



E-ISSN: 2706-8927  
P-ISSN: 2706-8919  
[www.allstudyjournal.com](http://www.allstudyjournal.com)  
IJAAS 2025; 7(1): 176-179  
Received: 24-10-2024  
Accepted: 26-11-2024

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## The relationship between smartphone use duration and cervical dysfunction in university students

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**DOI:** <https://doi.org/10.33545/27068919.2025.v7.i1c.1344>

### Abstract

**Objective:** This study examines how prolonged mobile phone use affects neck posture, headache occurrence, and cervical range of motion in university students.

**Methods:** Neck posture was assessed using photographic analysis, headaches were recorded through self-reported surveys, and cervical range of motion was measured with a goniometer. Participants were categorized based on their daily mobile phone use, and statistical analyses were performed to explore relationships between mobile phone usage and the outcomes.

**Results:** revealed a significant correlation between extended mobile phone use and poor neck posture, increased headache prevalence, and reduced cervical range of motion.

The findings suggest that excessive mobile phone usage adversely affects musculoskeletal health, emphasizing the need for interventions to mitigate these issues. This research provides insights into the ultimate consequences of modern technology on physical well-being and underscores the importance of ergonomic practices.

**Keywords:** Neck posture, headache, and cervical range of motion

### Introductions

As mobile phones have become more widely used, worries regarding the long-term effects on the musculoskeletal system have grown. Students at universities, in particular, use mobile devices extensively for social and academic reasons. The purpose of this study is to investigate how long-term mobile phone use affects university students' neck posture, headaches, and CROM.

Long-term mobile phone use is usually associated with a static and frequently uncomfortable posture, which is typified by rounded shoulders and a forward head position. The condition known as "text neck," which is linked to migraines, neck pain, and decreased cervical range of motion, can result from this posture. Students' quality of life and academic performance may be impacted by musculoskeletal diseases, which can be exacerbated by prolonged bad posture and repetitive stress.

Numerous musculoskeletal complaints have been linked to cell phone use in earlier research. There is still a lack of knowledge, nevertheless, about the precise effects on neck posture, the frequency and intensity of headaches, and the degree of cervical range of motion restriction among college students. By methodically investigating the connection between extended mobile phone use and its effects on cervical range of motion, headache frequency and intensity, and neck posture in this population, this study seeks to close these gaps.

To reduce the negative health impacts linked to mobile phone use, it is essential to comprehend these interactions in order to establish ergonomic guidelines and effective interventions. This study aims to educate students, teachers, and medical professionals on the physical effects of prolonged mobile phone use and the significance of implementing healthier mobile phone usage practices in order to avoid musculoskeletal issues.

### Literature review

#### Neck Posture and Mobile Phone Use

Research indicates that prolonged mobile phone use often results in a forward head posture (FHP), which increases the load on the cervical spine and surrounding muscles. Studies by Kim *et al.* (2015)<sup>[7]</sup> and Gustafsson *et al.* (2018)<sup>[3]</sup> show a clear link between mobile phone use and FHP.

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### Headaches Associated with Mobile Phone Use

Headaches are a common complaint among individuals who use mobile phones for extended periods. A study by Shariat *et al.* (2017) [12] found a significant association between prolonged screen time and headache frequency.

### Cervical Range of Motion (CROM)

Reduced CROM is another concern associated with prolonged mobile phone use. Research by Xie *et al.* (2016) [14] indicates that prolonged flexion of the neck during mobile phone use can lead to stiffness and decreased range of motion.

### Neck Posture

**Forward Head Posture (FHP):** Several studies have highlighted the prevalence of Forward Head Posture (FHP) among university students who frequently use mobile phones. FHP is characterized by the anterior positioning of the cervical spine, where the head is held forward of the body's center of gravity. This posture is commonly observed in individuals using mobile phones for extended periods.

Kim and Kim (2015) [7] found that university students who spent more than 5 hours daily on their phones exhibited a significantly greater degree of FHP compared to those with less usage.

Namwongsa *et al.* (2018) [9] demonstrated a correlation between the duration of smartphone use and the severity of FHP, emphasizing that longer usage leads to more pronounced postural deviations.

### Headaches

**Text Neck Syndrome:** The term "text neck" has been coined to describe the neck pain and damage sustained from looking down at a mobile phone, tablet, or other wireless devices too frequently and for too long. This syndrome is closely associated with headaches, particularly tension-type headaches and cervicogenic headaches.

Berolo *et al.* (2011) [1] conducted a cross-sectional study which found that individuals with higher mobile phone usage reported more frequent and severe headaches.

Gustafsson *et al.* (2017) [3] also reported a significant association between prolonged mobile phone use and the incidence of headaches among university students, attributing this to the sustained flexion of the neck and the consequent muscle strain.

### Cervical Range of Motion (ROM)

**Reduction in Cervical ROM:** Prolonged mobile phone use has been linked to a decrease in cervical range of motion, which can impact daily activities and overall quality of life.

Gustafsson *et al.* (2018) [2] assessed cervical ROM in university students and found that those with higher mobile phone usage had significantly reduced cervical flexion, extension, and rotation.

Quek *et al.* (2017) [10] reported similar findings, noting that excessive smartphone use was associated with reduced cervical ROM, which could predispose individuals to chronic neck pain and musculoskeletal disorders.

### Mechanisms and Pathophysiology

**Muscle Imbalance and Strain:** The prolonged forward head posture and neck flexion during mobile phone use can lead to muscle imbalances and strain in the cervical and

upper thoracic regions.

Szeto *et al.* (2002) [13] highlighted that prolonged static postures could cause muscle fatigue and decreased blood flow, contributing to pain and dysfunction.

Hansraj (2014) [5] quantified the forces exerted on the cervical spine during varying degrees of neck flexion, illustrating that even slight forward head posture can significantly increase the load on cervical structures.

### Interventions and Recommendations

Postural Education and Ergonomics: Interventions focusing on postural education and ergonomic adjustments have been suggested to mitigate the negative effects of prolonged mobile phone use.

Sharan *et al.* (2014) [11] advocated for ergonomic training and posture correction exercises to reduce the incidence of musculoskeletal complaints in mobile phone users.

Hwangbo *et al.* (2016) [6] found that specific exercises aimed at strengthening the cervical and upper back muscles could improve posture and reduce pain in individuals with FHP.

### Conclusion

The literature consistently indicates that prolonged mobile phone use negatively impacts neck posture, increases the incidence of headaches, and reduces cervical range of motion in university students. These findings highlight the need for awareness and preventive measures, including ergonomic education and targeted exercises, to mitigate these adverse effects. Further research is warranted to explore the long-term consequences and effectiveness of various interventions in this population.

### Methodology

#### Participants

A total of 200 university students aged 18-25 participated in this study. Participants were selected through convenience sampling from various faculties.

#### Data Collection

Data were collected through a structured questionnaire and clinical assessments. The questionnaire included sections on demographic information, mobile phone usage patterns, and the frequency and intensity of headaches. Clinical assessments measured neck posture using a goniometer and CROM using a cervical range of motion device.

### Results

#### Neck Posture

The average forward head posture angle was 25.4 degrees (SD = 5.2) among participants. A significant positive correlation ( $r = 0.72$ ,  $p < 0.001$ ) was found between hours of mobile phone use per day and the degree of FHP.

#### Headaches

Seventy-five percent of participants reported experiencing headaches at least once a week. There was a significant correlation ( $r = 0.65$ ,  $p < 0.001$ ) between prolonged mobile phone use and headache frequency. Participants using mobile phones for more than 5 hours daily reported the highest headache frequency.

#### Cervical Range of Motion (CROM)

Participants exhibited an average reduction in CROM of 15% compared to normative values. A significant negative

correlation ( $r = -0.68, p < 0.001$ ) was found between mobile phone use duration and CROM.

**Neck Posture**

The average forward head posture angle was 25.4 degrees (SD = 5.2) among participants. A significant positive correlation ( $r = 0.72, p < 0.001$ ) was found between hours of mobile phone use per day and the degree of FHP. Table 1 summarizes the FHP angles across different levels of mobile phone use.

**Table 1:** FHP angles across different levels of mobile phone use.

Hours of Use	Average FHP Angle (°)	Standard Deviation (SD)
<3	20.1	3.4
3-5	24.8	4.1
>5	28.7	5.8

**Headaches**

Seventy-five percent of participants reported experiencing headaches at least once a week. There was a significant correlation ( $r = 0.65, p < 0.001$ ) between prolonged mobile phone use and headache frequency. Participants using mobile phones for more than 5 hours daily reported the highest headache frequency. Table 2 provides the frequency of headaches based on mobile phone use duration.

**Table 2:** Headaches based on mobile phone use duration

Hours of Use	Headache frequency weekly	VAS
<3	1.2	3.1
3-5	2.5	5.4
>5	4.1	6.8

**Cervical Range of Motion (CROM)**

Participants exhibited an average reduction in CROM of 15% compared to normative values. A significant negative correlation ( $r = -0.68, p < 0.001$ ) was found between mobile phone use duration and CROM. Table 3 presents the CROM measurements for different levels of mobile phone use.

**Table 3:** Different levels of mobile phone use

Hours of Use	Flexion (°)	Extension (°)	Lat. Flex (°)	Rotation (°)
<3	45	55	40	75
3-5	38	48	35	68
>5	30	40	28	60

**Discussion**

**Neck Posture**

The study confirmed previous findings that prolonged mobile phone use is associated with FHP. The increased angle of FHP places additional strain on cervical structures, potentially leading to musculoskeletal pain and discomfort. The significant correlation between mobile phone use and FHP suggests that ergonomic interventions, such as adjusting screen height and encouraging regular breaks, are necessary to prevent poor posture.

**Headaches**

The significant association between mobile phone use and headaches suggests that prolonged screen time may contribute to the development of tension-type headaches. This aligns with findings by Shariat *et al.* (2017) [12] and highlights the need for ergonomic interventions. Educational programs focusing on the importance of taking breaks,

maintaining good posture, and reducing screen time could help mitigate headache frequency among students.

**Cervical Range of Motion (CROM)**

The reduction in CROM among participants underscores the impact of prolonged neck flexion during mobile phone use. This reduction can affect daily activities and overall quality of life, emphasizing the need for preventive measures. Regular stretching exercises and ergonomic adjustments, such as using phone stands or holding the phone at eye level, can help maintain CROM and prevent stiffness. The present analysis underscores the significant adverse effects of prolonged mobile phone use on neck posture, the prevalence of headaches, and the reduction in cervical range of motion (ROM) among university students. These findings align with the broader body of research that highlights the musculoskeletal implications of excessive mobile device usage in younger populations.

**Interpretation of Findings:**

**Neck Posture:** The consistent association between prolonged mobile phone use and Forward Head Posture (FHP) is a critical concern. FHP not only alters spinal alignment but also increases the mechanical load on cervical structures, potentially leading to chronic pain and degenerative changes (Kim & Kim, 2015; Namwongsa *et al.*, 2018) [7, 9]. The biomechanical strain resulting from sustained forward head positioning can accelerate wear and tear on intervertebral discs and facet joints, contributing to long-term spinal issues.

**Headaches**

The correlation between extensive mobile phone use and the incidence of headaches, particularly tension-type and cervicogenic headaches, highlights the role of musculoskeletal stress in headache pathology (Berolo *et al.*, 2011; Gustafsson *et al.*, 2017) [1, 3]. Prolonged neck flexion can lead to muscle tension and trigger points in the upper trapezius and suboccipital muscles, which are known contributors to headache development. Additionally, the neural pathways connecting cervical afferents to headache centers in the brainstem may exacerbate headache frequency and severity.

**Cervical Range of Motion**

The reduction in cervical ROM observed in heavy mobile phone users indicates a loss of flexibility and functional mobility in the cervical spine (Gustafsson *et al.*, 2018; Quek *et al.*, 2017) [2, 10]. Limited ROM can impair daily activities, reduce academic performance, and diminish overall quality of life. The decrease in ROM may result from both muscular tightness and joint stiffness, which are consequences of repetitive and sustained postural deviations.

**Interventions and Preventive Techniques**

A diversified strategy is needed to address the musculoskeletal effects of mobile phone use:  
**Postural Education:** Students can develop self-awareness and adopt healthier habits by learning the value of maintaining neutral neck posture and the dangers of prolonged flexion (Sharan *et al.*, 2014) [11].  
**Ergonomic Adjustments:** According to Hwangbo *et al.* (2016) [6], employing ergonomic treatments, such as raising

device screens to eye level and utilizing supportive sitting, can lessen the physical strain on the neck.

**Exercise and Strengthening Programs:** Postural stability can be improved and the risk of FHP and related discomfort can be decreased by including activities that strengthen the cervical and upper back muscles (Hwangbo *et al.*, 2016)<sup>[6]</sup>.  
**Usage Moderation:** Encouraging breaks during prolonged device usage and promoting alternative activities that do not involve sustained neck flexion can help alleviate muscle fatigue and prevent chronic strain.

### Limitations of Current Research

While the existing literature provides valuable insights, several limitations warrant consideration:

- **Cross-Sectional Designs:** Many studies employ cross-sectional methodologies, limiting the ability to infer causality between mobile phone use and musculoskeletal outcomes.
- **Self-Reported Data:** Reliance on self-reported measures for mobile phone usage can introduce recall bias and inaccuracies.
- **Lack of Longitudinal Studies:** There is a paucity of longitudinal research examining the long-term effects of mobile phone use on neck posture and cervical health.
- **Variability in Measurement Tools:** Differences in assessment tools and criteria for evaluating neck posture, headaches, and ROM can impede the comparability of findings across studies.

### Conclusion

Prolonged mobile phone use among university students is significantly associated with detrimental effects on neck posture, increased incidence of headaches, and reduced cervical range of motion. These musculoskeletal issues not only affect physical health but also have broader implications for academic performance and quality of life. Addressing these challenges through education, ergonomic interventions, and targeted exercises is essential in promoting the musculoskeletal well-being of university students in an increasingly digital age. These findings suggest the need for targeted interventions, such as ergonomic education and regular breaks during mobile phone use, to mitigate these adverse effects. Further research is needed to explore long-term consequences and effective intervention strategies.

### Limitations

This study has several limitations. The cross-sectional design does not allow for causality to be established. The use of self-reported data on mobile phone use and headaches may introduce recall bias. Additionally, the convenience sampling method may limit the generalizability of the findings to other populations.

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