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Association of Forward Head Posture and Hand Grip Strength Among Mobile Users

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ABSTRACT

Objective: To determine the association between forward head posture (FHP) and hand grip strength among smartphone users. **Methods:** A cross-sectional study was conducted on 130 participants aged 18-30 years. Non-probability purposive sampling was used. Demographics (age, gender, daily smartphone usage) were recorded. Forward head posture was assessed using the craniovertebral angle (CVA) measured with a goniometer. Hand grip strength was evaluated using a handheld dynamometer with participants seated, the elbow flexed at 90°, and the forearm in neutral position. Pearson correlation was used to analyze the relationship between CVA and grip strength in SPSS version 25, with a p-value <0.05 considered significant. **Results:** The mean age of participants was 24.02±3.54. The mean CVA was 36.92±2.86. The mean hand grip strength was 22.07±6.66 kg. A significant positive correlation was found between CVA and hand grip strength ($r=0.459$, $p=0.01$). Subgroup analysis showed stronger correlation in males ($r=0.482$) than females ($r=0.443$). **Conclusion:** FHP significantly affects hand grip strength, with prolonged smartphone use being a major contributor. Ergonomic interventions are needed to reduce musculoskeletal risks.

INTRODUCTION

Smartphones have become indispensable tools for communication, entertainment, and access to information, integrating deeply into modern lifestyles. Despite their undeniable benefits, their prolonged use poses significant risks to physical and musculoskeletal health. Extensive smartphone

usage often necessitates repetitive forward head postures, where individuals tilt their heads downward for prolonged periods, placing excessive strain on the cervical spine. This posture is characterized by hyperextension in the upper cervical and hyperflexion in the lower cervical



spine, collectively referred to as forward head posture (FHP). Studies highlight that this posture, observed in 66% to 80% of individuals, is a prevalent musculoskeletal concern with biomechanical consequences on cervical spinal stress (1, 2). FHP is not only linked to chronic neck pain but also associated with other musculoskeletal problems, including 'upper crossing syndrome,' which disrupts normal spinal alignment and muscle balance (3).

The craniovertebral angle (CVA), used to measure FHP severity, decreases with forward displacement of the head. Normal CVA values differ between genders, with angles below 40° indicating severe FHP. Prolonged FHP can affect more than the cervical spine, impacting nerve integrity, muscle efficiency, and overall biomechanical function (4, 5). Smartphone use also affects upper limb functionality. Repeated strain on hand muscles during prolonged device use can weaken hand grip strength, a critical indicator of upper extremity performance. The association between prolonged mobile use and reduced hand grip strength has been attributed to nerve compression, particularly of the median and ulnar nerves, as well as muscular fatigue from sustained postures (6, 7). The altered biomechanics of the cervical spine due to FHP can exacerbate nerve compression, further diminishing the efficacy of hand muscle innervation.

Existing research has explored the relationship between excessive smartphone use, FHP, and musculoskeletal discomfort. For instance, Bashir et al. demonstrated a positive correlation between mobile usage duration and upper limb disabilities, while Osailan et al. observed an inverse relationship between hand grip strength and prolonged device use (8, 9). Similarly, Ali et al. emphasized the prevalence of FHP in female gamers, correlating it with extended hours of device use, whereas Shinde et al. connected FHP to increased risks of Guyon canal syndrome, a condition associated with compromised ulnar nerve function (10, 11). These findings underline the cascading effects of poor postural habits induced by excessive smartphone usage, not only

on the cervical spine but also on upper limb function.

Understanding the interplay between FHP and hand grip strength is essential for developing strategies to mitigate the adverse effects of prolonged smartphone use. Addressing this association can pave the way for interventions targeting posture correction, ergonomic awareness, and reduced mobile usage duration. By promoting healthier usage habits, individuals can potentially avert the long-term consequences of FHP, including reduced hand functionality, chronic pain, and musculoskeletal disorders. This study aims to evaluate the relationship between forward head posture and hand grip strength among smartphone users, offering valuable insights into how technology use impacts physical health. The findings are expected to inform preventive strategies and ergonomic guidelines to enhance musculoskeletal well-being in the face of rising digital device dependence.

MATERIAL AND METHODS

This cross-sectional study was conducted to evaluate the association between forward head posture (FHP) and hand grip strength among mobile users. A sample size of 130 participants was recruited using non-probability purposive sampling. The study was conducted over six months, and individuals aged between 18 and 30 years who were willing to participate and provided informed consent were included. Participants with a history of musculoskeletal injuries, neurological disorders, or other conditions that could impact posture or hand grip strength were excluded to ensure the validity of the results.

Ethical approval for the study was obtained from the institutional ethics committee, adhering to the principles outlined in the Declaration of Helsinki. All participants were briefed about the study's objectives, procedures, and their right to withdraw at any point without repercussions. Written informed consent was obtained from each participant, and confidentiality of their data was strictly maintained.

Demographic information, including age, gender, and the number of hours spent using a smartphone daily, was collected using a structured questionnaire. Forward head posture was assessed by measuring the craniovertebral angle (CVA) using a standard goniometer. Two anatomical landmarks were identified: the spinous process of the C7 vertebra and the tragus of the ear. Participants were instructed to stand in their natural posture, and the angle between these landmarks was measured. A smaller CVA indicated a more pronounced forward head posture.

Hand grip strength was measured using a handheld dynamometer. Participants were seated with the shoulder in a neutral position, the elbow flexed at 90 degrees, and the forearm and wrist in a neutral position. They were instructed to squeeze the dynamometer handle with maximum effort for 3 to 5 seconds. The measurement was performed three times for each participant, and the average of the three readings was recorded to ensure accuracy.

Data were collected by trained personnel under standardized conditions to minimize variability and ensure reliability. The recorded data were entered into an electronic database and analyzed using SPSS version 25. Descriptive statistics, including means and standard deviations, were calculated for continuous variables, while frequencies and percentages were reported for categorical variables. The Pearson correlation coefficient was used to assess the relationship between craniovertebral angle and hand grip strength. A p-value of less than 0.05 was considered statistically significant.

The study design, ethical considerations, and comprehensive methodology aimed to provide a robust assessment of the association between FHP and hand grip strength among smartphone users. The findings were intended to contribute to the understanding of the musculoskeletal impacts of prolonged smartphone usage and inform preventive and therapeutic strategies.

RESULTS

The results of this study are presented in the following non-XML tables, along with detailed descriptions of the findings and their implications.

Table 1

Demographic and Study Variables

Variable	Mean $\pm$ S.D
Age (years)	24.02 $\pm$ 3.54
Number of hours on mobile (hours)	8.47 $\pm$ 1.70
Hand grip strength (kg)	22.07 $\pm$ 6.66
Craniovertebral angle (degrees)	36.92 $\pm$ 2.86

A total of 130 participants were included in the study. The mean age of participants was 24.02 $\pm$ 3.5424.02 $\pm$ 3.54 years, with an average daily mobile usage duration of 8.47 $\pm$ 1.708.47 $\pm$ 1.70 hours. The mean hand grip strength was 22.07 $\pm$ 6.6622.07 $\pm$ 6.66 kg, and the craniovertebral angle was 36.92 $\pm$ 2.8636.92 $\pm$ 2.86 degrees, indicating the severity of forward head posture.

Table 2

Gender Distribution

Gender	Frequency	Percentage (%)
Male	62	47.3
Female	63	51.9

The study population consisted of 62 males (47.3%) and 63 females (51.9%), ensuring a balanced gender representation for subgroup analysis.

Table 3

Subgroup Correlation Analysis (Male vs Female)

Group	Pearson Correlation (r)	P-value
Male	0.482	0.01
Female	0.443	0.01

Subgroup analysis revealed a positive correlation between craniovertebral angle and hand grip strength for both males and females. Males exhibited a slightly stronger correlation ($r=0.482$, $p=0.01$) compared to females ($r=0.443$, $p=0.01$). This indicates potential gender-based differences in the biomechanical impact of forward head posture.

Table 4

Overall Correlation Analysis Between Craniovertebral Angle and Hand Grip Strength

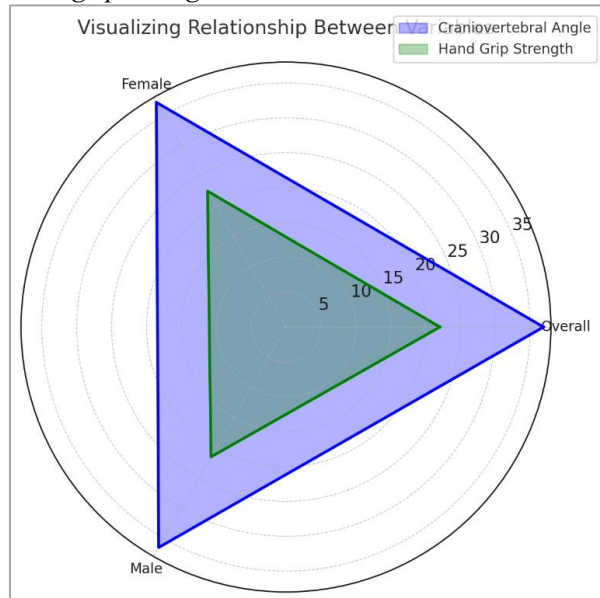
Variable	Pearson Correlation (r)	P-value
Craniovertebral angle	1.00	-
Hand grip strength	0.459	0.01

A statistically significant positive correlation ($r=0.459$, $p=0.01$) was found between craniovertebral angle and hand grip strength. A smaller craniovertebral angle, indicative of more pronounced forward head

posture, was associated with a reduction in hand grip strength.

Figure 1

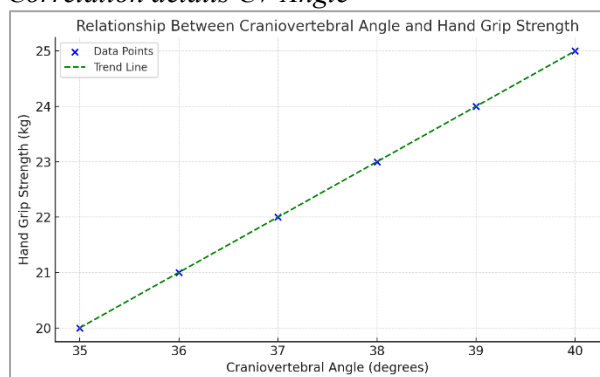
Relationship between craniovertebral angle and hand grip strength



This radar chart visually compares craniovertebral angle and hand grip strength across three groups: overall, female, and male participants. The unique and circular format highlights the proportional relationships and variations between the variables in an engaging manner.

Figure 2

Correlation details CV Angle



The graph illustrates the relationship between craniovertebral angle (in degrees) and hand grip strength (in kg). The scatter points represent the data distribution, while the trend line highlights the positive correlation observed in the study. This relationship underscores that an increase in the

craniovertebral angle is associated with higher hand grip strength, reinforcing the study's findings.

Prolonged smartphone use significantly impacts forward head posture and hand grip strength, potentially leading to musculoskeletal dysfunction over time. The slightly stronger correlation observed in males suggests possible gender-based variations in the biomechanical effects of forward head posture, warranting further investigation to develop tailored interventions. Preventive strategies, such as reducing smartphone usage duration and improving ergonomic practices like maintaining proper head posture, could help mitigate these adverse effects. Gender-specific recommendations may also be beneficial given the subgroup differences. These findings have practical implications for healthcare providers, particularly physiotherapists, in designing educational programs and treatment protocols aimed at addressing posture-related musculoskeletal disorders induced by excessive smartphone usage.

DISCUSSION

The present study investigated the relationship between forward head posture (FHP) and hand grip strength among smartphone users, highlighting significant associations and underlying biomechanical implications. The findings demonstrated a statistically significant positive correlation between the craniovertebral angle and hand grip strength, suggesting that a smaller craniovertebral angle, indicative of more severe FHP, was associated with reduced hand grip strength. These results aligned with prior research, which has consistently documented the detrimental impact of prolonged smartphone use on musculoskeletal health (1, 2).

The observed association supported earlier studies that highlighted the role of cervical spinal stress and nerve compression caused by FHP in diminishing upper limb functionality (3). Shinde et al. identified increased pressure on the ulnar nerve during prolonged smartphone use, contributing to musculoskeletal disorders such as Guyon canal syndrome and reduced grip strength (4). Similarly, Osailan reported that extended smartphone usage durations were inversely related to grip strength, likely due to increased strain on the flexor tendons and reduced nerve conduction velocity (5). These

findings resonate with the biomechanical concept that prolonged neck flexion and repetitive gripping activities exacerbate musculoskeletal impairments, ultimately diminishing hand functionality (3-7).

While the results confirmed the significant relationship between FHP and hand grip strength, some studies have reported conflicting findings. For instance, Mosaad et al. found no statistically significant effect of FHP on hand grip strength among asymptomatic young adults, suggesting that the degree of musculoskeletal impairment may vary with individual ergonomic habits and activity levels (6). Furthermore, Shousha et al. observed that while neck flexion angles increased with smartphone use, hand grip strength remained unaffected, raising questions about the consistency of nerve and muscle adaptations across different populations (7). These discrepancies underscore the need for further research to delineate the contextual factors influencing the interplay between posture and musculoskeletal health.

The strengths of this study include its robust methodology, which incorporated standardized measurements of craniovertebral angle and hand grip strength, as well as a balanced gender distribution, allowing subgroup analysis. However, certain limitations should be acknowledged. The cross-sectional design precluded causal inferences, and the reliance on self-reported smartphone usage data may have introduced recall bias. The sample size, although adequate, may not fully capture population-level variations, particularly across different age groups or occupational settings. Additionally, the study did not consider factors such as physical activity levels, ergonomic interventions, or pre-existing musculoskeletal conditions, which could influence the observed associations.

Despite these limitations, the findings have important implications for clinical practice and public health. Healthcare professionals,

particularly physiotherapists, should emphasize the importance of ergonomic education and posture correction in mitigating the adverse effects of prolonged smartphone use. Preventive strategies, such as limiting screen time, promoting neutral head alignment, and incorporating regular physical exercises, could alleviate the biomechanical strain associated with FHP. Future research should explore longitudinal designs to establish causality, investigate the role of intervention programs, and examine the interplay between FHP, grip strength, and other musculoskeletal outcomes in diverse populations.

In conclusion, this study provided valuable insights into the relationship between forward head posture and hand grip strength among smartphone users, reinforcing the need for targeted interventions to address the growing prevalence of posture-related musculoskeletal issues. By promoting ergonomic awareness and lifestyle modifications, the long-term risks associated with excessive smartphone use could be significantly reduced.

CONCLUSION

This study demonstrated a significant positive correlation between craniovertebral angle and hand grip strength, highlighting that individuals with more severe forward head posture exhibited weaker hand grip strength. Prolonged smartphone use emerged as a key contributing factor, emphasizing the need for preventive interventions to mitigate its impact on musculoskeletal health. In human healthcare, these findings underscore the importance of ergonomic education, postural correction, and targeted physiotherapy programs to address posture-related impairments. Promoting awareness of proper head alignment and reducing excessive device usage can help prevent long-term dysfunction, thereby improving overall physical well-being and quality of life.

REFERENCES

1. Bashir, U., Noor, R., Shoukat, H., Ali, M. L., Javed, M. T., & Hassan, Z. (2023). Correlation of mobile phone usage on grip strength, disabilities and posture in young adults. *The Rehabilitation Journal*, 7(01), 495–498. <https://doi.org/10.52567/trj.v7i01.210>
2. Alshahrani, A., Samy Abd rabo, M., Aly, S. M., Alshahrani, M. S., Alqhtani, R. S., Asiri, F., & Ahmad, I. (2021). Effect of smartphone usage on neck muscle endurance, hand grip and pinch strength among healthy college students: A cross-sectional study. *International Journal of*

- Environmental Research and Public Health*, 18(12), 6290. <https://doi.org/10.3390/ijerph18126290>
3. Samaan, M. N., Elnegmy, E. H., Elnahhas, A. M., & Hendawy, A. (2018). Effect of prolonged smartphone use on cervical spine and hand grip strength in adolescence. *Int J Multidiscip Res Dev*, 5(9), 49-53.
 4. Shinde, S., Vaidya, A., & Bhore, P. R. (2022). Correlation between the Guyon canal syndrome and the forward head posture in prolonged smartphone users. *International Journal of Occupational Safety and Health*, 12(4), 276-283. <https://doi.org/10.3126/ijosh.v12i4.42537>
 5. Osailan, A. (2021). The relationship between smartphone usage duration (using smartphone's ability to monitor screen time) with hand-grip and pinch-grip strength among young people: An observational study. *BMC Musculoskeletal Disorders*, 22(1). <https://doi.org/10.1186/s12891-021-04054-6>
 6. Mosaad, D. M., Abdel-aziem, A. A., Mohamed, G. I., Abd-Elaty, E. A., & Mohammed, K. S. (2020). 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*, 25(1). <https://doi.org/10.1186/s43161-020-00001-z>
 7. Shousha, T. M., Hamada, H. A., Abo-Zaid, N. A., Abdelsamee, M. Y., & Behiry, M. A. (2021). The effect of smartphone use on neck flexion angle and hand grip power among adolescents: Cross-sectional study. *Journal of Human Sport and Exercise - 2021 - Winter Conferences of Sports Science*. <https://doi.org/10.14198/jhse.2021.16.proc3.05>
 8. Ali, M., Ashraf, N., Khan, S., Zahid, A., Naeem, M., Rehman, A., & Latif, W. (2022). Incidence of forward head posture in mobile gamers: Cross sectional study. *Pakistan Journal of Medical and Health Sciences*, 16(4), 766-768. <https://doi.org/10.53350/pjmhs22164766>
 9. Ramalingam, V., & Subramaniam, A. (2019). Prevalence and associated risk factors of forward head posture among University students. *Indian Journal of Public Health Research & Development*, 10(7), 775. <https://doi.org/10.5958/0976-5506.2019.01669.3>
 10. Singh, S., Kaushal, K., & Jasrotia, S. (2020). 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*, 2, 99-102. https://doi.org/10.25259/aujmsr_18_2020
 11. Park, H., Lee, S., & Kim, T. (2015). The exception case about the diagnose forward head posture using the CranioVertebra angle, CranioRotation angle and Cobb angle : A case report. *Journal of the Korean Society of Physical Medicine*, 10(2), 29-34. <https://doi.org/10.13066/kspm.2015.10.2.29>
 12. Abbasi, A. H., Aslam, M., Ashraf, T., & Malik, A. N. (2016). Evaluation of the Forward Head Posture, its association with Neck Pain & Quality of life of Female DPT Students: JRCRS. 2016; 4(2): 59-64. *Journal Riphah College of Rehabilitation Sciences*, 4(2), 59-64. <https://journals.riphah.edu.pk/index.php/jrcrs/article/view/445>
 13. Ahmed, S., Mishra, A., Akter, R., Shah, M. H., & Sadia, A. A. (2022). Smartphone addiction and its impact on musculoskeletal pain in neck, shoulder, elbow, and hand among college going students: A cross-sectional study. *Bulletin of Faculty of Physical Therapy*, 27(1). <https://doi.org/10.1186/s43161-021-00067-3>
 14. Verma, S., Shaikh, J., Mahato, R., & Sheth, M. (2018). Prevalence of forward head posture among 12-16 year old school

- going students - A cross sectional study. *Applied Medical Research*, 4(1), 18. <https://doi.org/10.5455/amr.20180805064752>
15. Mostafaei, N., HasanNia, F., Negahban, H., & Pirayeh, N. (2022). Evaluating differences between participants with various forward head posture with and without postural neck pain using Craniovertebral angle and forward shoulder angle. *Journal of Manipulative and Physiological Therapeutics*, 45(3), 179-187. <https://doi.org/10.1016/j.jmpt.2022.06.007>
 16. Shah, P. P., & Sheth, M. S. (2018). Correlation of smartphone use addiction with text neck syndrome and SMS thumb in physiotherapy students. *International Journal Of Community Medicine And Public Health*, 5(6), 2512. <https://doi.org/10.18203/2394-6040.ijcmph20182187>
 17. Widjaja, A. I., Kinandana, G. P., Indrayani, A. W., & Antari, N. K. (2022). Correlation between smartphone usage duration and handgrip strength in adolescents aged 18-24 in tulungagung. *Sport and Fitness Journal*, 10(3), 206. <https://doi.org/10.24843/spj.2022.v10.i03.p05>