*International Journal of Health Sciences and Research*
*Vol.13; Issue: 6; June 2023*
*Website: www.ijhsr.org*
*Original Research Article* *ISSN: 2249-9571*

# Evaluation of Head Posture, Deep Cervical Flexor Muscle Performance and Disability in Electricians with Mechanical Neck Pain

**Hiral Jathania[1], Dr. Aishwarya Akash[2]**

[1]Student BPTh, Deep Paramedical Organizations Nett College of Physiotherapy, Thane
[2]Assistant Professor, Deep Paramedical Organizations Nett College of Physiotherapy, Thane

Corresponding Author: Dr. Aishwarya Akash

**DOI: https://doi.org/10.52403/ijhsr.20230610**

## ABSTRACT

**Background:** Electrical work is physically demanding, and there are a number of potential risks, including electrical shock, accidents from using machinery and hand tools, and work-related musculoskeletal disorders. One such structural problem is the advent of pain and issues with head posture as a result of keeping the head static for an extended period. The present study aims to determine the relationship between VAS and head posture, DCF muscle function, and disability.
**Method:** 80 electricians who had been identified as having mechanical neck pain participated in this observational study. The severity of neck pain, head posture, DCF muscle performance, and neck disability were all assessed using a Visual Analogue Scale (VAS), Craniovertebral Angle using Photographic Method, Modified Sphygmomanometer, and Neck Disability Index (NDI), respectively.
**Result:** Spearman rank correlation test demonstrates a significant moderate negative correlation between VAS and CVA, and VAS and DCF muscle performance. While there is a significant strong positive correlation between VAS and NDI.
**Conclusion:** Present study demonstrates a significant positive correlation between DCF, NDI, and CVA when compared with VAS. The age-related changes and the work demands of the electricians negatively impacts the strength and endurance of the deep cervical flexor muscles which in turn leads to a forward head posture causing a decline to perform the activity of daily living.

***Keywords:*** Electricians, head posture, craniovertebral angle, deep cervical flexor muscle performance, disability, mechanical neck pain

## INTRODUCTION

Electricians are experienced manual laborers and focus on electrical wiring for stationary machinery, transmission lines, and similar equipment. They specialize in the installation of new electrical components as well as the upkeep and repair of existing electrical infrastructure. The work may be strenuous and involve lifting objects, bending conduits, standing, stooping, and kneeling.

Occupational Safety and Health Administration (2014) states that because a significant amount of work is performed at ceiling height, in cramped spaces, or close to the floor, performing these tasks for a long duration may necessitate awkward postures on the part of employees. [1] While using various hand tools or equipment, adopting a continuous static head posture is associated with the development of work-related musculoskeletal disorders (MSDs or WMSDs) in electricians.

MSDs are conditions that affect the muscles, nerves, tendons, joints, cartilage, and supporting structures of the upper and lower limbs, neck, and lower back. [2]. Due to most of their job being done at ceiling

level or fixing stationary equipment, electricians are frequently exposed to physical components such as excessive force, repetition, incorrect body posture, vibration, and other factors that can cause musculoskeletal disorders. MSDs not only diminish productivity at work but are also the main reason for disability, sick leave, and lost workdays. The impairment might be caused by structural problems that appear gradually and can have an impact on different joints, and contractile and non-contractile tissues. One such structural problem is the development of discomfort and problems related to head posture as a result of keeping the head still for an extended length of time.

Mechanical neck pain (MNP) is characterized as discomfort that is largely localized to the posterior region of the neck and that can be made worse by neck movement or by holding a position for an extended period. [3] One way to evaluate MNP is by taking the Visual Analogue Scale (VAS) pain score. VAS is a subjective tool and is regarded as a reliable, perceptive, and reproducible technique for expressing pain intensity. [4]

MNP is frequently linked to forward head posture (FHP). [3] The term "forward head posture" refers to a position in which the head is forward of the vertical reference line in the sagittal plane that runs through the lobe or tragus of the ear and the point of the shoulder. [5] Upper cervical spine (C1-C3) and head extension and a relatively flexed mid-lower cervical spine (C4-C7) characterize the forward head posture. [6]

The craniovertebral (CV) angle can be measured as an objective way to evaluate head posture. [7] The "CV angle" is the angle created when a line extending from the tragus of the ear intersects a horizontal line going through C7. [7] This technique can accurately evaluate normal head-neck posture in the sagittal plane. There are several techniques for assessing posture, varying from manual methods like a goniometer, flexible ruler, and observational postural analysis by using the line of gravity to measurement through radiographic testing. One of the simple and observant evaluation techniques that are widely employed is photographic posture analysis using "MB-Ruler software." A study by Dipti Vilas et. al. stated that "MB-Ruler software" has good intra-rater (ICC=0.999) and inter-rater (ICC=0.892) reliabilities. [8]

As head posture is maintained for prolonged periods of time, the length-tension relationship of muscles is changed. [5] Gradually, the anterior cervical flexor muscles become weaker and the posterior cervical muscles shorten. [5] The longus colli, longus capitis, rectus capitis anterior, and lateralis are the deep cervical muscles that will be impacted. [5] Motor control issues are the cause of the deep cervical flexor muscles reduced activation. [5] Overuse of the superficial cervical flexors eventually causes tiredness and pain. In addition, if the posterior cervical muscle shortening persists over time, it may increase the loading on connective tissue and other non-contractile tissues, causing aberrant tension on the posterior cervical structures and myofascial discomfort. [5] In 2006, Fernandez-de-las-Pen˜ et al. found that the upper trapezius, temporalis, sternocleidomastoid, and sub-occipital muscles included most of the trigger sites in the forward head posture. [6]

The craniocervical flexion test (CCFT) measures the anatomical function of the longus capitis and colli muscles, which are deep cervical flexor muscles. [9] The deep cervical flexors' ability to contract and maintain isometric contraction (endurance) throughout the course of five phases of increasing craniocervical flexion range of motion is measured, along with their interaction with the superficial cervical flexors. [9] In a study by Harshit Soni et. Al. on "inter and intra-rater reliability of the craniocervical flexion test by using modified sphygmomanometer as a pressure bio-feedback," the Cranio-Cervical Flexion Test demonstrated excellent intra-rater and good inter-rater reliability with ICC being 0.89 and 0.75 respectively. [10] Instead of

Chattanooga Pressure Bio-Feedback in the Cranio-Cervical Flexion Test, a modified sphygmomanometer can be used because it is more affordable and readily available to all physiotherapists. [10]

Disability is any physical or mental condition that makes it harder for a person to engage in activities and interact with their environment. To assess neck pain and the resulting impairment, the Neck Disability Index (NDI) was implemented. The NDI, which consists of 10 components, measures how neck discomfort affects an individual's ability to manage activities of daily life. Electricians' job involves repair and maintenance services for automobiles, generators, compressors, dozers, and other construction equipment. If not addressed, the task will result in neck pain, difficulties focusing while working, and the need to lift heavy tools for work when working in a confined area, on a test bench, or while doing in-situ repairs for a prolonged period. The task is not completed effectively. It can worsen, disrupt sleep, cause issues with personal care, interfere with leisure activities, and even cause headaches. The intraclass correlation coefficients (ICCs) for NDI range from 0.50 to 0.98 and has acceptable reliability. [11]

## MATERIALS & METHODS

The observational study was carried out in the metropolitan city of Mumbai for a period of 18 months where 80 electricians with mechanical neck pain were included by convenience sampling.

***Inclusion and Exclusion Criteria***: 25-40 years old electricians, with ≥5 years of experience, working for a minimum of 6 hours were included in the present study along with the neck pain criteria as follows: (i) Neck pain that mostly worsens as a result of adopting bad posture during everyday activities and decreased by correction of one's posture; (ii) restricted flexion of the upper cervical spine (9 degrees or fewer) without any discomfort resulting from a restriction of cervicothoracic mobility; (iii) Long-lasting symptoms, such as individuals who reported neck discomfort at least once per week over the previous three months; (iv) Mild (VAS values of 1 to 3) to moderate (VAS scores of 4 to 6) and severe (VAS scores 7-10) neck pain intensity. Vertebrobasilar insufficiency symptoms, any condition involving the cervical spine including fracture or dislocation, recently undergone surgery, acute inflammatory problem, tumours, neurological conditions, and ankylosing spondylitis were excluded.

***Procedure:*** Ethical clearance from the ethical committee was taken. 80 electricians who were willing to participate were considered. All the subjects were screened according to the inclusion and exclusion criteria. The purpose of the study and procedure was explained to the subjects prior to the assessment. A written informed consent form was taken in the language best understood by the subject. Demographic data was noted down.

***Outcome Measures:***

1) Craniovertebral angle (CVA):

A craniovertebral angle was taken for the evaluation of forward head posture. [11] The subject neck was passively flexed and extended to identify the C7 spinous process. A body surface sticker was used to mark the C7 spinous process and tragus of the ear. All subjects were informed to sit comfortably. One standard lateral view image on iPhone 11 was taken with all the anatomical markers visible. The photographs were then transferred to the computer and evaluation of CVA was done using "MB-Ruler 5.4 Software." A craniovertebral angle of less than 48-50 degrees indicated forward head posture. [13]

2) Deep Cervical Flexor Muscle Performance (DCF):

Cranio-cervical flexion test (CCFT) was done to measure the endurance of deep cervical flexors muscles. The subjects were positioned in a crook lying. Just below the occiput, the modified sphygmomanometer

was positioned between the plinth and the posterior part of the neck. It was then inflated to a baseline pressure of 20 mmHg. The subjects were asked to perform a gentle, nodding head movement at five different pressure levels (22, 24, 26, 28, and 30 mmHg), hold each level for 10 seconds, and then rest for 30 seconds in between and were closely monitored for the correction of substituted movements. The DCF activation score and performance index were both evaluated in this test. These aspects were tested while the subject performed five progressive phases. [9]

3) Neck Disability Index (NDI):
Disability in electricians was assessed using Neck Disability Index which is designed to give information as to how neck pain affects the ability to manage in everyday life. Neck Disability Index is a 10-item questionnaire that includes pain, personal care, lifting, headaches, concentration, work, driving, sleeping, and recreation. A higher score indicates a more patient-related disability.
1 to 4 = No disability
5 to 14 = mild disability
15 to 24 = moderate disability
25 to 34 = severe disability
>35 = complete disability

## STATISTICAL ANALYSIS

Spearman's Rank Correlation test was administered to find the correlation between the variables such as VAS scores, CVA, DCF muscle performance and NDI.

## RESULT

The demographic data and study results are documented in (table 1). Of the total population (80), all the participants were male. The participants selected were aged between 25-40 years. (Figure-1). The mean age and standard deviation were 32.32 ±3.83. As per the inclusion criteria, participants with neck pain scored as mild (from 1 to 3 VAS scores), moderate (4 to 6 VAS scores), and severe (from 7 to 10 VAS scores) were included in the present study.
The participants were assessed for head posture by examining the craniovertebral angle (CVA). The mean score documented was 46.8 suggestive of abnormal CVA. Furthermore, the deep cervical flexor muscle performance was inspected by evaluating the performance index and the mean score reported was 54.58. In the present study, the mean score for NDI is 11.99, suggestive of mild disability.

**Table 1: Demonstrates demographic data and results of tests**

| Demographic Data | Mean ± SD |
|---|---|
| AGE | 32.32 ± 3.83 |
| GENDER<br>MALE | <br>80 |
| VAS | 3.4 ±1.72 |
| CVA | 46.8 ±1.74 |
| DCF MUSCLE PERFORMANCE | 54.6±15.46 |
| NDI | 11.99 ± 8.04 |

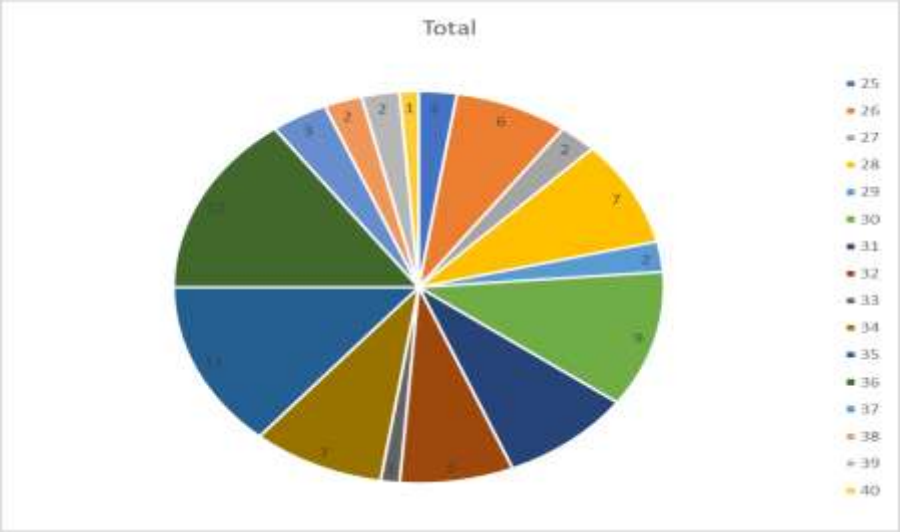



**Figure 1: Total Age Count**

**Table 2: Demonstrates results of VAS and NDI**

| | | NDI SCORE | | | |
|---|---|---|---|---|---|
| | | **NO DISABILITY** | **MILD DISABILITY** | **MODERATE DISABILITY** | **SEVERE DISABILITY** |
| VAS | MILD | 15 | 31 | 0 | 0 |
| | MODERATE | 0 | 6 | 19 | 4 |
| | SEVERE | 0 | 0 | 1 | 4 |

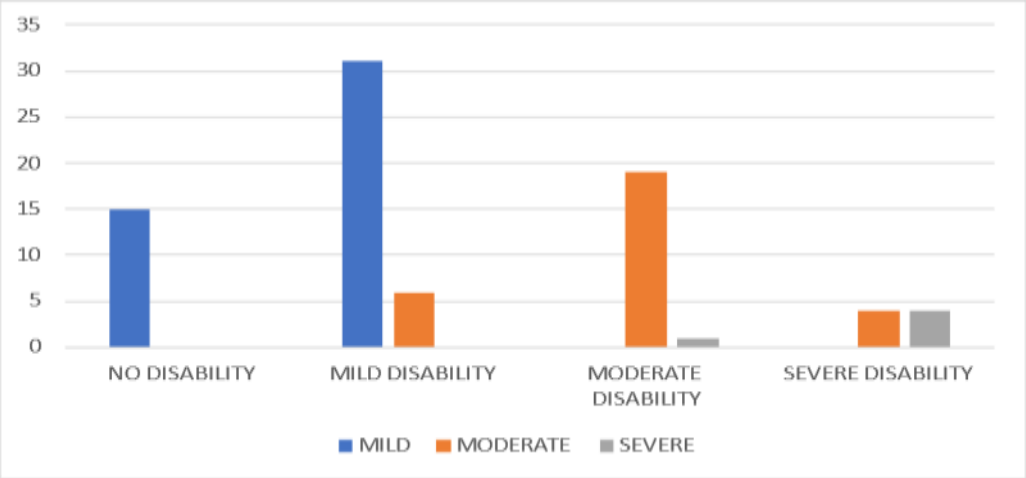
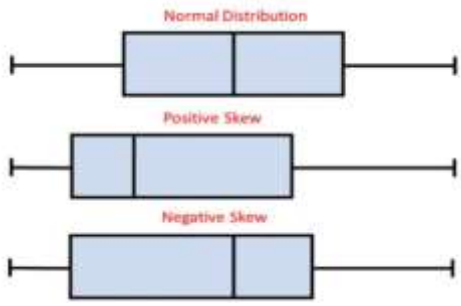



**Figure 2: Demonstrates results of VAS and NDI**

To assess the normality of the data, statistical analysis using a box plot was performed. The results of which demonstrated that the data were not distributed normally. Hence, to assess the data for its correlation and since the data is not normal, Spearman rank correlation test was administered. The score of variables of VAS with CVA, DCF muscle performance, and NDI were represented in the form of ranking using the Rank Average method. The results of which are suggestive of a moderate negative correlation between VAS and CVA and VAS and DCF muscle performance. It shows a very strong positive correlation between VAS and NDI.

As per the statistical data analysis, the result of the present study demonstrates that we accept

the alternative hypothesis and reject the null hypothesis.




Note: The line in the box is the median line, So in the Box plot if the area in the box divided by the median line is symmetric then the data is normal.

**Figure 3: Demonstrates results of normality distribution**

**Table 3: Demonstrates Spearman's correlation between VAS and CVA**

| **VAS** | **CVA** |
|---|---|
| | r= -0.564 |

**INFERENCE:** There is a significant moderate negative correlation between VAS and CVA, that is the greater the pain, the lower the CVA, and vice versa.

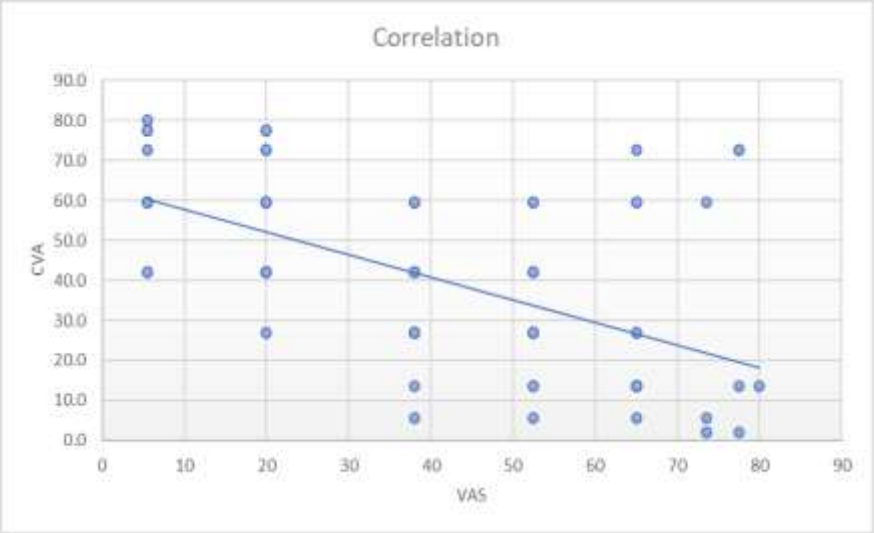



**Figure 4: Demonstrates correlation graph between VAS and CVA**

**Table 4: Demonstrates Spearman's Correlation between VAS and DCF muscle performance**

| | DCF muscle performance |
|---|---|
| **VAS** | r= -0.5553 |

**INFERENCE:** There is a significant moderate negative moderate correlation between VAS and DCF muscle performance, that higher the pain, the lower the deep cervical muscle performance.

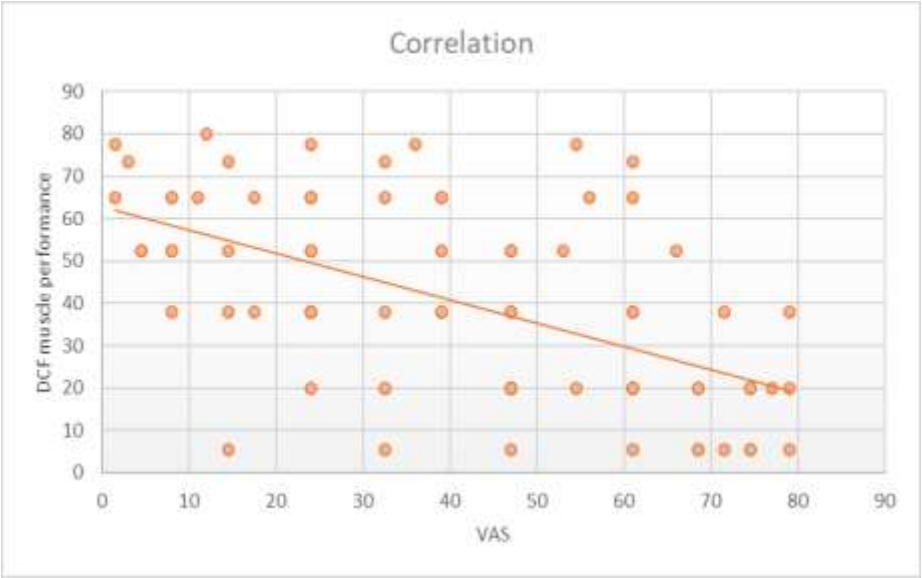



**Figure 5: Demonstrates correlation graph between VAS and DCF muscle performance**

**Table 5: Demonstrates Spearman's Correlation between VAS and NDI**

| | NDI |
|---|---|
| **VAS** | r= 0.942011 |

**INFERENCE:** There is a significant very strong positive correlation between VAS and NDI, that is higher the pain more is the disability.

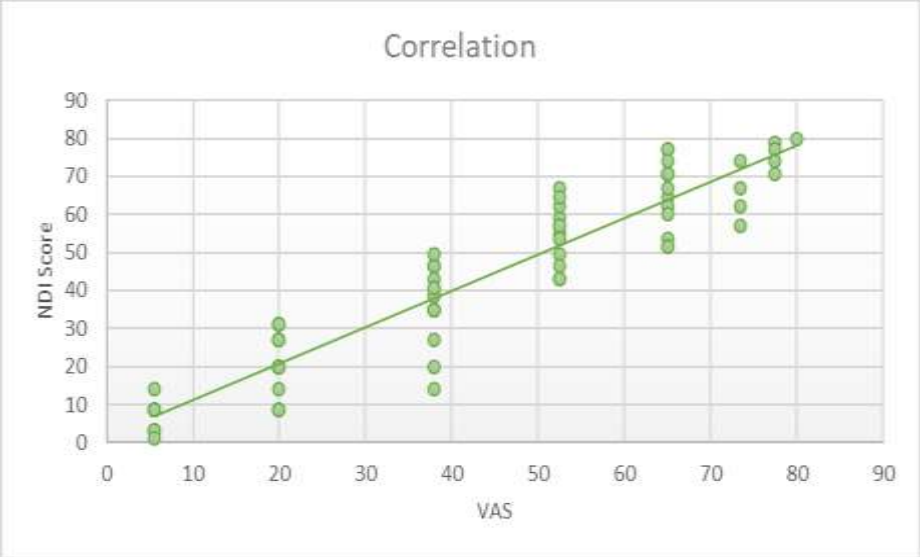



**Figure 6: Demonstrates correlation between VAS and ND**

## DISCUSSION

This study was conducted in Mumbai on 80 electricians with mechanical neck pain to evaluate their head posture, deep cervical flexor muscle performance, and disability, results of which demonstrated a significant moderate negative correlation between VAS and CVA as well as between VAS and DCF muscle performance. When analyzed for a correlation between VAS and NDI a significant very strong positive correlation was demonstrated.

Construction is one of the largest industries all over the world and consists of carpenters, cement masons, bricklayers, electricians, sheet metal workers, roofers, ironworkers, painter, and plumbers/pipefitters/steamfitters. [1,14] This sector routinely ranks among the riskiest professions, and it is responsible for a disproportionately high number of illnesses and injuries at work. [1] The most prevalent forms of health problems impacting billions of people globally are work-related musculoskeletal injuries/disorders (MSDs or WMSDs) causing limitations in their musculoskeletal systems, including muscular dysfunction, tingling, inflammation, and discomfort.

Electricians work both indoors and outdoors, at construction sites, and in homes, businesses, and factories. [1] Weather conditions, cramped spaces, and prolonged static posture at the task may be encountered by workers. According to a prevalence survey by Katherine L. Hunting et al, MSDs related to these professions affect the majority of the population, with the low back (51%), knee (33%), neck (38%), shoulder (27%) and hand and arm (18%) of the workers being most frequently affected. [15]

The present study emphasized the neck component of the electricians. 80 electricians with mechanical neck pain were included. Out of all the 80 participants, 35% of electricians fall in the 25-30 years age group and 65 % of electricians fall in the 31-40 years age group. A study by Natalie V. Schwatka et al. suggested that age-related physical changes might make activities more challenging for older employees engaged in construction work that includes electricians. [16] Physically strenuous labor may be challenging due to lower cardiac output and decreased physical activity tolerance. The loss of muscle mass and associated reductions in strength can also affect older employees. Age-related declines in bone density increase the likelihood of fractures. Chronic inflammatory diseases, which are linked to arthritis and other problems that can reduce the joint range of motion and function, are also more common in older people. Age-related changes in body composition and weight can increase

the risk of diabetes, hypertension, and decreased flexibility and mobility in employees. Overall, aging can result in considerable physical changes that make it more difficult for a person to undertake physically demanding activities, such as those in construction, without becoming injured.[16]

Visual Analogue Scale (VAS) was used to determine the severity of mechanical pain in the study subjects and it was observed that 6% had severe mechanical pain, 36% had moderate pain, whereas 58% had mild mechanical pain. Participants in the present study had fewer symptomatology and it substantially increased with the number of years worked when compared to those with less job experience. Participants with severe mechanical neck pain falling in the age group of 31 to 40 years are the potential candidates to develop age-related musculoskeletal disorders. Duration of break during work is another factor that accounts for most participants mild-to-moderate symptoms. This is suggested by Ahmad Alghadir et al. who stated that the duration of break (>20 minutes) has less prevalence of developing musculoskeletal pain. [17]

The head is supported by the spinal vertebrae in an upright position and is not supported by the vertebrae as much when it is flexed forward. To support the head, muscles, tendons, and ligaments must work harder. The main cause of mechanical pain is due to the diminished blood supply and oxygen to the soft tissues due to the tightening of posterior cervical muscles and weakening of anterior cervical muscles. [18]

In the present study, the forward head posture was determined by measuring the craniovertebral Angle. Results showed a significant moderate negative correlation between VAS and CVA (r= -0.564) indicating that a smaller CV angle corresponds to greater neck pain intensity and vice versa. In one study by Kwok Tung Lau et al. on "Relationships between sagittal postures of the thoracic and cervical spine, the presence of neck pain, neck pain severity, and disability," the CV Angle was negatively correlated with the presence of neck pain. [19] This might be due to the postures they acquire while working. Out of all the electricians, 46% of electricians showed FHP in the age group of 25-30 years whereas 69% showed FHP in the age group of 31-40 years. The FHP involves increased flexion of the lower cervical vertebrae and the upper thoracic regions whereas increased extensions of the upper cervical vertebrae and extension of the occiput on C1. Joint displacement causes pain and muscle spasms while the ligaments function as sensory organs in ligamentous-muscular reflexes. The muscles receive the reflex after it is transmitted by the ligamentous mechanoreceptors (such as pacinian corpuscles, golgi tendon organs, and ruffini endings).[20] Many biomechanical symptoms in the upper cervical spine might be brought on by joint instability. Synovitis can result from repeated biomechanical strain and microdamage that causes cytokines to cause an inflammatory response in the nearby synovial tissue. [20] Muscle imbalance brought on by weak short deep cervical flexors, rhomboids, serratus anterior, middle, and lower trapezius, as well as tight cervical extensors and pectorals, is the primary factor leading to forward head position (low CVA).[21] In many instances, a decrease in CVA is associated with headache, neck pain, rounded shoulders, thoracic kyphosis, myofascial pain syndrome, and TMJ disorders. [21]

The third objective of the present study demonstrated that there was a statistically significant moderate negative correlation between VAS and DCF muscle performance (r= -0.5553). This is suggestive of a positive correlation between neck pain intensity and deep cervical muscle performance, if pain increases the deep cervical muscle performance decreases and vice versa. Cranio-cervical flexion represents the action of the longus capitis in synergy with the longus colli, which causes a reduction of cervical lordosis. In the age group of 25-30 years, 29% of electricians demonstrated

moderate pain and 11% with severe pain whereas in the age group of 31-40 years, moderate and severe pain demonstrated 40% and 4% respectively. Individuals with moderate and severe neck pain on VAS were not able to achieve the highest pressure (30 mmHg) on CCFT i.e., their activation score was less and those with mild pain on VAS were able to reach the highest level (30 mmHg) but their holding capacity was less. Similar results were demonstrated by Thomas Tai Wing Chiu et.al. on individuals with chronic neck pain. [9]

The NDI measures several characteristics, including pain severity and several activities of daily living affected by structural and functional abnormalities of the cervical region. The results of the correlation analysis demonstrated that VAS and NDI scores are very strongly positively correlated (r=0.94201) and as NDI included pain severity, a positive correlation would be anticipated. Individuals with moderate to severe pain showed moderate to severe disability on NDI. In the age group of 25-30 years, 18% showed moderate disability and 7% were severely disabled whereas in the age group of 31-40 years, moderate and severe disability demonstrated were 29% and 12% respectively.

## CONCLUSION

To conclude, the VAS component has demonstrated a positive correlation with CVA, DCF muscle performance, and NDI in electricians. As per the result, 35% of electricians fall in the age group of 25-30 years. Out of these 29% showed moderate pain severity whereas 11% showed severe pain severity on VAS. The FHP was seen in 46% of electricians in the same age group whereas 40% of electricians were unable to achieve the highest activation score on CCFT. 25% of electricians demonstrated moderate to severe disability on NDI. The 31-40 years age group consisted of 65% electricians. On VAS, the moderate and severe pain demonstrated were 40% and 4% respectively. The FHP was seen in 69% of electricians whereas 44% did not achieve the highest activation score on CCFT thus a low-performance index. 41% of electricians showed moderate to severe disability on NDI. Moreover, with the results of this present study, there is an insight provided between age and the components affected. As the age increases, the development of forward head posture, decrease in strength and endurance of deep cervical muscles and decrease in activities of daily living can be seen in the electricians.

### *Declaration by Authors*

**Ethical Approval:** Approved
**Acknowledgment:** None
**Source of Funding:** None
**Conflict of Interest:** The authors declare no conflict of interest.

## REFERENCES

1. Choi SD, Yuan L, Borchardt JG. Musculoskeletal disorders in construction: practical solutions from the literature. Professional safety. 2016 Jan 1;61(01):26-32.
2. Hales TR, Bernard BP. Epidemiology of work-related musculoskeletal disorders. Orthopedic Clinics of North America. 1996 Oct 1;27(4):679-709.
3. Balthillaya GM, Parsekar SS, Gangavelli R et al. Effectiveness of posture-correction interventions for mechanical neck pain and posture among people with forward head posture: protocol for a systematic review. BMJ open. 2022 Mar 1;12(3): e054691.
4. Conti PC, De Azevedo LR, De Souza NV et al. Pain measurement in TMD patients: evaluation of precision and sensitivity of different scales. Journal of oral rehabilitation. 2001 Jun;28(6):534-9.
5. Subbarayalu AV. Measurement of craniovertebral angle by the Modified Head Posture Spinal Curvature Instrument: A reliability and validity study. Physiotherapy theory and practice. 2016 Feb 17;32(2):144-52.
6. Subbarayalu AV, Ameer MA. Relationships among head posture, pain intensity, disability, and deep cervical flexor muscle performance in subjects with postural neck pain. Journal of Taibah University medical sciences. 2017 Dec;12(6):541.

7. Choi KH, Cho MU, Park CW et al A comparison study of posture and fatigue of neck according to monitor types (moving and fixed monitor) by using flexion relaxation phenomenon (FRP) and craniovertebral angle (CVA). International Journal of Environmental Research and Public Health. 2020 Sep;17(17):6345.
8. Kadu DV, Shetye JV. Reliability of "MB-Ruler Software" to Measure Craniovertebral Angle Using the Photographic Method. Journal of Health and Allied Sciences NU. 2022 Jul;12(03):307-11.
9. Wing Chiu TT, Hung Law EY, Fai Chiu TH. Performance of the craniocervical flexion test in subjects with and without chronic neck pain. Journal of Orthopaedic & Sports Physical Therapy. 2005 Sep;35(9): 567-71.
10. Soni H, Hingarajia D, Dey S et al. Inter and Intra-Rater Reliability of the Craniocervical Flexion Test by Using Modified Sphygmomanometer as a Pressure Bio-Feedback. Indian Journal of Physiotherapy & Occupational Therapy. 2012 Oct 1;6(4).
11. MacDermid JC, Walton DM, Avery S et al. Measurement properties of the neck disability index: a systematic review. Journal of orthopaedic & sports physical therapy. 2009 May;39(5):400-17.
12. Mohamed RE, Amin MA, Omar HM. Computed tomography-guided celiac plexus neurolysis for intractable pain of unresectable pancreatic cancer. The Egyptian Journal of Radiology and Nuclear Medicine. 2017 Sep 1;48(3):627-37.
13. Shaghayeghfard B, Ahmadi A, Maroufi N et al. Evaluation of forward head posture in sitting and standing positions. European spine journal. 2016 Nov; 25:3577-82.
14. Albers J. Simple solutions: Ergonomics for construction workers. US Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health; 2007.
15. Hunting KL, Welch LS, Cuccherini BA et al. Musculoskeletal symptoms among electricians. American journal of industrial medicine. 1994 Feb;25(2):149-63.
16. Schwatka NV, Butler LM, Rosecrance JR. An aging workforce and injury in the construction industry. Epidemiologic reviews. 2012 Jan 1;34(1):156-67.
17. Alghadir A, Anwer S. Prevalence of musculoskeletal pain in construction workers in Saudi Arabia. The Scientific World Journal. 2015 Mar;2015.
18. Kataria J, Sindhu B, Pawaria S. Effect of mechanical neck pain with forward head posture on scapula position in primary school teachers. Al Ameen J Med Sci. 2020;13(1):25-30.
19. Lau KT, Cheung KY, Chan MH et al. Relationships between sagittal postures of thoracic and cervical spine, presence of neck pain, neck pain severity and disability. Manual therapy. 2010 Oct 1;15(5):457-62.
20. Chu EC, Lo FS, Bhaumik A. Plausible impact of forward head posture on upper cervical spine stability. Journal of family medicine and primary care. 2020 May;9(5):2517.
21. Selvaganapathy K, Rajappan R, Dee TH. The effect of smartphone addiction on craniovertebral angle and depression status among university students. International Journal of Intagrative Medical Sciences. 2017;4(5):537-42

How to cite this article: Hiral Jathania, Aishwarya Akash. Evaluation of head posture, deep cervical flexor muscle performance and disability in electricians with mechanical neck pain. *Int J Health Sci Res.* 2023; 13(6):46-55. DOI: *https://doi.org/10.52403/ijhsr.20230610*

******