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Prevalence Of Upper Limb Nerve Compression In Smartphone-Using University Students With Forward Head Posture

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Abstract

Background:

With the growing integration of digital technology in education and daily life, smartphones have become indispensable tools, particularly among university students. However, this convenience comes with consequences—prolonged use of smartphones has been increasingly associated with musculoskeletal issues, including altered cervical posture. One of the most common postural abnormalities observed in frequent smartphone users is Forward Head Posture (FHP), a condition where the head is positioned anteriorly in relation to the body's vertical axis. FHP has been linked to increased cervical spine strain and may contribute to upper limb nerve compressions.

Objective:

This study aimed to determine the prevalence of upper limb nerve compression among smartphone-using university students with FHP and to explore the relationship between smartphone addiction and the incidence of neural tension affecting the radial, ulnar, and median nerves.

Methods:

A descriptive cross-sectional study was conducted at Sharda Hospital, Greater Noida, involving 211 students aged 18–25 years who presented with FHP. Participants completed the Smartphone Addiction Scale – Short Version (SAS-SV), and were categorized based on cutoff values to determine addiction severity. The Upper Limb Tension Test (ULTT) was used to assess neural tension in the median, radial, and ulnar nerves. Statistical analysis was performed using SPSS version 23.

Results:

Out of 211 participants, 75.4% were classified as smartphone-addicted. Among them, 47.2% demonstrated median nerve involvement, followed by radial (34.6%) and ulnar (18.2%) nerve compression. Even among students with lower addiction scores, significant nerve tension was observed, indicating that FHP alone may contribute to neural stress. However, the group with higher addiction scores showed a greater prevalence of symptoms.

Conclusion:
The findings indicate a strong association between excessive smartphone use and increased risk of upper limb nerve compression in students with FHP. Educational initiatives focused on ergonomic posture, smartphone usage moderation, and early intervention are essential to prevent long-term neuromuscular complications in this vulnerable population.

Keywords: Forward Head Posture, Smartphone Addiction, Upper Limb Nerve Compression, University Students, Ergonomics, Neural Tension

INTRODUCTION

In today's era of digitalization, the ubiquity of smartphones among university students has profoundly changed postural behaviour and musculoskeletal well-being. Chronic smartphone use is often related to persistent neck flexion and inadequate ergonomics, which could be linked to forward head posture (FHP)—a prevalent postural deviation involving anterior deviation of the head from the vertical body axis.[(1)] FHP has been associated with changed cervical spine biomechanics and elevated muscular tension, which can predispose to upper limb nerve compression syndromes, including thoracic outlet syndrome, carpal tunnel syndrome, and cubital tunnel syndrome.

The pervasive integration of smartphones into daily life has revolutionized communication, education, and entertainment, particularly among university students. In India, the proliferation of affordable smartphones and widespread internet access have led to a significant increase in screen time among young adults. While these devices offer numerous benefits, their excessive use has been linked to various musculoskeletal disorders, notably in the upper limbs and cervical spine. Most people now consider a mobile device to be necessary, especially young folks who are addicted to web browsing, texting, and gaming. Texts, music, television, the internet, pictures, and games are all examples of how this is utilized for communication and amusement. Computer technology now plays a major role in people's daily lives because of internet services and work. [(2)] Muscle imbalances and strain on the neck and shoulder areas result from this misalignment, which increases the burden on cervical structures. Long-term FHP can cause "tech neck," which is characterized by stiffness, discomfort, and in extreme situations, cervical disc herniation (Verywell Health, 2024). Furthermore, because of poor ergonomics and repetitive strain, prolonged neck flexion while using a smartphone has been linked to upper limb nerve compressions, including cubital tunnel syndrome and carpal tunnel syndrome. [(3)]

Based on earlier studies on internet addiction, the relatively new idea of "smartphone addiction" (SA) has also been examined. Because they enable constant internet access regardless of time or location, smartphones set themselves apart from more conventional computer or laptop Internet use. The primary reasons of smartphone addiction are excessive Internet use or Internet addiction disorder. [(4)]

The link between the overuse of smartphones and musculoskeletal pain has been highlighted by recent evidence. A cross-sectional study of Saudi Arabian university students, for instance, reported that the 12-month prevalence of musculoskeletal disorders (MSDs) was greater among those reporting symptoms of smartphone addiction and was greater in the shoulder (20.13%), elbow (5.11%), and wrist/hand (13.42%) areas. (Alqahtani et al., 2022). Along a similar line, a study conducted by[(5)], emphasized ergonomics' significance in maintaining musculoskeletal health by pinning neck flexion posture in smartphone use as a major causative factor in neck diseases. The COVID-19 pandemic further exacerbated these issues, as remote learning and social distancing measures led to increased reliance on digital devices. A study by [(6)] found that 59.1% of Saudi university students experienced neck or shoulder pain associated with device use, with a significant proportion adopting poor postures, such as holding the phone with one hand and tilting the neck downward. These results highlight the necessity of raising awareness and developing intervention techniques to lessen the negative health effects of extended smartphone use.

The purpose of this study is to find out how often upper limb nerve compression symptoms are among university students with forward head posture who use smartphones. By identifying the extent of this issue and its associated risk factors, the research seeks to inform the development of educational and ergonomic interventions to enhance musculoskeletal health among young adults.

AIM OF THE RESEARCH

To find out the Prevalence of Upper Limb Nerve Compression (Radial, Ulnar and Median nerve) in Smartphone-Using University Students with Forward Head Posture.

OBJECTIVES OF STUDY

- To identify the correlation between smartphone addiction and the occurrence of upper limb nerve compression in this population.
- To identify the specific upper limb nerves (Radial, Ulnar and Medial nerve) that are most affected by compression in smartphone-using university students with forward head posture.

METHODOLOGY

- Study Design: Cross Sectional study
- Study Setting: Sharda Hospital, Greater Noida, UP
- Study Subjects: Individuals with forward head posture
- Study Duration: 6 months
- Sample Size: To obtain the appropriate sample size for the Prevalence of Upper Limb Nerve (Radial, Ulnar and Median nerve) Compression in Smartphone-Using University Students with Forward Head Posture, the following parameters were considered for sample size.
- Standard Normal Variate – 1.96
- Prevalence – 73% or 0.73
- Margin of error – 6% or 0.6
- Sample size (n) – 211

- **Inclusion Criteria**: -

1. Forward head posture
2. Smartphones users
3. Age between 18 to 25 years
4. Both female & male

- **Exclusion Criteria**: -

1. neck and hand deformities
2. cervical spondylolisthesis
3. Acute inflammatory lesions
4. Any recent history of trauma
5. fracture or surgery in the neck
6. those who have symptoms and having treatment were excluded from the study.

The purpose of this study is to look at the connection between smartphone addiction and forward head posture (FHP), as well as any possible link between smartphone addiction and upper limb nerve compression in those with FHP.

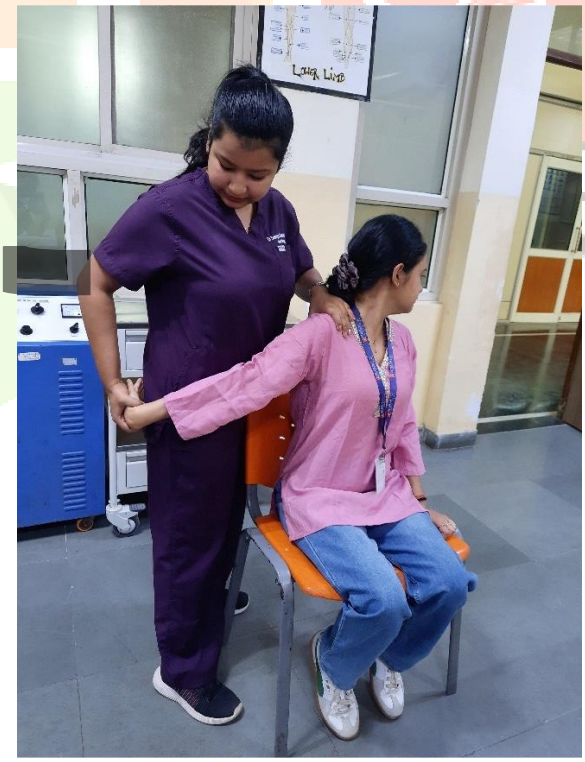
Phase 1: Participant Screening and Grouping

Initially, participants were screened for the presence of forward head posture using a ruler-based method. This method involved measuring the craniovertebral angle by aligning a vertical plumb line with a reference point on the body, typically the tragus of the ear and the spinous process of C7. Participants who met the criteria for FHP were selected for further evaluation. These individuals were given the Smartphone Addiction Scale – Short Version (SAS-SV) once their posture had been evaluated. The level of smartphone dependency was measured by this verified 10-item survey. Total scores ranged from 10 to 60, with each item being assessed on a 6-point Likert scale (1 being strongly disagree and 6 being strongly agree). Participants were grouped according to predetermined cut-off values: males who scored ≥31 and females who scored ≥33 were at high risk of developing a smartphone addiction. Based on these scores, participants will be divided into two groups:

- Group A: Participants with forward head posture and a score above the SAS-SV cutoff (indicative of smartphone addiction).
- Group B: Participants with forward head posture but a score below the cutoff (not indicative of smartphone addiction).

Phase 2: Neural Tension Assessment

- In the second phase, all participants underwent the Upper Limb Tension Test (ULTT) to evaluate the presence of nerve tension or compression in the upper limb. The ULTT was performed bilaterally, focusing on three major peripheral nerves:
- ULTT1: Median nerve
- ULTT2: Radial nerve
- ULTT3: Ulnar nerve



- Fig No 3.1 Therapist is performing ULTT on the participant

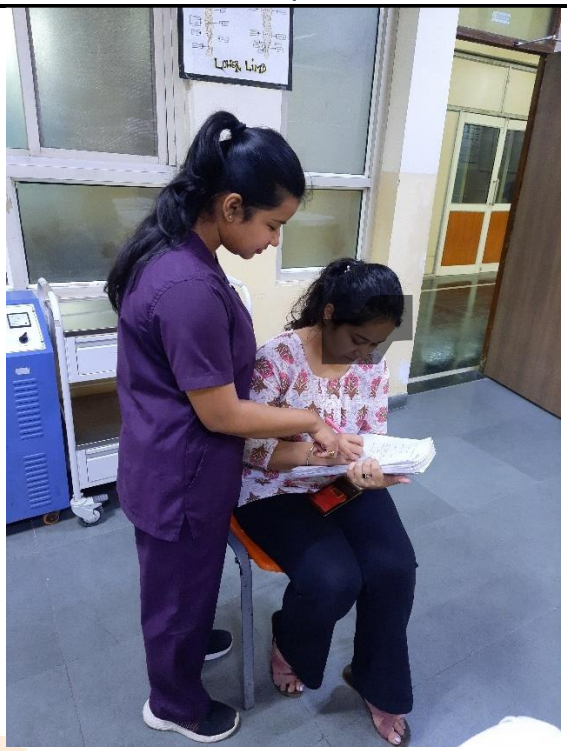


Fig No 3.2 Participant is filling the questionnaire scale

DATA ANALYSIS

The statistical analysis was performed using version 24 of the Statistical Package for Social Sciences (SPSS). The prevalence of nerve compression was assessed in both groups using descriptive and inferential statistical methods. The rate of positive ULTT results between the high and low smartphone addiction groups was compared using the paired and unpaired t-tests. Additionally, in relation to the intensity of smartphone addiction, the investigation determined whether nerve (ulnar, median, or radial) had the highest prevalence of tension or compression. This makes it clearer whether using a smartphone more frequently is linked to a higher risk of nerve involvement in people with FHP

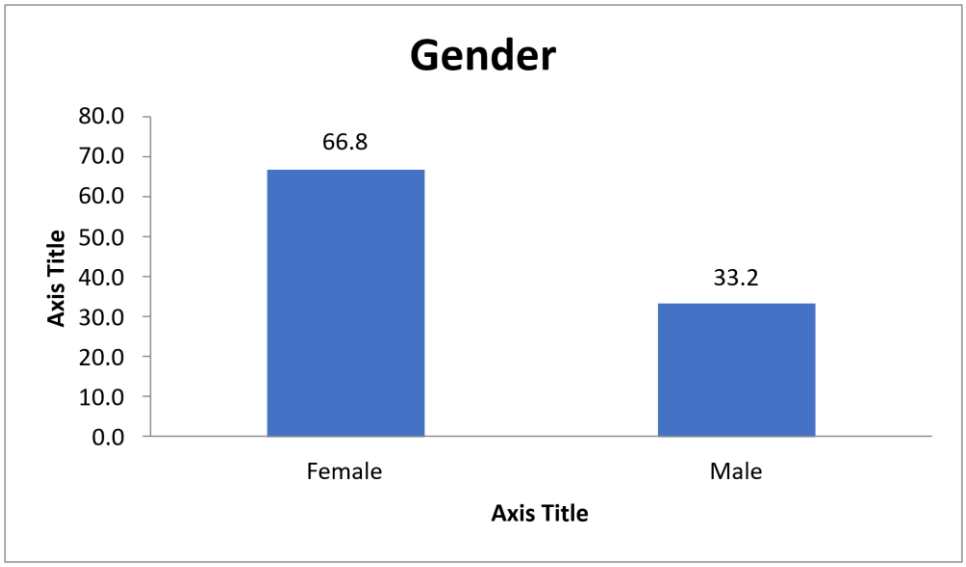
RESULTS

The table5.1 and graph 5.1 are presenting the distribution of participants by sex in the study sample. Out of a total of 211 university students, 141 (66.8%) were female and 70 (33.2%) were male. This indicates that females made up two-thirds of the study population, while males comprised the remaining one-third. The valid percent matches the raw percentage, confirming that no data was missing in this variable. The cumulative percent shows a progressive total, reaching 100% with the inclusion of both sexes, indicating complete data coverage for participant gender.

Table 5.1 Sex distribution

	Sex	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	141	66.8	66.8	66.8
	Male	70	33.2	33.2	100.0
	Total	211	100.0	100.0	

Graph 5.1 Sex distribution



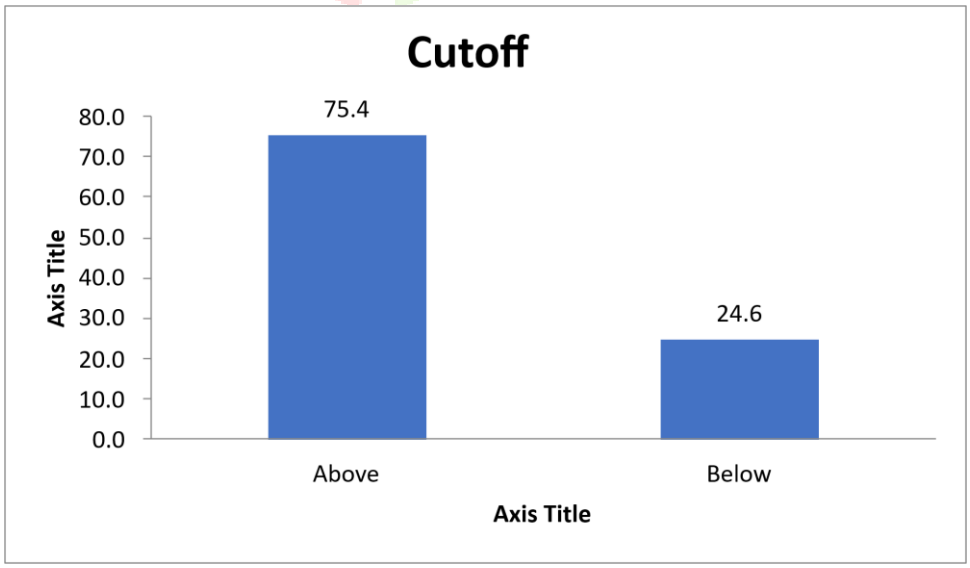
The table 5.2 and graph 5.2 are displaying the distribution of participants based on their scores on the Smartphone Addiction Scale relative to the established cutoff values. Out of a total of 211 participants, 159 individuals (75.4%) scored above the cutoff, indicating a likely presence of smartphone addiction. In contrast, 52 participants (24.6%) scored below the cutoff, suggesting lower levels of smartphone dependency.

This distribution suggests a high prevalence of smartphone addiction among university students with forward head posture and underlines the importance of further investigation into its potential health consequences, including upper limb nerve compression.

Table 5.2 Smartphone Addiction Cutoff Distribution

	Cutoff	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Above	159	75.4	75.4	75.4
	Below	52	24.6	24.6	100.0
	Total	211	100.0	100.0	

Graph 5.2 Smartphone Addiction Cutoff Distribution



The table 5.3 and graph 5.3 are presenting a crosstabulation of participant sex and smartphone addiction status (above or below the cutoff score).

- Among the 141 female participants, 105 (74.5%) scored above the cutoff, indicating a high prevalence of smartphone addiction, while 36 (25.5%) scored below the cutoff.
- Among the 70 male participants, 54 (77.1%) scored above the cutoff and 16 (22.9%) scored below.

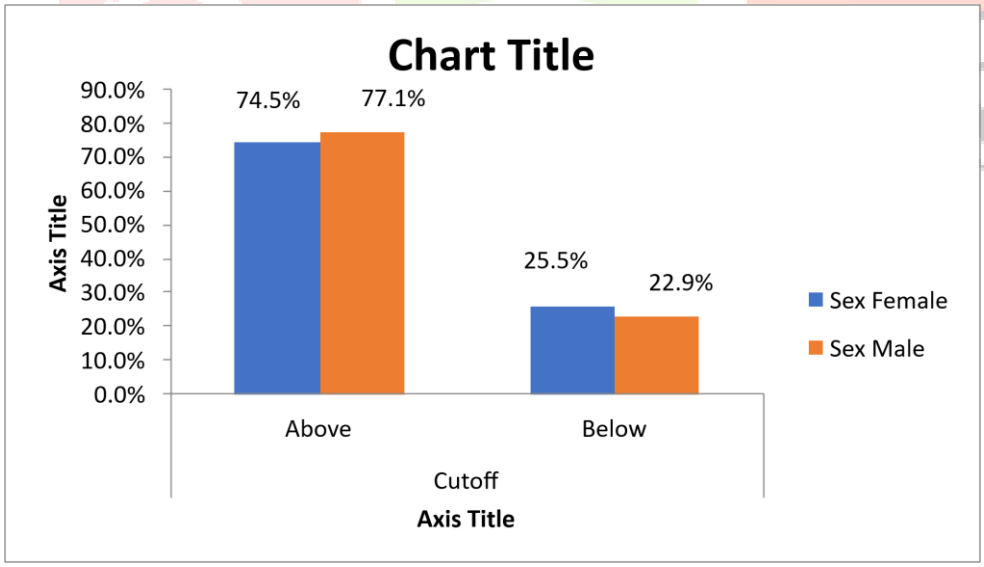
This distribution shows that most of both males and females in the study exceeded the cutoff for smartphone addiction, with males showing a slightly higher prevalence (77.1%) than females (74.5%). However, the difference between sexes is relatively small.

Overall, 75.4% of the total participants scored above the cutoff, confirming a high prevalence of smartphone addiction across the sample, regardless of sex. This uniformity across genders suggests that smartphone addiction is a common issue among university students with forward head posture.

Table 5.3 Sex and Smartphone Addiction Cutoff Crosstabulation

Sex * Cutoff Crosstabulation					
			Cutoff		
			Above	Below	Total
Sex	Female	Count	105	36	141
		% within Sex	74.5%	25.5%	100.0%
	Male	Count	54	16	70
		% within Sex	77.1%	22.9%	100.0%
Total		Count	159	52	211
		% within Sex	75.4%	24.6%	100.0%

Graph 5.3 Sex and Smartphone Addiction Cutoff Crosstabulation



This table 5.4 and graph 5.4 are presenting the crosstabulation of Upper Limb Tension Test (ULTT) findings—categorized by nerve involvement (median, radial, ulnar)—with smartphone addiction status (above or below the cutoff).

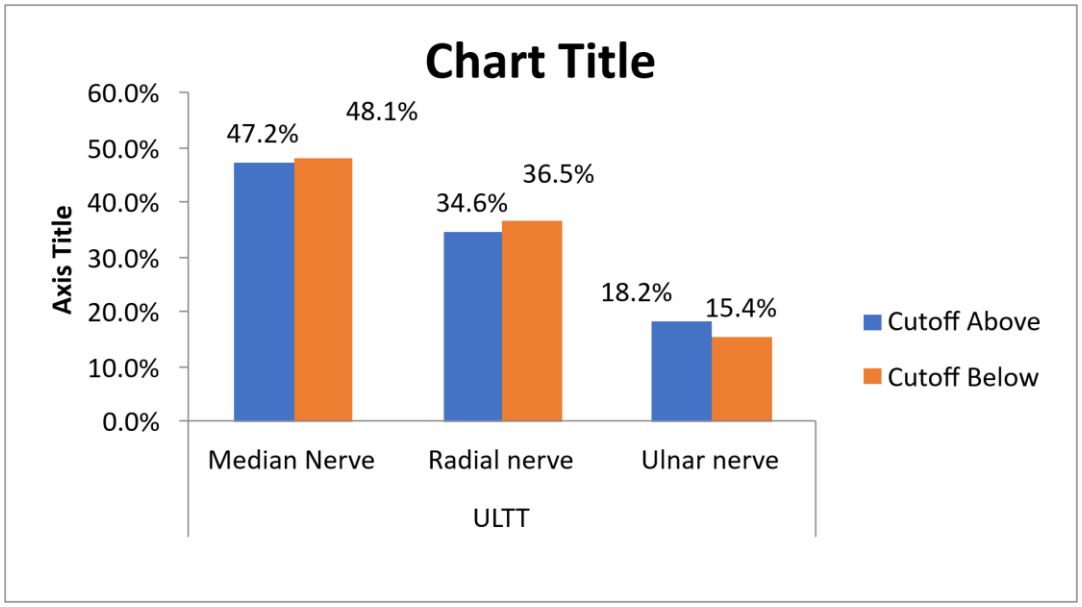
Key Observations:

1. Median Nerve Involvement:
   - 75 participants (47.2%) in the "Above Cutoff" group tested positive for median nerve tension.
   - 25 participants (48.1%) in the "Below Cutoff" group also had median nerve involvement.
   - Overall, the median nerve was the most frequently affected across both groups, with a total of 100 cases (47.4%).
2. Radial Nerve Involvement:
   - A total of 55 participants (34.6%) above the cutoff showed radial nerve involvement.
   - 19 participants (36.5%) below the cutoff also tested positive for radial nerve tension.
   - Radial nerve issues were the second most common, with 74 cases (35.1%) in total.
3. Ulnar Nerve Involvement:
   - Among those above the cutoff, 29 participants (18.2%) had ulnar nerve involvement.
   - In the below-cutoff group, 8 participants (15.4%) showed ulnar nerve tension.
   - Ulnar nerve was the least commonly affected, involved in only 37 participants (17.5%).

Table 5.4 ULTT and Smartphone Addiction Cutoff Crosstabulation

ULTT * Cutoff Crosstabulation					
			Cutoff		
			Above	Below	Total
ULTT	Median Nerve	Count	75	25	100
		% within Cutoff	47.2%	48.1%	47.4%
	Radial nerve	Count	55	19	74
		% within Cutoff	34.6%	36.5%	35.1%
	Ulnar nerve	Count	29	8	37
		% within Cutoff	18.2%	15.4%	17.5%
Total		Count	159	52	211
		% within Cutoff	100.0%	100.0%	100.0%

Graph 5.4 ULTT and Smartphone Addiction Cutoff Crosstabulation



DISCUSSION

The prevalence of upper limb nerve compression in college students who exhibit forward head posture (FHP) was investigated in this study, with a focus on the part that smartphone addiction plays. Given the rise in smartphone use, the results shed important light on the growing worry over postural abnormalities and their neuromuscular effects.

A cross-sectional study conducted in which examined the association between Guyon Canal Syndrome (GCS) and FHP in long-term smartphone users (7). The study reported a statistically significant positive correlation ($r = 0.27$, $p = 0.0177$) between FHP and GCS, indicating that long-term FHP has the tendency to apply moderate pressure on the ulnar nerve and induce GCS. This highlights the possibility that smartphone related postural abnormalities have the potential to cause upper limb nerve compression. A significant percentage of the participants (75.4%) had a score above the cutoff on the Smartphone Addiction Scale, suggesting high prevalence of problematic smartphone use among FHP students. The finding concords with existing literature that has reported growing smartphone dependence among young adults because of academic, social, and entertainment demands. The increased use of addiction among women (74.5%) than men (77.1%) also tally with a few studies indicating that women could be having more smartphone use, especially for communication and social networking. The association between smartphone use and postural changes like FHP has been documented. state that extensive handheld device use is highly correlated with prolonged cervical flexion and shoulder protraction, leading to muscle fatigue and postural imbalance. [8] This is supported by a study conducted in Saudi Arabia during the COVID-19 pandemic that identified university students to have a 12-month prevalence of musculoskeletal disorders (MSDs) in the wrist/hand (13.42%), elbow (5.11%), and shoulder (20.13%) areas.

The study highlighted the significance of excessive smartphone use for musculoskeletal health by pointing to a high correlation between smartphone addiction and the prevalence of MSDs in the upper limbs [9]. Furthermore, 59.1% of participants in a study on neck and shoulder pain among Saudi university students reported feeling uncomfortable when using computers or smartphones. Further demonstrating the link between extended, inappropriate gadget use and musculoskeletal problems, the study found a strong correlation between the prevalence of neck and shoulder pain and the duration and posture of device use. [6]

Importantly, the study revealed that median nerve involvement was the most common, affecting 47.4% of all participants, followed by the radial nerve (35.1%) and ulnar nerve (17.5%). Among those with smartphone addiction above the cutoff, median nerve compression remained the most prevalent (47.2%). These results suggest a potential link between prolonged smartphone use and increased tension or compression in the median nerve, likely due to sustained wrist flexion and repetitive thumb movement associated with texting and browsing. Furthermore, the high percentage of radial and ulnar nerve involvement reinforces the broader musculoskeletal impact of forward head posture combined with habitual smartphone handling.

The study also highlights that even among individuals with lower addiction scores, nerve involvement was not negligible—suggesting that forward head posture itself may independently contribute to neural tension. However, the slightly higher prevalence of nerve tension in the high addiction group supports the hypothesis that excessive smartphone use may exacerbate nerve compression risk, particularly in the context of poor postural habits.

CONCLUSION

The aim of this research was to examine the correlation between smartphone addiction and the incidence of upper limb nerve compression in college students with forward head posture (FHP). The results showed that a vast majority (75.4%) of the participants with FHP had a score higher than the set cutoff on the Smartphone Addiction Scale, suggesting a high rate of smartphone overuse among them. Women made up most of the sample (66.8%), and the same pattern of high addiction scores was seen for both men and women.

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