RESEARCH PAPER

Assessing The Impact of Smartphone Use and Neck Pain Among Undergraduate Physiotherapy Students: A Cross-Sectional Study

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ABSTRACT
Background: Neck pain is a prevalent health problem, largely reported in adult population. However, with emerging new technologies, technical uses in current education system are inducing a shift in the prevalence of this issue from adulthood to students also. The recent trends of Smartphone use and poor functional activity enhance the symptoms faster. Objective: To assess the impact of Neck Pain among undergraduate physiotherapy students using smartphone gadgets. Methodology: Total 137 undergraduate students were evaluated with a kobo tool box where subjects were asked to fill proforma with Web Designed Questionaries on Smartphone gadget uses, Numeric Pain Rating Scale, Neck Disability Index. The data were analysed with Pearson's and Spearmen's Correlation analysis at significance level 5%. Results: There was a predominance of females over males (females-53%, males-38%). A moderate to strong and statistically significant link between NPRS and NDI among smartphone users suggests that increased pain intensity was correlated with heightened functional disability. Conclusions: The study finds significant impact of Neck Pain among Undergraduate Physiotherapy Students with Smartphone uses.

Keywords: Neck, Pain, Cervical, Smartphone, Physiotherapy, Students.
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INTRODUCTION

Neck pain in general is a global cause of disability. It is a public health problem that has increased remarkably nowadays. The prevalence, independent of age, is high, and equal to low back pain.[1] Neck pain is a prevalent health problem, largely reported in adult patients. However, very recent data showed that new technologies are inducing a shift in the prevalence of this relevant issue from adulthood to all of the Paediatric ages.[2] A study by Shah & Sheth in 2018 concluded that in recent days, there is a steep increase in smartphone use among university students for internet access, social networking, educational purposes, gaming, and other daily activities.[3] The smartphone emerges as an inevitable gadget in modern society and its increased usage leads to addiction and other physical problems among users.[4] A survey had shown that 79% of the 18-44 year-old people spend most of their time with smartphones.[5] According to a recent study conducted on 2061 students, 74.8 percent of respondents were addicted to mobile phone and moderate to severe nomophobic .[6] There is growing evidence that, compared to neutral standing, adults, or even children, display more forward head posture (FHP) when viewing a cell phone that leads to mechanical strain forces on the joints and ligaments of the cervical spine, and as a result there is increased gravitational force on the posterior neck musculature.[1]

Neck Pain also referred as Tech Neck Syndrome and musculoskeletal disease (MSD) involving the neck or shoulder region are quite common.[7] Smartphone addiction and overuse are associated with MSDs, especially in the neck and upper limbs. While viewing the smartphone, the user flexes the neck to look down at the screen resulting in excessive lordosis in the lower cervical region with a compensatory kyphosis in the upper thoracic region. This faulty posture is also referred to as the "forward head", "turtle neck" or "text neck" posture which is due to excessive gravitational moment could abnormally load the articular structures of the cervical spine and neck extensor muscles resulting in inefficiency and fatigue.[4] In the neutral position, an adult's head weighs 10-12 pounds. With the flexion of the head, the load increases towards the neck, and the weight is calculated to be 27, 40, 49, and 60 pounds at 15°, 30°, 45°, and 60°, respectively. People who use a smartphone frequently have a downward gaze to focus on

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lowered things and keep their heads in a forward position for lengthy periods, which can cause neck strain.[5]

In India, the demand for Health care professionals for serving the ever-increasing population is always there. Although many forms of Allied health sciences are practiced in India, the undergraduate program for obtaining the Degree of Physiotherapy as Bachelor of Physiotherapy is much sought after. They frequently study for hours at a stretch, even joining dedicated coaching classes for entrance exam preparation; often at the cost of physical and recreational activities. After joining the undergraduate course, students must study the basics of all modern medical & Allied subjects in a short span of four and a half years. Undergraduate students have been reported to have a high prevalence of neck and upper extremity pains. The rapid development and easy availability of communication technologies have led to their widespread use by the general public. Increasing usage of electronic gadgets like laptops, smartphones, tablets, and other wearable devices has been found to increase the incidence of Tech neck symptom in general and among students in particular. It has been postulated that these devices force the user to keep the neck in a specific position for a long time, thereby putting a strain on the neck muscles and thus producing neck discomfort and pain. There are a few reported studies of the prevalence of neck pain in Physiotherapy students and in undergraduate students of Allied sciences from other parts of the world. There are limited studies from India, which have focussed on the musculoskeletal pain (MSP) in undergraduate Physiotherapy students. Following research, it has been determined that participants with FHP exhibited abnormal sensorimotor control and autonomic nervous system dysfunction, in comparison with those presenting with simple normal head alignment.

The Global Burden of Disease (GBD) 2017 reported the Musculo-skeletal conditions to be the second highest contributor of global disability. While, neck pain was found to cause discomfort, disability, and impaired quality of life. Undergraduate students have been reported to have a high prevalence of neck and upper extremity pains. The prevalence of neck pain has been reported as 48-78%.[8]

Earlier researches were conducted to determine the effects of smartphone addiction on the musculoskeletal system and several researchers reported a strong connection between neck and shoulder pain and total time spent using a mobile phone. The link between neck posture and smartphone use is unclear. The treatment remains symptomatic with some advice, Medicine, Physiotherapy and yoga sessions to help relieve the pain.[7]

It is hypothesized that the prevalence of neck disorders among smartphone users may be associated with poor neck posture and smartphone overuse. The findings of this study could trigger an initiative for awareness and strategies to prevent the occurrence of Neck pain among smartphone users. Addressing the methodological shortcomings and limitations in the earlier research published in the entire North East region, India, the current study aimed to determine the prevalence of neck disorder and smartphone overuse among Undergraduate Physiotherapy college or university students in Assam. Hence this study aims to find the prevalence of Neck Pain due to excessive use of mobile phones/digital gadgets and its impact on their activities of daily living among Undergraduate Physiotherapy college or university students in Assam.

MATERIALS AND METHODS:

The study design was cross sectional study among Physiotherapy undergraduate students of various educational institute in Assam. Study was approved by ethical committee of the institution. Through Purposive sampling ,137 participants were included in the study. Other inclusion criteria were age of 18-25 years of either sex having minimum duration of Smartphone uses and able to understand and fill the questionnaire in English. Subjects having Neck Pain due to traumatic or Pathological fracture of cervical spine causing Upper extremity involvement were excluded from the study.

A Web based self-administered questionnaire was developed using the Kobo Toolbox (Global Kobo Toolbox server, (Harvard Humanitarian Initiative)) and was circulated through WhatsApp and E-mail to the undergraduate Physiotherapy students of various colleges of Assam, India. The form includes

The Consent of the Study: including the college name and Year/Semester currently studying. Participants who will agree to participate in the study will be included in the study.

Socio-Demographic Variables of the subjects include Name, Age, Gender, Body Mass Index (BMI), Current Alcohol/Tobacco use, do you perform Physical Exercise?

Numerical Pain Rating Scale (NPRS): a pain intensity measuring tool that uses a scale of 0-10 to measure the intensity of pain where 0 means no pain, 1-4 means mild pain, 5-6 moderate pain and 7-10 means severe pain.

Self-Designed Questionnaire on using Smartphones/Electronic Gadgets:

Do you use Smartphones/Electronic Gadgets? (Yes, No, No Answer)

What is your most common communication mode (texting, calling, no answer)

Average screen time per day on Smartphones/Digital gadgets (do not use, <2 hrs per day, 2-4 hrs per day, >4 hrs per day, no answer)

Preferred posture of using Smartphones/Digital gadgets (Lying down, Sitting, Semi reclining, standing)

Do you use pillow (Do not Use, soft pillow, hard pillow, No Answer)

What is your Sleep pattern? (Good, Disturbed, No answer)

Average time of Two/Four-wheeler riding (<1 hr per day, 1-2 hrs per day, >2 hrs per day, no answer)

Neck Disability Index (NDI): designed to give information as how the neck pain affects a person's ability to manage everyday life. NDI has total 10 sections. Each section has 6 questions with a score ranging from 0-5. The final result will be expressed in percentage (%). The higher score indicates that the patient has reported greater neck disability.

STATISTICAL ANALYSIS: The data collected using Kobo Toolbox was exported through a Microsoft Excel

sheet, which was then checked for missing responses for software related issues and response of the participant was excluded from the analysis. This data was then exported into Statistical Package for the Social Sciences (SPSS) version 24 (IBM Corp) for analysis. Proportions and means were calculated, along with 95% confidence interval (CI) and standard deviation (SD), respectively. As the data was not normally distributed, Spearman correlation coefficient was used to assess the relationship among NPRS, NDI, Smartphone use, Postural factor and its impact on BMI, Exercise, Sleep Pattern, and Riding. The significance level was set at 5%.

RESULTS: Out Of 150 students, 137 (91.3%) students responded to the questionnaire which include 80(53.3%) were male, and the remaining 57(38%) were female. Another 13 responses out of 150 had a significant amount of missing data due to some software-related issues. As per Socio Demographic detail 77.3% (116) students were under the age group of more than 20 years and 12% (18) were under 20 years of age. The table also displays the body mass index ranged at normal (70%), Underweight (4%), Overweight (10%) and Obese (2%). 87.3% students also exhibit no consumption of any bad habits. According to total responses, 28.6 percent of students experienced discomfort in their neck whereas 64.6 percent of the respondent didn't experience any discomfort. The table also demonstrates 54% students enrolled for daily physical exercises.

Table 1: Socio-demographic and the clinical characteristics of the participants (n=137)		
Variable and category	Frequency	Percentage
Age (in years)		
<20	18	12%
≥20	116	77.33%
Gender		
Male	57	38%
Female	80	53.33%
BMI		
18.5-24.9	105	70%
25.0-29.9	15	10%
<18.5	6	4%
≥30	3	2%
Current alcohol/tobacco use		
Yes	5	3.33%
No	131	87.33%
Do you perform physical exercise?		
Yes	81	54%
No	56	37.33%
Do you have neck pain/discomfort?		
Yes	43	28.67%
No	97	64.67%

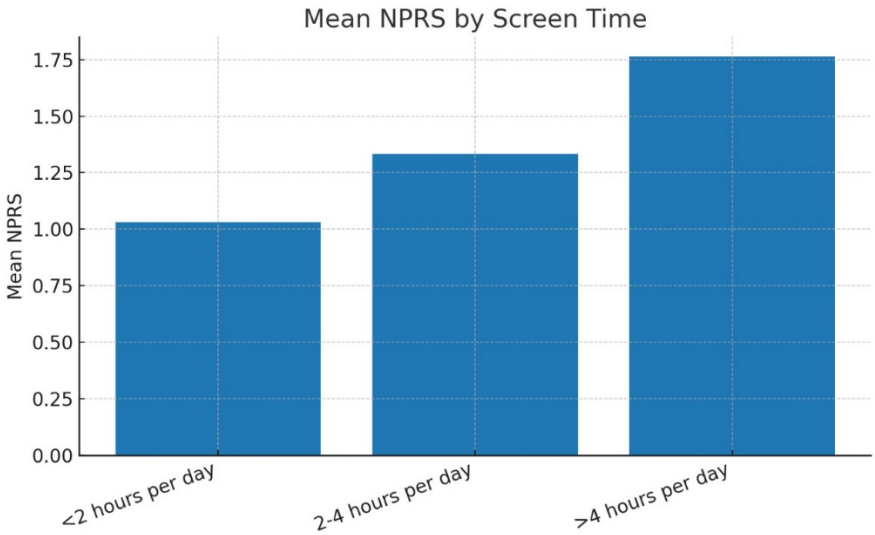
The Self-Designed Questionnaire on using Smartphones/Electronic Gadgets shows 92% use smartphones, majority for texting (59%), with 38.67% using devices 2–4 hours per day and 34.67 % uses >4 hours per day. Data shows 51.33 % students preferred lying down posture whereas 31.33% prefers sitting while using smartphone. Participants present with 78.67% good sleep and 14.67 % s disturbed sleep pattern.

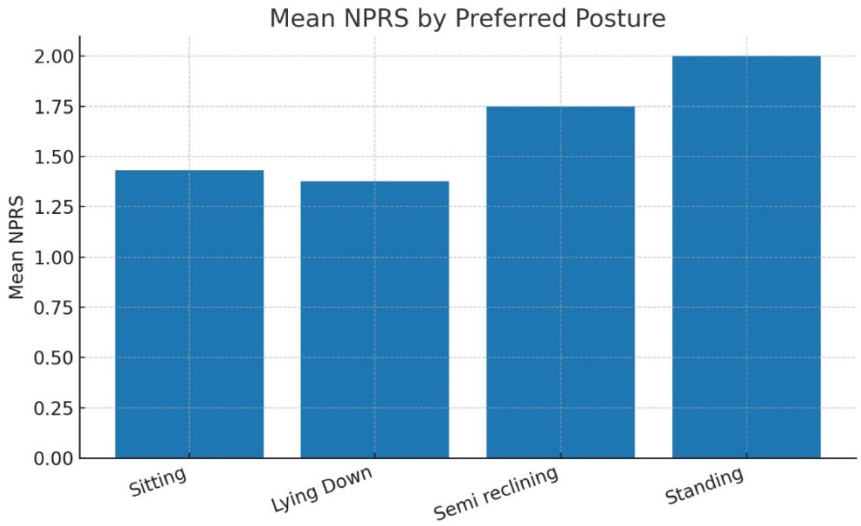
QUESTIONS	FREQUENCY	PERCENTAGE
Do you use Smartphones/Electronic Gadgets?		
Yes	138	92%
No	2	1.33%
What is your most popular communication mode?		
Texting	89	59.33%
Calling	51	34%
Average screen time per day on Smartphones/Digital gadgets:		
2-4 hours per day	58	38.67%
>4 hours per day	52	34.67%
<2 hours per day	29	19.33%
Preferred posture of using Smartphones/Digital gadgets:		
Lying Down	77	51.33
Sitting	47	31.33
Semi reclining	15	10
Standing	1	0.67

Do you use pillow?		
Use soft pillow	111	74%
Use Hard pillow	19	12.67%
Do not use	10	6.67%
What is your sleep pattern?		
Good/Sound	118	78.67%
Disturbed	22	14.67%
Average time of riding two/four-wheeler		
Do not ride	72	48%
<1 hr per day	44	29.33%
1-2 hrs per day	15	10%
>2 hrs per day	6	4%

Correlation Between Smartphone Use and Neck Pain (NPRS)

Descriptive statistics was used to analyse NPRS score with Mean score of 0.48 and standard deviation of 0.81, median at 0. Table illustrates Higher average screen time on smartphone (>4 hrs/day) is associated with increased NPRS scores. The graph also represents Students using devices in lying or semi-reclining positions reported higher NPRS scores in comparison to sitting or standing posture.

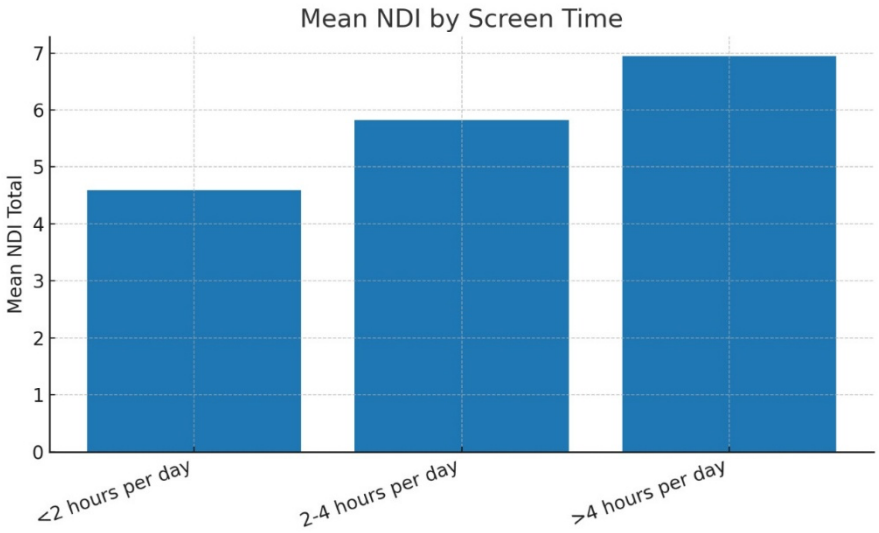


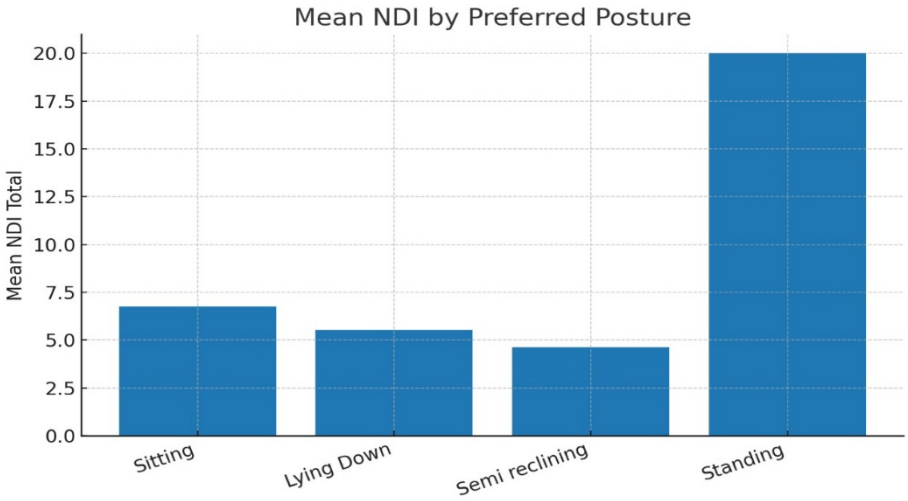


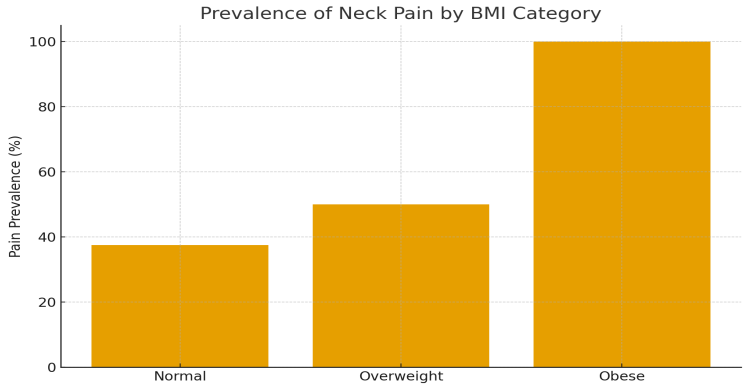
Correlation Between Smartphone Use and Neck Disability Index (NDI)

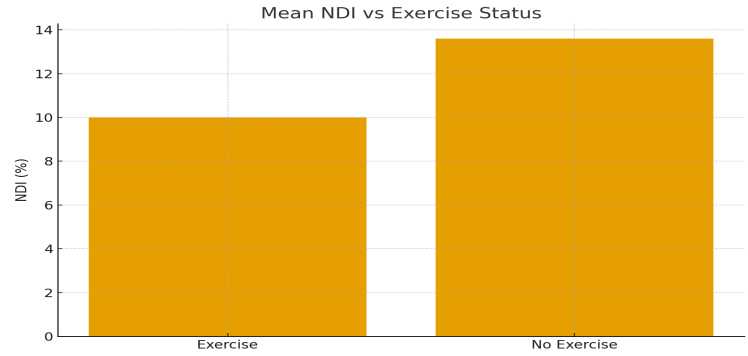
Neck disability index of students reports minimal to mild disability in domains like personal care, lifting, reading, concentration, sleep, and recreation. NDI scores also indicate moderate to severe difficulties in work, driving ability. Neck disability Index score shows higher disability in students with higher daily screen time (>4 hours). Graph shows mean NDI score of smartphone users in lying down

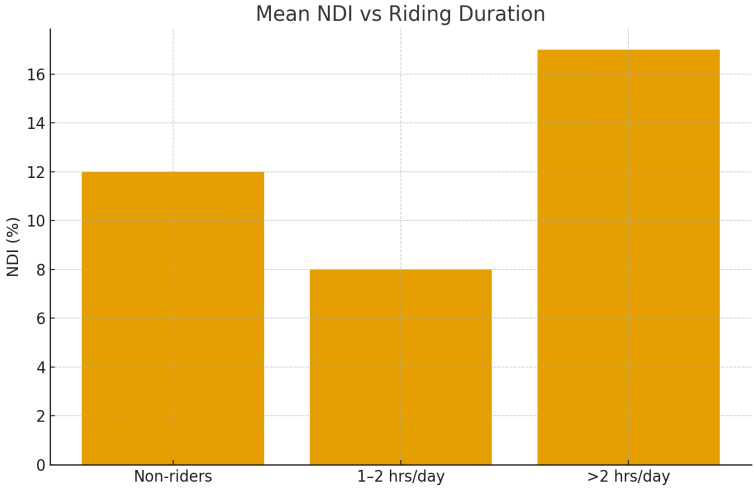
or semi-reclining postures have notably higher disability compared to those who sit.



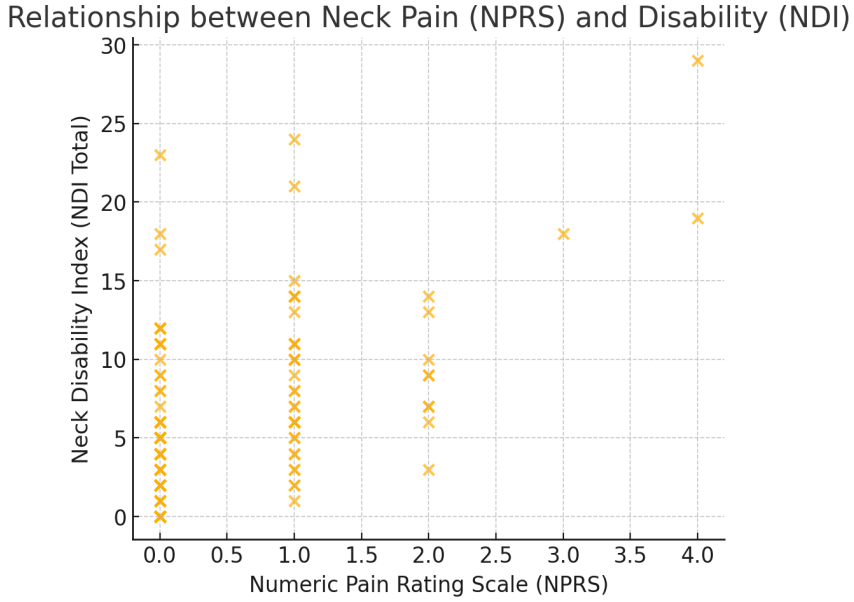








The above graph describes the statistical significance of neck pain among Higher BMI, mean lower Neck disability index in exercise group and no significant association of NDI with Riding duration



The figure shows a clear positive relationship of higher neck pain scores that associated with higher neck disability scores.

Objective	Pearson r (p-value)	Spearman ρ (p-value)	Significant at p<0.05?	Notes
Smartphone Use vs NPRS	r≈0.15 (p=0.063)	ρ≈0.13 (p=0.107)	No	Weak, not significant
NPRS vs Posture	n/a	n/a	No	No association
NDI vs Smartphone Use	r≈0.156 (p=0.059)	ρ≈0.17 (p=0.035)	Yes (Spearman)	Slight positive
NDI vs Posture	n/a	n/a	No	No significant difference
BMI vs Pain prevalence	-	-	Yes	χ^2 p=0.011
Exercise vs NDI	-	-	Borderline Yes	Mann-Whitney p=0.046
Sleep vs NDI	-	-	Yes	p=0.002 (NDI higher with disturbed sleep)
Riding vs NDI	-	-	No	No association
NPRS vs NDI (Smartphone users)	r≈0.44 (p<0.001)	ρ≈0.47 (p<0.001)	Yes	Strong positive correlation

Smartphone Use vs. Neck Pain Severity (NPRS)

There was a slight increase in average pain severity with higher smartphone use, but the correlation was not statistically significant at the 95% confidence level. Participants using smartphones **>4 hours/day** had a higher mean pain score than those using <2 hours, yet Pearson's correlation was weak ($r \approx 0.15$) and did not reach significance ($p = 0.063$). Spearman's rank correlation similarly showed no significant association ($\rho = 0.13$, $p = 0.107$). Thus, **no significant linear correlation** between smartphone screen time and neck pain severity was found ($p > 0.05$).

Neck Pain Severity vs. Preferred Posture

The average pain scores were varying similar for those who usually used their phone lying down, semi-reclining, or sitting. Only the **standing** posture group had a notably higher mean pain. Overall, statistical tests showed no significant differences in pain distribution across posture categories ($p > 0.5$), indicating Preferred posture **did not show a significant association** with neck pain severity in our analysis

Neck Disability (NDI) vs. Smartphone Use

Participants with longer daily screen time tended to report higher neck disability on average with mean NDI increased from 9% to 13.5% as usage went from <2 hrs to >4 hrs/day. This positive trend was reflected in a **significant Spearman correlation** ($\rho \approx 0.17$, $p = 0.035$). Pearson's correlation was similar in magnitude ($r \approx 0.156$) but was borderline in significance ($p = 0.059$), likely due to slight non-normality. Thus, using non-parametric criteria it finds **higher smartphone use associated with higher NDI** ($p < 0.05$).

Neck Disability vs. Preferred Posture

There was **no significant difference** in neck disability across the different preferred postures for smartphone use (ANOVA $p = 0.32$; Kruskal-Wallis $p = 0.25$). The mean NDI was around 10–13% for those who prefer lying down, semi-reclining, or sitting, with overlapping 95% CIs.

Impact of BMI, Exercise, Sleep Pattern, and Riding

Body Mass Index (BMI): Obese participants (BMI ≥30) had a 100% pain prevalence versus 37% in the normal BMI group. This association was statistically significant ($p = 0.011$). The mean Neck Disability Index of obese individuals (20%) was higher than normal (11%), but this difference was not significant ($p = 0.59$) given the small obese sample. Overall, **BMI showed a significant impact on neck pain occurrence ($p < 0.05$)**, but not on Neck disability score.

Physical Exercise: The neck pain prevalence was lower among exercisers (31.8% vs 47.5% in non-exercisers), but this did not quite reach significance ($p = 0.077$). Notably, the **mean NDI was lower in the exercise group**. This difference in disability approached significance – a Mann-Whitney test found **$p = 0.046$** – suggesting exercisers had slightly better neck function. In summary, regular exercise **may be associated with reduced neck pain and disability**, but in our sample the effect was weak, bordering on the 95% confidence threshold.

Sleep Pattern: Sleep quality showed a strong relationship with neck outcomes. Participants with **disturbed sleep** had a much higher average NDI (21% disability) compared to those with good sleep (9.8%), a highly significant difference ($p = 0.002$). In addition, 54.5% of disturbed sleep reported neck pain, versus 35.4% of good sleepers. These results indicate that **poor sleep is significantly associated with greater neck disability**.

Two/Four-Wheeler Riding: Pain prevalence was roughly similar for non-riders (42% had pain) and heavy riders >2 hours/day (42.9%), and slightly lower for those riding 1–2 hours (29.4%), but these differences were not statistically significant ($p = 0.63$). Mean NDI showed a minor change (moderate riders had lowest NDI 8%, heavy riders highest 17%), but again this variation failed to reach significance ($p = 0.25$). Therefore, it finds **no clear impact**

of riding duration on neck pain or NDI at the 95% confidence level.

DISCUSSION

The present study investigated the relationship between smartphone use and neck pain and disability among students, with additional consideration of BMI, physical exercise, sleep pattern and two/four-wheeler riding.

In this study neck symptoms were more prevalent in female (53%) in compare to male (38%) smartphone users which may attribute the difference to underlying gender-related psychological and biological factors. It is in accordance with a study by Sirajudeen MS et al (2018) musculoskeletal mechanics, metabolic regulations, and hormonal factor inducing pain-related perception and threshold.[11]

Although students with higher daily screen time (>4 hours/day) reported slightly greater neck pain intensity on the NPRS compared to those using smartphones for less than 2 hours, the correlation between screen time and pain severity was weak and not statistically significant. Both Pearson and Spearman correlation coefficients remained small indicating that increased smartphone use alone did not show a clear association with pain intensity which is also supported by a study of Gustafsson and co-authors(2017) found no association between time spent texting on a mobile phone and neck pain.[12] In contrast, neck disability showed a small but statistically significant association with smartphone use: NDI scores increased from about 9% to 13.5% as usage rose from <2 to >4 hours per day, and Spearman's correlation reached significance. This suggests that prolonged smartphone use may contribute more to functional limitation than to immediate pain intensity, possibly through cumulative postural strain and altered daily activities. Al Abdulwahab SS et al suggests This changes the natural alignment of cervical spine and increases the additional of stress on the cervical spine, leading to discomfort and spasm in the surrounding skeletal soft tissues.[13]

Preferred posture during smartphone use did not demonstrate a significant association with either NPRS or NDI, despite descriptively higher mean scores in lying or semi-reclining postures. Statistical tests showed no meaningful difference in disability across sitting, lying, semi-reclining or standing categories, which may reflect overlapping confidence intervals and limited numbers in some posture subgroups, especially standing. This may be aligned with the Support of spine causing relaxation of associated structure thereby inhibition of nociceptors leads to a comfortable appearance of posture to perform functional activity without any discomfort.

Role of BMI emerged as an important factor for pain occurrence: all obese participants reported neck pain compared with about one-third of those with normal BMI, and this association was statistically significant However, despite higher mean NDI scores in the obese this difference was not statistically significant, likely due to the very small number of obese individuals in the sample and reduced power to detect between-group differences. These results support that higher BMI may increase susceptibility to neck pain, but a stronger conclusion about its impact on disability would require a larger, more balanced sample. In a recent study by Zafar Azeem et al (2025) Suggests obesity-caused postural change also results in cervical spine misalignment, increasing the risk of musculoskeletal injury enhance defective balance and coordination tend to go hand in hand with decreased proprioception, perception the body awareness in space.[14]

Regular physical exercise showed a potentially protective trend. Students who exercised had lower neck pain prevalence and lower mean NDI, with the disability difference reaching borderline statistical significance. Although the effect size appears modest and just at the 95% confidence threshold, this pattern suggests that habitual physical activity enhances bone mineral density may contribute to better neck function and could be encouraged as a preventive strategy in student populations with improved mobility, functional improvement, proprioceptive awareness, and postural control. It suggests a research work of Vincent KR (2012) focuses on Physical exercise to stabilise the musculature and solidify painful joints prior initiating weight-bearing aerobic exercise which Self-efficacy is maximised with exercise and reduces joint pain and disability symptoms.[15]

Sleep quality demonstrated one of the strongest associations with neck outcomes. Participants reporting disturbed sleep had more than double the neck disability and a higher prevalence of pain with a highly significant p-value. This highlights a close relationship between poor sleep and musculoskeletal complaints, which may be bidirectional: pain can disturb sleep, and inadequate sleep can heighten pain sensitivity and impair recovery in accordance with a study by which suggested, a modification of the serotoninergic neurotransmission systems, which are involved in the regulation of sleep and pain might decrease the pain threshold along with genetic factor.[16]

Riding duration and relationship between pain and disability Two/four-wheeler riding duration did not show a significant association with either neck pain prevalence or NDI. Although heavy riders (>2 hours/day) had slightly higher mean NDI and moderate riders (1–2 hours/day) the lowest, these differences were small and statistically non-significant, suggesting that, in this sample, riding exposure was not a major determinant of neck problems conveying the inclusion of male and female ratio signifies the changes on musculoskeletal architecture.

Finally, there was a moderate to strong and statistically significant link between NPRS and NDI among smartphone users. This suggests that increased pain intensity was correlated with heightened functional disability. The finding suggest that smartphone screen time shows a weak direct correlation with pain intensity, but a moderate association with neck-related disability. Furthermore, modifiable factors such as BMI, exercise, and particularly sleep quality may significantly influence neck health among the students.

To the best of our knowledge, this is the first study in India to determine the prevalence of Neck Pain by employing a Web based Questionary related to Pain, Smartphone use, Postural stress, Sleep Quality, Body Stature and functionality of Undergraduate Physiotherapy students. The

Finding of current study supports the Biomechanical hypothesis that Tech Neck syndrome may be a Primary cause of Musculoskeletal Neck disorder among younger population with excessive smartphone uses.

The implications of the current study is to make an effort to reduce the over use of a smartphone, and implement various regime for prevention of Sedentary life style and focusing on Physical exercises to enhance a proper Healthy life style along with sound sleep could also be advised.

The study had few limitations too. The number of responses received is not relatively high along with software-based glitch of Self-administered questionnaires does increase the risk of response bias. The questionnaire lacked questions for assessing psychological states of students. Further research should emphasize on a larger cohort for generalized results, representing the bigger population and a long-term progressive complication of Neck Pain on the cervical spine is also feasible.

CONCLUSIONS

In Conclusion the present study showed that Neck Pain is significantly prevalent among Undergraduate Physiotherapy students of Assam with excessive use of smartphone and its impact on their activities of daily living. Based on the various observations made in this study, that increased pain intensity was correlated with heightened functional disability among smartphone users which need public health remedial program for understanding musculoskeletal risk and ergonomic way of handling electronic gadgets.

Disclaimer: The manuscript has been prepared as a part of Ph.D. research project

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Authors' contribution

Conceptualization: Kangkan Talukdar, Dr. Lohit Kumar Kalita

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Validation: Sasanka Mahanta, Srikant Sikatia

Investigation: Kangkan Talukdar, Srikant Sikatia

Resources: Kangkan Talukdar, Sasanka Mahanta

Data Curation: Kangkan Talukdar, Mayur Das

Writing - Review & Editing: Kangkan Talukdar

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