International Journal of Yoga, Physiotherapy and Physical Education
www.sportsjournal.in
ISSN: 2456-5067
Received: 09-08-2026, Accepted: 08-09-2026, Published: 23-09-2026
Volume 11, Issue 3, 2026, Page No. 144-147

Correlation of craniovertebral angle with hand grip strength in bank workers with Neck pain

Dr. Gauri Sharad Suryavanshi, Dr. Vaishali Ingole, Dr Pawan Kumar
Department of Physiotherapy, Lokmanya Tilak College of Physiotherapy, Mumbai, India
Corresponding Author: Dr Pawan Kumar
DOI: https://doi.org/10.66856/ijyppe.2026.11.3.11082

Abstract
Background: Bank workers are frequently exposed to prolonged computer use, sustained sitting, repetitive upper-limb activity and static working postures, which may contribute to neck pain and postural changes. Craniovertebral angle (CVA) is an objective measure of head and neck alignment, while hand grip strength (HGS) reflects upper-limb muscular performance.
Objective: To find the correlation between craniovertebral angle and hand grip strength in bank workers with neck pain.
Methodology: An observational study was conducted in Navi Mumbai using a sample of 100 bank workers. Participants were selected using random sampling. Neck pain/disability was screened using the Neck Disability Index (NDI). CVA was measured using Kinovea software and HGS was measured using a digital hand-held dynamometer. Three trials were recorded. Descriptive statistics, the Shapiro–Wilk test and Spearman's rank-order correlation were used for analysis.
Results: The mean age was 33.12 ± 4.86 years. Fifty-six participants (56%) were male and 44 (44%) were female. Eighty-nine participants (89%) were right-hand dominant and 11 (11%) were left-hand dominant. Mean CVA was 48.96 ± 3.22°. Mean dominant-hand HGS was 28.98 ± 4.96 kg and mean non-dominant-hand HGS was 24.30 ± 4.63 kg. CVA showed a very weak negative correlation with dominant-hand HGS ($\rho = -0.110$, $p = 0.277$) and non-dominant-hand HGS ($\rho = -0.067$, $p = 0.505$). Neither correlation was statistically significant.
Conclusion: The present study did not demonstrate a statistically significant correlation between CVA and hand grip strength in bank workers with neck pain. The null hypothesis was therefore not rejected.

Keywords: Craniovertebral angle, hand grip strength, bank workers, neck pain, Kinovea, Neck Disability Index

Introduction

The rising incidence of work-related musculoskeletal disorders (WMSDs), particularly among banking personnel, has been strongly associated with increasing reliance on computers. Extended computer usage and inadequate ergonomic setups can lead to neck discomfort. Many office employees spend prolonged periods at computers while maintaining static, unsupported positions that may contribute to musculoskeletal pain.

Forward Head Posture (FHP), characterized by a forward positioning of the head relative to the torso, is one of the common postural issues among individuals who use computers. Kinovea software provides an affordable method for evaluation and allows measurement of the Craniovertebral Angle (CVA), a recognized measure of postural alignment.

Hand grip strength (HGS) is an important measure of upper-limb function, general health and muscle fitness. Studies cited in the source material indicate that individuals with FHP or neck discomfort may demonstrate lower HGS, potentially related to altered muscle activation patterns and neuromuscular inhibition associated with cervical dysfunction.

Bank employees are among occupational groups susceptible to neck-related musculoskeletal problems because of prolonged sitting, frequent computer use and poor workstation ergonomics. Despite this exposure, relatively few studies have specifically examined the relationship between CVA and HGS in bank workers experiencing neck pain.

Understanding the relationship between postural abnormalities and muscular performance may help guide ergonomic and rehabilitative interventions. Evaluating CVA and HGS together may provide information about postural and upper-limb function in sedentary professionals.

Methodology

This study adopted an observational study design and was conducted in Navi Mumbai. A random sampling method was used to recruit participants. A total sample of 100 bank workers with neck pain was selected for the study.

Participants aged between 25 and 40 years, of either gender, who were working on computers for more than or equal to 7–8 hours per day, had work experience of more than 5 years, and reported a Neck Disability Index (NDI) score of 5 or more were included in the study. Participants with a pre-diagnosed neurological condition such as carpal tunnel syndrome or cervical radiculopathy, recent surgery of the upper limb or spine, a pre-diagnosed cardiopulmonary condition, or a history of head injury were excluded from the study

Ethical approval was obtained from the Institutional Ethics Committee prior to commencement of data collection. Permission was obtained from the concerned bank branch manager. Prior to participation, the purpose and procedure of the study were clearly explained to all participants, and written informed consent was obtained. Demographic details were collected using a structured assessment form. Neck pain and disability were assessed using the Neck Disability Index (NDI). Participants with an NDI score of 5 or more were included in the study. Craniovertebral angle was measured using Kinovea software, and hand grip strength was assessed using a digital hand-held dynamometer.

The craniovertebral angle was measured in the sagittal view using the tragus and C7 as anatomical landmarks. Hand grip strength was measured for both dominant and non-dominant hands using a digital hand-held dynamometer, and three trials were recorded for each hand. All collected data were recorded systematically and kept confidential. The collected data were subsequently used for statistical analysis. Descriptive statistics were used to summarize the study variables, and Spearman's rank-order correlation was used to determine the relationship between craniovertebral angle and hand grip strength. A significance level of $p < 0.05$ was considered statistically significant.

Statistical Analysis

Data from 100 bank workers with neck pain were entered, sorted and analyzed. Descriptive statistics were used to summarize demographic and study variables. Continuous variables included age, CVA, dominant-hand HGS and non-dominant-hand HGS. Categorical variables included sex and hand dominance.

The Shapiro–Wilk test was used to assess distribution. CVA and dominant-hand HGS were not normally distributed, whereas non-dominant-hand HGS was normally distributed. Spearman's rank-order correlation was therefore used to assess the relationship between CVA and HGS. A significance level of $p < 0.05$ was adopted with a 95% confidence level.

Data Anaylsis and Results

Data from 100 bank workers with neck pain were entered, sorted and analyzed. Descriptive statistics were used to summarize demographic and study variables. Continuous variables included age, CVA, dominant-hand HGS and non-dominant-hand HGS. Categorical variables included sex and hand dominance.

The Shapiro–Wilk test was used to assess distribution. CVA and dominant-hand HGS were not normally distributed, whereas non-dominant-hand HGS was normally distributed. Spearman's rank-order correlation was therefore used to assess the relationship between CVA and HGS. A significance level of $p < 0.05$ was adopted with a 95% confidence level.

Results

The study included 100 bank workers with neck pain. The mean age was 33.12 ± 4.86 years. Fifty-six participants (56%) were male and 44 (44%) were female. Eighty-nine participants (89%) were right-hand dominant and 11 (11%) were left-hand dominant.

The mean CVA was 48.96 ± 3.22°, with a median of 49.00° and a range of 40–58°. Mean dominant-hand HGS was 28.98 ± 4.96 kg and mean non-dominant-hand HGS was 24.30 ± 4.63 kg.

Table 1: Demographic Characteristics

Characteristic	Result
Total participants	100
Age, mean ± SD	33.12 ± 4.86 years
Male	56 (56%)
Female	44 (44%)
Right-hand dominant	89 (89%)
Left-hand dominant	11 (11%)

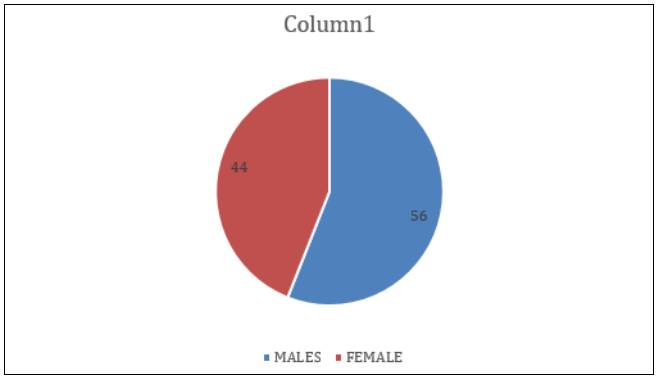

Fig 1: Sex distribution

Interpretation: The bar graph shows that 56% of participants were male and 44% were female. Males constituted a slightly larger proportion of the study population than females.

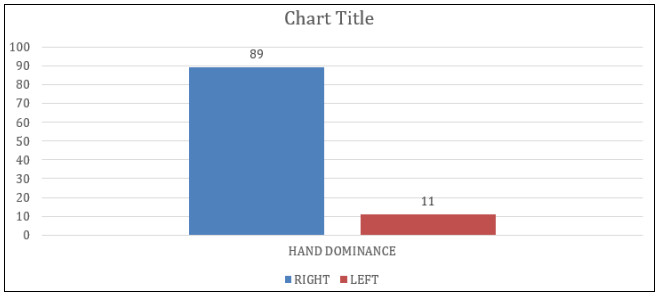

Fig 2: Hand Dominance

Interpretation: The graph demonstrates that 89% of participants were right-hand dominant, whereas 11% were left-hand dominant. Therefore, right-hand dominance was considerably more common in the study population.

Table 2: Descriptive Statistics of Study Variables

Variable	N	Mean ± SD	Median	IQR	Minimum	Maximum
CVA (°)	100	48.96 ± 3.22	49.00	47.00–50.25	40	58
Dominant HGS (kg)	100	28.98 ± 4.96	28.62	26.12–31.62	18.57	40.30
Non-dominant HGS (kg)	100	24.30 ± 4.63	24.75	19.83–27.96	13.73	38.53

Table 3: Normality Test

Variable	N	Shapiro–Wilk W	p-value	Interpretation
CVA	100	0.965	0.009	Non-normal
Dominant HGS	100	0.970	0.021	Non-normal
Non-dominant HGS	100	0.976	0.060	Normal

The Shapiro–Wilk test showed that CVA and dominant-hand HGS were not normally distributed because their p-values were less than 0.05. Non-dominant-hand HGS demonstrated a normal distribution because $p = 0.060$. Spearman's rank-order correlation was selected to assess the relationship between CVA and HGS.

Table 4: Correlation between Craniovertebral Angle and Hand Grip Strength

Variables	Spearman's ρ	p-value	Interpretation
CVA vs dominant HGS	−0.110	0.277	Very weak negative correlation; not significant
CVA vs non-dominant HGS	−0.067	0.505	Very weak negative correlation; not significant

There was a very weak negative correlation between CVA and dominant-hand HGS (ρ = −0.110, p = 0.277). Similarly, a very weak negative correlation was observed between CVA and non-dominant-hand HGS (ρ = −0.067, p = 0.505). Since both p-values were greater than 0.05, there was no statistically significant relationship between CVA and HGS in either hand. Therefore, the null hypothesis was not rejected.

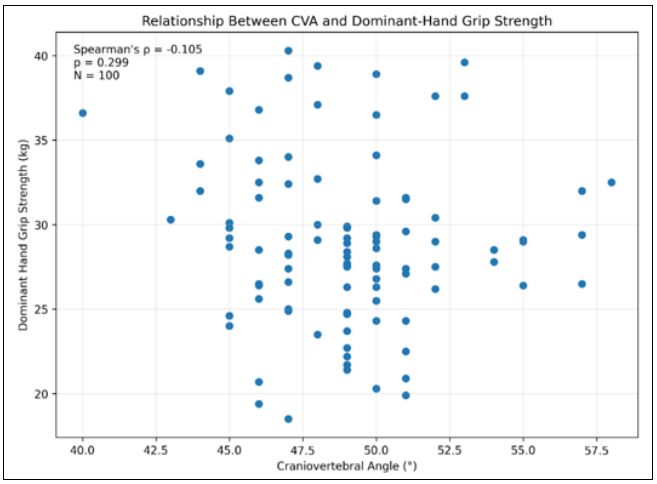

Fig 3: CVA VS Dominant HGS Scatter Plot

Interpretation: The scatter plot demonstrates a very weak negative relationship between CVA and dominant-hand HGS. The Spearman correlation coefficient was ρ = −0.110, with p = 0.277. This indicates that there was no statistically significant association between craniovertebral angle and dominant-hand grip strength.

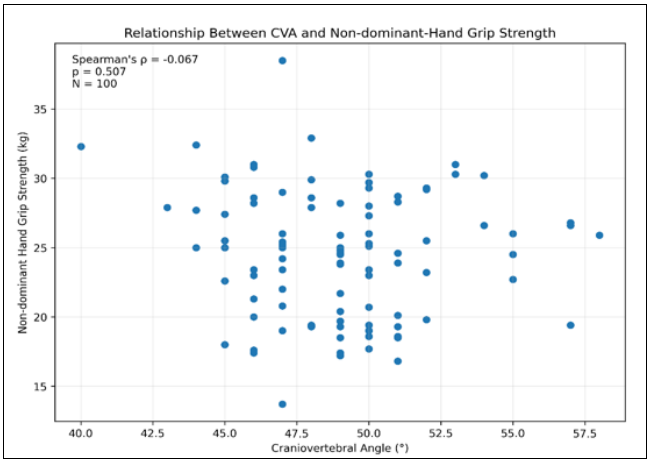

Fig 4: CVA VS Non Dominant Hgs Scatter Plot

Interpretation: The scatter plot demonstrates a very weak negative relationship between CVA and non-dominant-hand HGS. The Spearman correlation coefficient was ρ = −0.067, with p = 0.505. This relationship was not statistically significant, indicating that CVA was not significantly associated with non-dominant-hand grip strength.

Discussion

This observational study examined the correlation between craniovertebral angle and hand grip strength among bank workers with neck pain. The study included 100 participants with a mean age of 33.12 ± 4.86 years; 56% were male and 44% were female. Right-hand dominance was present in 89% of participants.

The mean CVA was 48.96 ± 3.22°. CVA provides an objective measure of sagittal head and neck alignment and is commonly used to quantify forward head positioning. In the present study, CVA was measured using Kinovea software by identifying the tragus and C7 landmarks in the sagittal plane. The source synopsis cites previous evidence supporting the validity and reliability of Kinovea for angular and distance measurements.

Mean dominant-hand HGS was 28.98 ± 4.96 kg, while mean non-dominant-hand HGS was 24.30 ± 4.63 kg. The greater grip strength of the dominant hand may be related to habitual use and functional demands. HGS can also vary according to age, sex, hand dominance and general muscular conditioning.

The Shapiro–Wilk test showed that CVA and dominant-hand HGS were not normally distributed, while non-dominant-hand HGS was normally distributed. Spearman's correlation demonstrated very weak negative relationships between CVA and dominant-hand HGS and between CVA and non-dominant-hand HGS. Neither relationship was statistically significant.

The present findings differ from the parent study by Macwan and Radadiya, which investigated CVA, neck pain and HGS among computer users and proposed a possible relationship between altered craniovertebral posture and reduced HGS. Mosaad *et al.* reported an association between forward head and rounded shoulder posture and reduced HGS in asymptomatic young adults. The present study assessed CVA alone, whereas combined postural factors may have different relationships with grip strength.

The very weak correlations observed may also reflect the multifactorial nature of HGS. Grip strength can be influenced by hand dominance, age, sex, physical activity and general muscular conditioning. CVA alone does not provide information about thoracic kyphosis, rounded shoulders, scapular position or cervical muscle endurance. These additional factors may influence upper-limb function.

Overall, the present study did not demonstrate a statistically significant correlation between CVA and HGS in bank workers with neck pain. The findings suggest that CVA and HGS should not be interpreted as directly associated based on the present data alone.

Limitations

- The study had a cross-sectional observational design, so cause-and-effect relationships could not be established.
- The study included only 100 bank workers with neck pain, which may limit generalization to other populations.

- Factors such as ergonomics, physical activity, shoulder posture and thoracic posture were not assessed.
- Cervical muscle strength/endurance was not evaluated.
- The study was conducted in a specific setting in Navi Mumbai, limiting wider applicability.
- Measurement-related variability in CVA and hand grip strength cannot be completely excluded.

Conclusion

The present study evaluated the correlation between craniovertebral angle and hand grip strength in 100 bank workers with neck pain. Mean CVA was 48.96 ± 3.22°, mean dominant-hand HGS was 28.98 ± 4.96 kg, and mean non-dominant-hand HGS was 24.30 ± 4.63 kg.

A very weak negative correlation was found between CVA and dominant-hand HGS ($\rho = -0.110$, $p = 0.277$) and between CVA and non-dominant-hand HGS ($\rho = -0.067$, $p = 0.505$). Both correlations were statistically non-significant.

Therefore, the present study concludes that there was no statistically significant correlation between craniovertebral angle and hand grip strength in bank workers with neck pain. The null hypothesis was not rejected. Further studies with larger samples and additional factors such as ergonomic exposure, shoulder and thoracic posture, physical activity and cervical muscle performance are recommended.

References

1. Macwan NS, Radadiya T. Association of Craniovertebral Angle with Neck Pain and Hand Grip Strength in Individuals Working on Computers: An Observational Study Protocol. Scope,2023:13(4):1532-40.
2. Mosaad DM, Abdel-Aziem AA, Mohamed GI, Abd-Elaty EA, Mohammed KS. Effect of forward head and rounded shoulder posture on hand grip strength in asymptomatic young adults: a cross-sectional study. Bulletin of Faculty of Physical Therapy,2020:25(1):1-8.
3. Singh S, Kaushal K, Jasrotia S. Prevalence of forward head posture and its impact on the activity of daily living among students of Adesh University–A cross-sectional study. Adesh University Journal of Medical Sciences & Research,2020:2(2):99-102.
4. Wollesen B, Gräf J, Schumacher N, Meyer G, Wanstrath M, Feldhaus C, et al. Influences of neck and/or wrist pain on hand grip strength of industrial quality proofing workers. Safety and Health at Work,2020:11(4):458-65.
5. Marzban H, Rezaei E, Shahmahmoudi F, Zangiabadi Z, Sahebi A, Makki F. Musculoskeletal disorders among bank workers: a systematic review and meta-analysis. BMC Musculoskeletal Disorders,2024:25(1):951.
6. Mani P, Sethupathy K, Francis AK. Test-retest reliability of electronic hand dynamometer in healthy adults. Int J Adv Res.,2019:7(5):325-1.
7. Subbarayalu AV, Ameer MA. Relationships among head posture, pain intensity, disability and deep cervical flexor muscle performance in subjects with postural neck pain. J Taibah Univ Med Sci,2017:12(6):541-7.
8. Singla D, Veqar Z. Association between forward head, rounded shoulders, and increased thoracic kyphosis: a review of the literature. Journal of Chiropractic Medicine,2017:16(3):220-9.
9. Smith L, Hamer M, Ucci M, Marmot A, Gardner B, Sawyer A, et al. Weekday and weekend patterns of objectively measured sitting, standing, and stepping in a sample of office-based workers: the active buildings study. BMC Public Health,2015:15(1):9.
10. Vijay SA. Work-related musculoskeletal health disorders among the information technology professionals in India: A prevalence study. Int J Mgmt Res Bus Strat.,2013:2(2):118-28.
11. Bohannon RW. Hand-grip dynamometry predicts future outcomes in aging adults. J Geriatr Phys Ther.,2008:31(1):3-10.
12. Bhanderi DJ, Choudhary SK, Parmar SA. A study of occurrence of musculoskeletal discomfort in computer operators. Indian J Community Med.,2008:33(1):65-6.
13. Janwantanakul P, Pensri P, Jiamjarasrangsri V, Sinsongsook T. Prevalence of self-reported musculoskeletal symptoms among office workers. Occupational Medicine,2008:58(6):436-8.
14. Cagnie B, Danneels L, Van Tiggelen D, De Loose V, Cambier D. Individual and work-related risk factors for neck pain among office workers: a cross-sectional study. Eur Spine J.,2007:16(5):679-86.
15. Zárate-Tejero CA, Rodríguez-Rubio PR, Brandt L, Krauss J, Hernández-Secorún M, Hidalgo-García C, et al. Measuring Craniovertebral Angle Reference Values in Adults Using Kinovea Software. Applied Sciences,2024:14(19):8639.
16. Arshad MU, Zia W, Jamshaid G, Khan B, Hassan J, Akram A. Prevalence of Neck Pain related to working hours among Bankers: A cross-sectional Study. PBMJ,2021:4(2):229-32.
17. Puig-Diví A, Escalona-Marfil C, Padullés J, Busquets Faciaben A, Padullés X, Marcos-Ruiz D. Validity and reliability of the Kinovea program in obtaining angles and distances using coordinates in 4 perspectives. PLOS ONE,2019:14:e0216448.
18. K PR, Pinto RF. Exploring the relationship between craniovertebral angle, hand grip strength and handwriting performance in students. Int J Res Med Sci.,2025:13(11):4785-9.