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Research Article

Impact of Text Neck Syndrome on Posture and Prolonged Device Use among Postgraduate Students

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A B S T R A C T

Introduction: Text neck syndrome is characterised as an overuse syndrome or repetitive stress injury, involving the positioning of the head in a forward or downward manner while focusing on a mobile device or any other electronic gadget for extended durations. Consequently, this leads to the tightening of shoulder muscles, discomfort in neck muscles, and possibly even persistent headaches.

Primary Objective: The primary objective of this study was to determine the prevalence of text neck syndrome among the young adult population by utilising the Neck Disability Index (NDI) questionnaire.

Methodology: An analysis conducted cross-sectional study included 490 postgraduate students aged between 18 to 25 years from various academic departments at Avinashilingam University, Coimbatore, Tamil Nadu. Demographic profiles were compiled from the participants, who were then tasked with completing the Neck Disability Index questionnaire. Subsequently, the collected data was scrutinised to explore the correlation between neck pain and neck posture during mobile phone usage.

Results: The results indicated that females demonstrated a higher vulnerability, primarily adopting a 30° neck flexed posture while using their smartphones for an average of 4 hours daily. Moreover, the age bracket most impacted was identified as 22 years.

Conclusion: 42% had mild disability and 18% had moderate disability, 5% had Severe disability. It was also found that increased hours of smartphone usage leads to increased neck disability, The study also found that increased neck flexion position while using their smartphones leads to increased neck disability.

Keywords: Text Neck Syndrome, Neck Disability Index, Stress Injury, Smartphone, Neck Pain, Neck Disability

Introduction

The term "Text Neck" was introduced by Dr Dean L Fishman, a US chiropractor. This phenomenon, also known as "Text Neck" or alternatively referred to as "Turtle Neck Posture," can be characterised as a condition of repetitive stress injury and neck pain resulting from prolonged use of handheld devices for texting or viewing. The recent advancements in Smartphone technology have resulted in a significant rise in the dependency of individuals on these devices, leading them to dedicate a substantial amount of time to handheld gadgets.[1]

This tendency can lead to chronic headaches, neck pain, upper back pain, shoulder discomfort, an increased curvature of the spine, and hand discomfort. Using these devices causes a prolonged flexion of the neck, which results in a forward head posture. According to a recent study done in Thailand, Text Neck Syndrome has spread over the world and is now affecting a wide range of people who use mobile phones, regardless of age. This syndrome has become a major source of concern, as it may affect a considerable number of people who use cell phones globally.[2]

As one of the most common bad postures in the sagittal plane, the forward head position is known to cause muscular overstretching and fibre shortening. Overuse syndrome and irreversible harm could arise from neglecting to treat or correct Text Neck Syndrome. In addition, it may result in serious consequences like flattening of the spinal curve, early onset arthritis, misalignment of the spine, degeneration of the spine, disc compression, disc herniation, and an excessive posterior curve in the upper thoracic vertebrae to preserve balance, which could put pressure on the cervical spine and neck muscles. It may also result in neck stiffness, muscle atrophy, nerve injury, radiating pain, overall soreness, weakness, and numbness.[3]

A comprehensive analysis of 15 scholarly articles revealed that the most common musculoskeletal complaints among users of mobile devices pertained to the neck (17.3–67.8%).[4-6] According to two different studies conducted in Pakistan and India, the prevalence of text neck syndrome was 42.5% and 43.6%, respectively.[7,8] In addition, two further studies of mobile phone users at Aljouf University and Qassim University in Saudi Arabia revealed that 71.2% and 59.5%, respectively, reported having cervical pain.[9–11] Numerous studies have shown that increased smartphone use and extended screen time are linked to a variety of musculoskeletal pains.[12–14] Nevertheless, research on "Text Neck Syndrome" is still in short supply.

Gender-specific anatomical differences significantly influence the effects of text neck syndrome in women, as evidenced by various studies. Women typically possess narrower shoulders and less developed upper body musculature, which diminishes their ability to support the head's weight during prolonged forward flexion, leading to increased cervical spine strain. Research indicates that women exhibit higher cervical spinal compression per unit exertion force, particularly in flexed postures, which correlates with their greater incidence of neck pain.[15] Several studies have highlighted that women are more prone to developing TNS compared to men. The study indicates that females tend to use mobile phones more than males, with an average usage of 6.9 hours compared to 5.6 hours for males. This increased usage may contribute to a higher prevalence of neck pain among women, as they are more likely to report musculoskeletal pain and chronic pain conditions than men.[10] Thus, we included female gender participants in this study.

Aim and Objectives of the Study As more individuals use technology, text neck syndrome is becoming a concerning issue. Owing to the widespread use of smartphones, additional research is required to determine the incidence of text neck syndrome in different nations. Furthermore, it is still unclear from the literature what behaviours people engage in when using smartphones and neck disabilities. Hence, the aim of this research was to (a) investigate the prevalence of text neck syndrome among the young adult population (b) differences among the degree of handheld device and neck disability, and (c) duration of hand-held device in terms of hours of usage and neck disability.

Subjects and Methodology

Study Design

The research design implemented in this study was a cross-sectional analysis. Convenient sampling was chosen for the purpose of achieving the objective of the prevalence in neck disability among postgraduate students and it discovered that the participants were postgraduate students who frequently used their phones and other digital devices for academic, recreational, and leisure purposes.A total of 490 postgraduate students from various departments at the Avinashilingam Institute for Home Science and Higher Education for Women, a Deemed University situated in Coimbatore, Tamil Nadu, were enlisted in the investigation, which lasted for a duration of five months.

Procedure

In relation to the methodology, the primary step entailed delivering a comprehensive explanation of the study's nature and objectives to the participants, followed by a detailed briefing on the Neck Disability Index. Subsequently, consent was obtained from each postgraduate student after the explanation. An electronic self-administered questionnaire was then disseminated to the postgraduate students, with representatives from the first and second PG departments utilising WhatsApp to distribute the questionnaire link. The questionnaire was divided into two sections.

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- **Part 1:** The first section included demographic information such as age, gender, department, daily smartphone usage duration, purpose of smartphone use, neck muscle warm-up practices, phone usage breaks, and neck positioning during smartphone use. After seeing the different neck postures (0°, 15°, 30°, 45°, and 60°) (Figure 1), participants were asked to select the one they used their smartphones in the most frequently. The next section of the questionnaire was only accessible to students who reported having neck pain.
- **Part 2: (Neck Disability Index Questionnaire):** The Neck Disability Index, which includes 10 questions with a maximum score of 50 and scores for each person ranging from 0 to 5, was the subject of the second section of the questionnaire. These components cover everyday activities (lifting, work, driving, recreation), additional daily activities (personal care, reading), and subjective signs (pain severity, headaches, concentration, sleep). Higher scores indicate higher perceived disability levels in people with neck discomfort. The Neck Disability Index is a commonly used and extensively validated measure for assessing self-reported disability. After the distribution of the questionnaires, the data was carefully examined and interpreted.

Neck Disability Index Ratings

- 0–4 points (0–8%): no disability
- 5–14 points (10–28%) indicate a mild disability
- 15–24 points (30–48%) indicate a moderate disability
- 25–34 points (50–64%) indicate a severe disability
- 35–50 points (70–100%) indicate a complete disability

Participants

- Inclusion criteria for this study encompassed postgraduate female students aged between 18 and 25 years.
- Individuals with pre-existing medical conditions or known factors that could lead to neck pain, congenital cervical issues, traumatic or pathological cervical problems, and those with prior spinal cord injuries were excluded from the study.

Duration of the study: 5 months (490 samples had been collected for the study between November 29, 2023, and April 16, 2024.)
Timing of questionnaire completion: 20 minutes
IRB approval number: AUW/IHEC/WS-22-23/FHP-05 provided by the Institutional Human Ethics Committee of Avinashilingam University

Results

Data Analysis

The collected data were analysed using the software IBM SPSS Statistics version 26 using ANOVA and Duncan post-hoc tests. A variance analysis was carried out to ascertain the variations among the groups into which the sample was divided in relation to head positioning during smartphone operation and the total duration of handheld device utilisation. The classifications were delineated as follows: head flexion angles at 0°, 15°, 30°, 45°, and 60°, and the duration of handheld device usage categorised as 1–2 hours, 2–3 hours, 3–4 hours, 4–5 hours, and exceeding 5 hours. A one-way ANOVA was done between the groups to find out the significant difference in terms of head position, hours of smartphone and computer usage. Given the presence of significant differences identified, a subsequent Duncan post-hoc test was administered to determine which specific groups exhibited severe neck disability. The findings indicated that discernible differences existed among the groups.

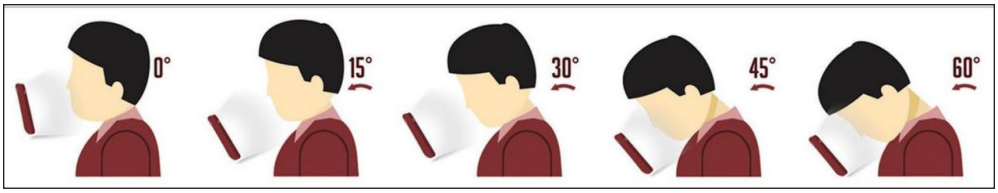

Figure 1.Degrees of Neck Flexion Position

Table 1.Data Reported by the Participants

Variables	n	%
Age of the students (years) (mean ± SD)	21 ± 2	
Amount of daily smartphone use (hours)		
1–2	64	13.0
2–3	119	24.2

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3–4	139	28.3
4–5	95	19.3
> 5	73	15.0
Reason of smartphone usage		
Using the internet	142	29.0
Social media	196	40.0
Education	125	25.5
Calling	23	5.0
Gaming	4	0.8
Warm up of neck muscles prior to using a cell phone		
Yes	124	25.0
No	366	75.0
Taking breaks while using their cell phones		
Yes	423	87.0
No	67	13.0
Position of the neck while using their smartphones		
0°	43	8.7
15°	190	38.7
30°	196	40.0
45°	43	9.0
60°	18	3.6
Hours of computer usage (hours per day)		
< 2	353	72.0
2–4	99	20.0
> 4	37	7.5

Table 1 shows that the majority of respondents (N = 139, 28.3%) have used mobile phones for more than 3–4 hours. The mean age of our study subjects was 21 ± 2 years. The purpose of usage of mobile phones was found to be higher for social media usage (N = 196, 40%) which is almost half of the sample chosen. It is vital to know that most of the text neck syndrome might result from an excessive view of social media. Most of the people with reported text neck syndrome did not use any warm-up exercises (N = 366, 75%). However, most people took breaks (N = 423, 87%) in between the use of mobile phones. In terms of degrees of neck flexion and usage of mobile phones, the majority (N = 196, 40%) of the respondents used 30 degrees. The study showed that 353 (72%) participants used a computer for less than two hours.

The study found that among PG students, text neck syndrome was prevalent in 31.5%. Table 2 shows that total of 490 postgraduate students, 218 (42%) had mild disability, 77 (18%) had moderate disability, and 26 (5%) had severe disability.

To analyse the goals of the research, the sample was divided into various categories in terms of head position while using smartphones and hours of usage of handheld devices. The categories are as follows: head flexion position as 0°, 15°, 30°, 45°, 60° and duration of using handheld devices usage as 1–2 hours, 2–3 hours, 3–4 hours, 4–5 hours, and more than 5 hours.

A one-way ANOVA was done between the groups to find out if there was any significant difference in terms of head position, hours of smartphone and computer usage.

Table 2.Neck Disability Index

Grades of disability	Frequency	Percentage
No disability	169	35
Mild disability	218	42
Moderate disability	77	18
Severe disability	26	5
Total	490	100

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Table 3.Hours of Daily Smartphone Usage and Neck Pain-Related Disability as Measured by the Neck Disability Index Questionnaire

No. of Hours	N	Mean	Std Deviation	Std Error	Sources of Variances	df	F	Significance	Subset for Alpha = 0.05		
									1	2	3
1–2	64	6.89	6.47	64	Between Groups	4	5.694	0.000**	6.89	-	-
2–3	119	7.73	7.52	119					7.73	-	-
3–4	139	8.30	6.46	139	Within Groups	485			8.30	8.30	-
4–5	95	10.23	7.89	95					-	10.23	10.23
> 5	73	11.76	8.66	73					-	-	11.76
Total	490	8.87	7.51	490	Total	489			-	-	-
Sig.									0.16	0.18	0.06

** Significant at 0.01 level

Table 3 shows the hours of usage of smartphones by the sample of the study. The sample was categorised into five groups according to the hours of usage as reported by the sample: 1–2 hours (N = 64, mean = 6.89 hours, SD = 6.47), 2–3 hours (N = 119, mean = 7.73 hours, SD = 7.52), 3–4 hours (N = 139, mean = 8.30 hours, SD = 6.46), 4–5 hours (N = 95, mean = 10.23 hours, SD = 7.89) and more than 5 hours (N = 73, mean = 11.76 hours, SD = 8.66). The sample self-reported measure of neck pain by neck disability index score was compared between the usage times. It was inferred that most samples used the smartphone with the prevalence of neck pain in the 3–4 hours category. Further 64 participants reported the highest usage of more than 5 hours. The Neck Pain Disability Index scale was used to compare the groups' self-reported neck pain with the number of hours they spent using smartphones each day.

ANOVA analysis was conducted to compare the difference between five groups based on hours of smartphone usage (1-2,2-3,3-4,4-5,>5 hours) and self-reported neck pain assessed through the Neck Pain Disability Index scale. And also compare the difference with in the each group and Neck Pain Disability Index scale The findings indicated significant variations in hours of usage and the self-reported level of neck disability index ($F(4,485) = 9.24$ $p < 0.01$). Consequently, it can be deduced that the posture of the neck while using smartphones contributes to the occurrence of text neck syndrome, as indicated by the score on the neck disability index.

Further Duncan post-hoc test was conducted to ascertain which among the groups had severe neck disability. It was inferred that increased hours of Smartphone usage leads to increased neck disability, with 1–2 hours reporting lesser pain (N = 64, mean = 6.89) than other groups. It may also be inferred that more than five hours of mobile phone usage leads to higher reporting of neck disability (N = 73, mean = 11.76). Thus, similar to earlier studies, this study proved that increased phone usage leads to neck disability.[15]

Table 4. Neck Position while Using Smartphones and Neck Pain-Related Disability as Measured by the Neck Disability Index Questionnaire

Degree of Neck Flexion Position	N	Mean	Std Deviation	Std Error	Sources of Variances	df	F	Significance	Subset for Alpha = 0.05		
									1	2	3
0°	43	7.2	6.50	0.99	Between Groups	4	9.24	0.000**	7.2	-	-
15°	190	7.11	6.25	0.45					7.11	-	-
30°	196	9.65	7.65	0.54	Within Groups	485			9.65	9.65	-
45°	43	12.23	9.13	1.39					-	12.23	12.23
60°	18	14.83	9.50	2.24	Total	489			-	-	14.83
Total	490	8.87	7.51	0.33					-	-	-
Sig.									0.120	0.096	0.092

**-Significant at 0.01 level

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Table 4 shows the neck positions of the study participants while using smartphones. The sample was categorised into four groups according to the degree of neck flexion position of usage as reported by the sample: 15° (N = 190, mean = 7.11, SD = 6.25), 30° (N = 196, mean = 9.65, SD = 7.65), 45° (N = 43, mean = 12.23, SD = 9.13), and 60° (N = 18, mean = 14.83, SD = 9.50). The sample self-reported measure of neck pain by neck disability index score was compared between the Neck positions while using their Smartphone. It was inferred that most participants used smartphones with the prevalence of neck pain in the 30° of neck flexion category. Further 34 participants reported 45° of neck flexion.

ANOVA analysis was conducted to compare the different between four groups based on the position of the neck during smartphone useage (0°, 15°, 30°, 45°, 60°) and self-reported neck pain assessed through the Neck Pain Disability Index scale. And also compare the difference with in the each group and Neck Pain Disability Index scale The findings indicated significant variations in neck position during smartphone use and the self-reported level of neck disability index ($F(4,485) = 9.24$ $p < 0.01$). Consequently, it can be deduced that the posture of the neck while using smartphones contributes to the occurrence of text neck syndrome, as indicated by the score on the neck disability index.

A further Duncan post-hoc test was conducted to ascertain which among the groups had severe neck disabilities. It was inferred that increased neck flexion position while using their Smartphone usage leads to increased neck disability, with 15° of neck flexion causing less pain (N = 190, mean = 7.11) than other groups. It may also be inferred that 60° of neck flexion while using their Smartphone usage leads to higher reporting of neck disability (N = 18, mean = 14.83). Thus it is proved that increased neck flexion position leads to neck disability which has been proven in earlier studies too.[16]

Discussion

The investigation conducted in this research revealed that the incidence of text neck syndrome among postgraduate students amounted to 31%. An analogous study carried out in India, encompassing social groups similar to those in our research; found that 32% of physiotherapy students suffered from text neck syndrome.[17] A survey conducted among 2353 university students in Korea revealed that 34.0% of them encountered neck impairments.[18] A research study at Aljouf University, involving cell phone users from medical and dental colleges, found that 71.2% of the 282 students experienced cervical discomfort.[9] Recent research conducted in India noted that 42.5% of the participants displayed neck disabilities.[8]The alignment of the head, neck, and body while using cell phones can disrupt the normal biomechanics of the spine, resulting in muscle spasms and neck pain.[6,19–22] Constantly bending forward increases the chance of developing early arthritis and changing the posture of the neck, which can cause irreversible harm.[23–25]

A substantial proportion of participants in our research study disclosed utilising their smartphones for over 3 to 4 hours daily (31.5%) and exceeding 5 hours per day (17.3%). A statistical procedure known as analysis of variance (ANOVA) was conducted in order to compare various groups based on their daily smartphone usage durations and self-reported neck pain levels, measured using the Neck Pain Disability Index scale. The findings indicated notable distinctions among the different hours of smartphone utilisation and the reported levels on the neck disability index scale ($F(4,485) = 5.694$, $p < 0.001$). Subsequently, a Duncan post-hoc examination was executed to identify the group displaying more severe neck disability, revealing that increased smartphone usage hours corresponded to heightened neck disability, with individuals using their phones for 1–2 hours reporting lower pain levels (N = 64, mean = 6.89) compared to the other groups. Furthermore, it could be deduced that individuals utilising their mobile phones for over five hours daily were more inclined to report increased neck (N = 73, mean = 11.76), suggesting a plausible association between excessive phone usage and musculoskeletal symptoms.

Thus, it is evident that escalated phone usage contributes to neck disability, a phenomenon supported by previous studies. Two studies carried out in Korea and Brazil demonstrated that 42.1% and 76.6% of the participants, respectively, allocated more than 4 hours per day to the utilisation of their mobile devices.[3,20] The significant prevalence of individuals spending an extensive amount of time exceeding 4 hours each day on mobile phones poses a noteworthy concern due to the association between musculoskeletal symptoms in the upper limbs and the period of smartphone usage.[20] Moreover, the duration of time spent on mobile phones not only shows a correlation with the intensity of neck discomfort ($r = 0.14$, $p = 0.001$) but also with the duration of the discomfort ($r = 0.1$, $p = 0.036$).[21]

Regarding the positioning of the neck, it was observed that the majority of students maintained a neck position of 30° while using their smartphones (41.8%). Furthermore, students who adopted a 60° neck position experienced greater neck disability in comparison to those with 15°, 30°, and 45° neck positions. A comparative analysis was performed using analysis of variance (ANOVA) to assess

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the different neck postures individuals assumed when utilising smartphones and their self-reported levels of neck discomfort, evaluated through the Neck Pain Disability Index scale. The findings indicated significant variances among the neck positions during smartphone usage and the reported levels of neck disability index scale ($F(4,485) = 9.24$ $p < 0.01$). Subsequently, a Duncan post-hoc test was performed to determine which group exhibited more severe neck disabilities due to increased flexion of the neck while using a smartphone. The results showed that higher degrees of neck flexion during smartphone usage were associated with increased neck disability, with 15° of neck flexion resulting in lower pain levels (N = 190, mean = 7.11) compared to other categories.

Additionally, it can be deduced that a 60° neck flexion while using smartphones leads to a higher incidence of reported neck disability (N = 18, mean = 14.83). Therefore, it is evident that heightened neck flexion positions contribute to neck disability, a phenomenon supported by previous studies.[25]

An investigation of the relationship between postural angles and the incidence of shoulder and neck pain was carried out in Portugal. The study's conclusions showed that people with the forward head position were more likely to report having neck pain than people without it (29.8% vs 8.4%). A different study conducted in Hong Kong supported this result by showing a negative correlation, even after correcting for age ($r = –0.3101$, $p = 0.015$), between the craniovertebral angle (CV) and the Northwick Park Neck Pain Questionnaire ($r = –0.395$, $p = 0.002$). In other words, a lower CV angle—a sign of a forward head posture—was associated with a higher degree of neck impairment.[26]

The most of participants in our research study spent more than 2 hours per day (82.6%) and 4.2% spent more than 4 hours daily on computer usage, which was compared across different time frames. The findings indicated that individuals in the < 2 hours per day category experienced a higher prevalence of neck pain. Five samples indicated the highest usage of over 4 hours per day. An ANOVA analysis was performed to compare computer usage hours and self-reported neck pain using the neck disability index scale. The outcomes revealed significant variances between computer usage hours and the reported neck disability index score ($F(2,139) = 3.401$, $p < 0.03$). Hence, it can be inferred that excessive smartphone usage might contribute to text neck syndrome as per the neck disability index score. A subsequent Duncan post-hoc test was executed to identify the group with increased neck disability due to more hours of computer usage per day, showing that < 2 hours per day reported lower pain (N = 19, mean = 6.63) compared to other groups. It can also be interpreted that using the computer for over four hours daily results in a higher reporting of neck disability (N = 5, mean = 15.40).

It follows that consistent with earlier findings, there is a clear correlation between greater computer usage and neck impairment. Although there was no difference in the neck's position in relation to the trunk when using the computer, the "low" monitor condition showed more bending in the atlanto-occipital and upper cervical joints. To be more precise, the average maximum flexion of the neck increased in correlation with the "low" monitor.[27]

According to our study, a significant number of postgraduate students (40%) had extended neck bending moments when using smartphones or other electronic devices for social media, which may be contributing to the high prevalence of text neck syndrome.

Our study shows that only 25% of students warmed up their neck muscles before using their smartphones, but 87% took regular breaks while using them. A study conducted in Pakistan with 500 medical students found that only 6% warmed up their neck muscles before using their phones, and only 12% took breaks while using them.[4] Neck strains from extended smartphone use may be avoided by implementing stretching exercises, warming up the neck muscles, and setting aside time every 20 minutes to rest the neck muscles.[28]

Future Scope

The future scope encompasses the possibility of conducting further studies on a larger scale, with a larger sample size, in multi-centred settings to achieve extensive research for generalised results that accurately represent the entire population. The insufficiency of studies examining text neck syndrome within the adolescent population persists.

Clinical Implications

Prevention proves to be more effective than remediation; as such, the main duty of physiotherapists is to promote awareness of text neck syndrome among young adults, particularly within a larger demographic, underlining the importance of physical exercises, and disseminating information within educational institutions promptly to avoid the onset of this text neck syndrome caused by technology.

Conclusion

The research undertaken in this study brought to the forefront that the impact of text neck syndrome among postgraduate students was 31.5%. The results revealed that increased degrees of neck flexion while using smartphones were related to heightened neck disability, and prolonged periods of smartphone and computer use were associated with increased neck disability.

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