task and assessed maximum lifting capacity by progressively increasing the load.

The absence of significant correlations for the left-hand lifting test suggests that the relationship may not be consistent across sides. Possible explanations include hand dominance, asymmetrical symptoms, or variability in the sample, although these factors were not directly evaluated in the present analysis.

Forward Static Neck Bend

The forward static neck bend test did not demonstrate significant correlations with resting NPRS ($r = -0.43$, $p = 0.67$), activity NPRS ($r = -0.32$, $p = 0.78$), or NDI ($r = -0.43$, $p = 0.88$).

Although the direction of all correlations was negative, the relationships were not statistically significant. This suggests that the ability to maintain a sustained forward-flexed neck position was not significantly associated with the participants' reported pain or disability in this sample.

This finding is noteworthy because the test was specifically designed to assess sustained cervical flexion. Reesink et al¹⁶. described the forward static neck bend test as a test addressing occupational exposure to **awkward neck positions and static muscular contractions**. However, the authors also noted that this test was self-designed and that its test–retest reliability had not been established in the literature.

The lack of a significant correlation in the present study may therefore reflect the fact that sustained cervical postural endurance represents a different construct from perceived pain and disability. It may also reflect measurement variability associated with a relatively novel test.

Manual Muscle Testing of Cervical Flexors

Manual muscle testing of the cervical flexors showed weak and non-significant negative correlations with resting NPRS ($r = -0.13$, $p = 0.88$), activity NPRS ($r = -0.25$, $p = 0.76$), and NDI ($r = -0.33$, $p = 0.67$).

Therefore, the present findings do not demonstrate a significant relationship between cervical flexor MMT and either pain or disability. This suggests that **manual muscle strength of the cervical flexors alone may not adequately reflect the functional limitations experienced by individuals with neck pain**.

This finding is clinically relevant because functional capacity is multidimensional. A patient may have relatively preserved cervical muscle strength while still demonstrating limitations in repetitive reaching, carrying, overhead work, or lifting. Conversely, pain and disability may be influenced by several factors beyond muscle strength, including movement tolerance, endurance, fear of movement, psychosocial factors, and work demands.

Relationship between NPRS and NDI

The pattern of findings also highlights the distinction between **pain intensity and disability**. NPRS measures symptom intensity, whereas the NDI evaluates the impact of neck pain on activities and daily functioning. The NDI is a widely used and well-established patient-reported outcome measure for neck pain. A systematic review by MacDermid et al. reported acceptable reliability and validity of the NDI across multiple neck-pain populations and noted that the NDI is related to measures of pain and physical functioning.

More recent evidence also supports the psychometric properties of the NDI. A 2024 systematic review and meta-analysis involving 79 studies reported good internal consistency and test–retest reliability, with pooled correlations between the NDI and pain-rating measures ranging from **0.38 to 0.89** across studies. These findings support the use of the NDI in the present study as a measure of patient-perceived disability.²²

The present results demonstrate that some FCE tasks correlated more strongly with NDI than with resting

NPRS. This may be because the NDI reflects the functional consequences of neck pain rather than simply the intensity of symptoms. Therefore, performance-based FCE measures may have greater conceptual overlap with disability than with pain intensity alone.

Functional Capacity Versus Patient-Reported Outcome

An important implication of the present study is that **FCE and patient-reported measures should not be considered interchangeable**. The FCE evaluates what an individual can actually perform under standardized physical conditions, whereas NPRS and NDI capture the patient's experience of pain and disability.

This distinction is supported by the conceptual framework of Reesink et al.¹⁶, who emphasized that functional capacity evaluation, clinical examination, and self-reported outcomes provide different perspectives on the patient. They recommended that FCE should be combined with medical and psychosocial evaluation rather than being used as a stand-alone assessment.

The present findings support this approach because some functional tests demonstrated strong correlations with pain or disability, while others did not. Thus, a patient's reported disability cannot be assumed solely from their physical performance, and conversely, a patient's functional capacity cannot be determined solely from their NPRS or NDI score.

CONCLUSION

Overall, the present study demonstrates that several functional capacity measures are negatively associated with pain and disability in individuals with neck pain. The strongest and most consistent findings were observed for the **two-hand carrying test**, which demonstrated significant negative correlations with resting pain, activity-related pain, and NDI. Repetitive side reaching, repetitive overhead reaching, static overhead work, and right-hand waist-to-overhead lifting also demonstrated significant negative relationships with selected pain or disability measures.

In contrast, forward static neck bending and cervical flexor MMT did not show significant correlations with NPRS or NDI. These findings reinforce the concept that neck pain-related disability is multidimensional and that muscle strength or isolated postural endurance does not necessarily reflect overall functional ability.

Thus, the findings support the use of a **multidimensional assessment approach**, combining performance-based functional capacity testing with validated patient-reported measures such as NPRS and NDI. The FCE may provide information about actual physical performance that cannot be obtained from pain and disability questionnaires alone, while NPRS and NDI provide important information about the patient's subjective experience. Together, these measures may provide a more comprehensive assessment of individuals with neck pain and may be particularly useful when evaluating work-related functional limitations.

LIMITATIONS OF THE STUDY

The correlation coefficients reported in the present study indicate **Correlation and not causation**. Furthermore, the interpretation of the results should take into account the sample size, potential measurement error, side-to-side differences, and the number of correlations tested. Multiple statistical comparisons may increase the probability of obtaining a statistically significant result by chance. Therefore, the significant correlations should ideally be interpreted alongside effect sizes, confidence intervals, sample characteristics, and, where appropriate, adjustment for multiple comparisons.

FUTURE RECOMMENDATIONS

1. Study can be done with larger sample size.
2. Other Variables for Neck pain like Range, Strength, Proprioception can also be included and even acute cases

REFERENCES

1. American Academy of Orthopaedic Surgeons. OrthoInfo. [Multiple diseases and conditions and treatment articles (<https://orthoinfo.aaos.org/>)]. Accessed 1/18/2022.
2. American Association of Neurological Surgeons. Cervical Spine (<https://www.aans.org/en/Patients/Neurosurgical-Conditions-and-Treatments/Cervical-Spine>). Accessed 1/18/2022.
3. Beltran-Alacreu H, López-de-Uralde-Villanueva I, Calvo-Lobo C, Fernández-Carnero J, La Touche R. Clinical features of patients with chronic non-specific neck pain per disability level: A novel observational study. *Revista da Associação Médica Brasileira*. 2018 Aug;64(8):700-9.
4. Steenstra IA, Ibrahim SA, Franche RL, Hogg-Johnson S, Shaw WS, Pransky GS. Validation of a risk factor-based intervention strategy model using data from the readiness for return to work cohort study. *Journal of occupational rehabilitation*. 2010 Sep;20(3):394-405.
5. Sharma S, Jahanvi, Sachan K. Impact of neck pain on daily living and work productivity among individuals in rural population. *Int J Multidiscip Res Dev*. 2026;13(1):491-496.
6. Jing X, Wang Y, Zhang Y, Li F, Tian D, Zhang F, et al. Global, Regional, and National Burden of Neck Pain in Young Population, 1990–2021: An Age–Period–Cohort Analysis and Projections to 2050 Based on the Global Burden of Disease Study 2021. *Global Spine Journal*, 2025.
7. Machino M, Ando K, Kobayashi K, Nakashima H, Morozumi M, Kanbara S, et al. Impact of Neck and Shoulder Pain on Health-Related Quality of Life in a Middle-Aged Community-Living Population. *BioMed Research International*, 2021:2021:6674264.
8. Kaljić E, Jurišić M, Katana B, Trtak N, Vranešić AE, Jevtić N, et al. Incidence and impact of neck pain on daily life activities of the student population. *Journal of Health Sciences*, 2022;12(2):116–121.
9. Kazeminasab, S., Nejadghaderi, S. A., Amiri, P., Pourfathi, H., Araj-Khodaei, M., Sullman, M. J. M., Kolahi, A. A., & Safiri, S. (2022). Neck pain: global epidemiology, trends and risk factors. *BMC musculoskeletal disorders*, 23(1), 26. <https://doi.org/10.1186/s12891-021-04957-4>
10. Peng B, Yang L, Li Y, Liu T, Liu Y. Cervical Proprioception Impairment in Neck Pain-Pathophysiology, Clinical Evaluation, and Management: A Narrative Review. *Pain Ther*. 2021 Jun;10(1):143-164. doi: 10.1007/s40122-020-00230-z. Epub 2021 Jan 12. PMID: 33464539; PMCID: PMC8119582.
11. Guzman J, Hurwitz EL, Carroll LJ, Haldeman S, Côté P, Carragee EJ, Peloso PM, van der Velde G, Holm LW, Hogg-Johnson S, Nordin M, Cassidy JD. A New Conceptual Model of Neck Pain: Linking Onset, Course, and Care: The Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *European Spine Journal* 2008;17(Suppl 1):14-23.
12. Merskey H, Bogduk N, International Association for the Study of Pain. Task Force on Taxonomy. Classification of chronic pain : descriptions of chronic pain syndromes and definitions of pain terms. Seattle: IASP Press, 1994.
13. Misailidou V, Malliou P, Beneka A, Karagiannidis A, Godolias G. Assessment of patients with neck pain: a review of definitions, selection criteria, and measurement tools. *J Chiropr Med* 2010;9(2):49-59.
14. Rezai, M., Côté, P., Cassidy, J. D., & Carroll, L. (2009). The association between prevalent neck pain and health-related quality of life: a cross-sectional analysis. *European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society*, 18(3), 371–381. <https://doi.org/10.1007/s00586-008-0823-6>.
15. Tanik F, Ozer Kaya D. Relationships between function, pain severity and psychological and cognitive levels in people with chronic neck pain: cross-sectional study. *Pain Manag Nurs*. 2024;25(6):645-651. doi:10.1016/j.pmn.2024.06.008.
16. Reesink DD, Jorritsma W, Reneman MF. Basis for a functional capacity evaluation methodology for patients with work-related neck disorders. *Journal of occupational rehabilitation*. 2007 Sep;17(3):436-49.
17. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition. *Cephalalgia*. 2018;38(1):1-211. doi:10.1177/0333102417738202.
18. Reneman MF, Roelofs M, Preuper HS. Reliability and agreement of neck functional capacity evaluation tests in patients with chronic multifactorial neck pain. *Archives of Physical Medicine and Rehabilitation*. 2017 Jul 1;98(7):1476-9.

19. Dieleman JL, Cao J, Chapin A, Chen C, Li Z, Liu A, Horst C, Kaldjian A, Matyas T, Scott KW. US health care spending by payer and health condition, 1996-2016. *JAMA*. 2020;323(9):863–884. doi: 10.1001/jama.2020.0734. [\[DOI\]](#) [\[PMC free article\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#).
20. Lezin N, Watkins-Castillo S. The impact of musculoskeletal disorders on Americans-opportunities for action. *Burden Musculoskelet Dis US Prev Soc Econ Cost*. 2016;
21. Safiri S, Kolahi A-A, Hoy D, Buchbinder R, Mansournia MA, Bettampadi D, et al. Global, regional, and national burden of neck pain in the general population, 1990–2017: systematic analysis of the Global Burden of Disease Study 2017. *BMJ*. 2020;368. [\[DOI\]](#) [\[PMC free article\]](#) [\[PubMed\]](#).
22. Saltychev M, Pyrkäs K, Karklins A, Juhola J. Psychometric properties of neck disability index – a systematic review and meta-analysis. *Disabil Rehabil*. 2024;46(23):5415-5431. doi:10.1080/09638288.2024.2304644.