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Association Between Perceived Stress and Altered Pain Pressure Threshold in Upper Trapezius and Sternocleidomastoid in Smartphone Addict Young Adult: A Pilot Cross-Sectional Study

Anjana S Shetty[1], Dr. R. Kamalakannan[2]

[1]BPT Student, Institute of Physiotherapy, Srinivas University, Mangalore, India.
[2]Associate Professor, Institute of Physiotherapy, Srinivas University, Mangalore, India.

Corresponding Author: Anjana S Shetty

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ABSTRACT

Background: Smartphones have become an essential part of daily life, particularly among young adults. Excessive smartphone use may lead to smartphone addiction, which has been associated with psychological stress and musculoskeletal problems, including altered pain sensitivity in cervical muscles.

Aim: To evaluate the association between perceived stress and pressure pain threshold (PPT) of the upper trapezius and sternocleidomastoid muscles in smartphone-addicted young adults.

Methods: This pilot cross-sectional observational study included 10 smartphone-addicted young adults aged 18–25 years selected through convenience sampling after obtaining written informed consent. Smartphone addiction was assessed using the Smartphone Addiction Scale–Short Version (SAS-SV), perceived stress using the Perceived Stress Scale (PSS-10), and PPT of the upper trapezius and sternocleidomastoid muscles using a handheld pressure algometer. Correlation analysis was performed to examine the relationship between perceived stress and PPT.

Results: The mean age of participants was 22.80 ± 0.79 years, with equal numbers of males and females. The mean SAS-SV score was 33.00 ± 1.41 and the mean PSS score was 26.80 ± 3.99. Mean PPT was 2.18 ± 0.14 kg/cm² for the upper trapezius and 1.67 ± 0.42 kg/cm² for the sternocleidomastoid. Perceived stress showed a moderate negative correlation with upper trapezius PPT ($r = -0.585$, $p = 0.076$) and a weak negative correlation with sternocleidomastoid PPT ($r = -0.378$, $p = 0.281$). These correlations were not statistically significant.

Conclusion: Smartphone-addicted young adults demonstrated moderate perceived stress and reduced cervical muscle PPT. Although higher perceived stress was associated with lower PPT, the associations were not statistically significant. Larger studies are needed to confirm these findings.

Keywords: Smartphone addiction, perceived stress, pressure pain threshold, upper trapezius, sternocleidomastoid.

INTRODUCTION

Smartphones have become an integral part of modern life and are widely used for communication, education, entertainment, internet browsing, photography, social networking, and gaming. Their portability and multifunctionality have resulted in prolonged daily usage across all age groups, particularly among young adults. [12]

During smartphone use, individuals commonly adopt a forward head posture with sustained neck flexion while viewing the screen. Holding this position for prolonged periods of time puts continuous strain on the cervical spine and associated soft tissues, which can lead to musculoskeletal disorders, especially in the neck and upper back. [1,3]

A number of studies have linked excessive smartphone use with adverse physical and psychological outcomes. Neck pain, muscle fatigue, decreased cervical range of motion, and postural deviations are often reported by individuals with problematic smartphone use. Prolonged use of smartphones has also been linked to musculoskeletal discomfort in the neck and upper back, wrists, and other areas of the musculoskeletal system. [3,4]

Beyond its physical effects, excessive smartphone use may negatively influence psychological well-being. Increased dependence on smartphones has been associated with social withdrawal, loneliness, emotional difficulties, anxiety, and depressive symptoms. Excessive users may engage less frequently in face-to-face social interactions and experience greater difficulty expressing emotions than individuals with healthier smartphone usage patterns.[12]

Smartphone ownership has increased rapidly worldwide, with research indicating that the majority of adults aged 18–44 years use their smartphones almost continuously throughout the day. Similarly, recent world reports suggest that over half of the global population actively uses social media, spending an average of more than two hours per day on such platforms. [5,12] This prolonged screen time means that you are also more likely to be stuck in bad postural habits for longer.

Pain threshold is the minimum intensity of a stimulus at which it is perceived as painful. It is commonly assessed by gradually increasing a mechanical or electrical stimulus until the individual first reports pain. Pain serves as an important protective mechanism by alerting the body to potential tissue damage and remains one of the most common reasons for seeking healthcare. [4,5].

Non-specific neck pain is one of the most common musculoskeletal complaints and can be a major hindrance to everyday living and quality of life. Multiple factors contribute to its development, including prolonged sitting, poor posture, repetitive movements, muscle overuse, psychological stress, and inappropriate sleeping positions. [6,7]

Stretching exercises targeting cervical muscles, particularly the sternocleidomastoid and upper trapezius, are commonly prescribed to reduce pain and improve muscle flexibility. However, evidence comparing the relative effectiveness of stretching these muscles remains limited, highlighting the need for further investigation. [11]

Stress is another important factor associated with musculoskeletal health. Persistent psychological stress has been identified as a potential contributor to long-term musculoskeletal pain, especially among adolescents and young adults. Although several studies have demonstrated a relationship between stress and musculoskeletal symptoms, the underlying mechanisms are not yet fully understood.[11,12]

Population-based studies have consistently reported a high prevalence of musculoskeletal pain among adolescents. Findings from the Young HUNT study demonstrated that a substantial proportion of adolescents experienced chronic pain, with many reporting pain at multiple body sites. Similar trends have been observed in Swedish adolescents, where neck and shoulder pain has been associated with psychosocial stress and other psychological factors. Collectively, these findings suggest a close relationship between perceived stress and musculoskeletal pain in young populations, emphasizing the importance of further research in this area. [11,12,13]

MATERIALS & METHODS

This pilot cross-sectional study included 10 young adults aged 22–24 years. Ethical

approval was obtained from the Institutional Ethics Committee before participant recruitment. Participants were selected using a convenience sampling method. Male and female students who satisfied the eligibility criteria and voluntarily signed written informed consent forms were enrolled in the study.

Eligibility for participation was confirmed by administering the Smartphone Addiction Scale–Short Version (SAS-SV). Only individuals whose scores met or exceeded the recommended cut-off values were included in the analysis. Before the assessments, demographic characteristics such as age, sex, height, weight, body mass index (BMI), occupation, and the side of neck pain were recorded using a structured data collection form.

Perceived stress was evaluated using the Perceived Stress Scale (PSS-10). Pressure pain threshold (PPT) of the bilateral upper trapezius and sternocleidomastoid muscles was measured using a handheld pressure algometer. Pressure was gradually increased at each test site until the participant first indicated that the sensation had changed from pressure to pain. The value displayed on the algometer at that moment, expressed in kg/cm^2, was documented for statistical analysis.

The collected information was entered into Microsoft Excel and analysed using IBM SPSS software. Continuous variables were summarised using mean ± standard deviation (SD), median with interquartile range (IQR), and minimum–maximum values, while categorical variables were presented as frequencies and percentages. Pearson's correlation coefficient was used to examine the relationships among smartphone addiction (SAS-SV), perceived stress (PSS), and pressure pain threshold (PPT). Statistical significance was determined using a two-tailed p-value < 0.05.

Inclusion criteria: Young adults aged 18–25 years, both males and females, who met the criteria for smartphone addiction based on the Smartphone Addiction Scale–Short Version (SAS-SV), were willing to participate by providing written informed consent, and were able to understand and complete the study questionnaires were included in the study.

Exclusion criteria: Individuals with a history of neck surgery or recent neck injury, diagnosed neurological or musculoskeletal disorders affecting the neck, congenital deformities of the cervical spine, current use of pain-relieving or muscle relaxant medications, or those who were unwilling to participate in the study were excluded.

Outcome Measures:

PERCEIVED STRESS SCALE: The Perceived Stress Scale (PSS) is a psychological instrument designed to measure the degree to which situations in one's life are appraised as stressful. It evaluates how unpredictable, uncontrollable, and overloaded respondents find their lives during the past month.

Smartphone Addiction Scale–Short Version (SAS-SV): The SAS-SV was used to assess the level of smartphone addiction among participants. It is a validated self-administered questionnaire consisting of 10 items rated on a 6-point Likert scale. Higher scores indicate greater smartphone addiction. Participants who met the recommended cut-off scores (≥31 for males and ≥33 for females) were included in the study.

Testing instrument: Handheld algometer.

Hand-held Algometer:

Handheld also called a pressure algometer or pressure pain threshold meter is a portable instrument used to objectively measure the Pressure Pain Threshold (PPT). A handheld algometer is a device that applies gradually increasing pressure to a muscle or soft tissue until the person first perceives the sensation as painful. The pressure at that moment is recorded as the Pressure Pain Threshold (PPT).

Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0. Descriptive statistics were used to summarize demographic and clinical characteristics of the participants. Continuous variables including age, height, weight, BMI, Smartphone Addiction Scale–Short Version (SAS-SV), Perceived Stress Scale (PSS), and Pressure Pain Threshold (PPT) of the upper trapezius and sternocleidomastoid muscles were expressed as mean, standard deviation, median, minimum, maximum, and range. Categorical variables such as gender, occupation, BMI category, and site of pain were presented as frequencies and percentages.

Pearson's correlation coefficient (r) was used to determine the relationship between perceived stress and pressure pain threshold of the upper trapezius and sternocleidomastoid muscles. Correlation analysis was also performed to evaluate the relationship between PPT values of the two muscles. Statistical significance was set at $p < 0.05$.

RESULT

A pilot cross-sectional study included 10 young adults. The participants had a mean age of 22.80 ± 0.79 years, with ages ranging from 22 to 24 years. Equal numbers of male and female participants were included (50% males and 50% females), and all participants were students.

Table 1. Demographic Characteristics of Participants (N = 10)

Age (years)	Frequency (n)	Percentage (%)
22	4	40.5
23	4	40.0
24	10	20.0
Total	10	100.0

Age Summary

Variable	Mean ± SD	Median (IQR)
Age (years)	22.80 ± 0.79	23.00(22.00-23.25)

The mean height was 166.60 ± 11.08 cm, mean weight was 64.20 ± 16.53 kg, and mean BMI was 22.69 ± 4.01 kg/m². Based on BMI classification, 60% of participants had normal BMI, 30% were overweight, and 10% were underweight. Pain was equally distributed between the right and left sides (50% each).

Table 2. Descriptive Statistics of Outcome Variables (N = 10)

Outcome Variable	Mean ± SD	Median (IQR)	Min–Max
Perceived Stress Scale (PSS)	26.80 ± 3.99	27.50 (24.00-30.25)	21–33
Pressure Pain Threshold (Upper Threshold kg/cm^2)	2.18 ± 0.14	2.20 (2.10-2.30)	1.90–2.40
Pressure Pain Threshold (Sternocleidomastoid kg/cm^2)	1.67 ± 0.42	1.75 (1.40-2.00)	1.10-2.40
SAS-SV	32.90 ± 1.37	33.00 (32.00-34.00)	31-35

The mean Perceived Stress Scale (PSS) score was 26.80 ± 3.99, indicating a moderate level of perceived stress among participants. The mean Pressure Pain Threshold (PPT) was 2.18 ± 0.14 kg/cm² for the upper trapezius muscle and 1.67 ± 0.42 kg/cm² for the sternocleidomastoid muscle.

The mean SAS-SV score among the participants was approximately 33, confirming that the recruited participants fulfilled the criteria for smartphone addiction according to the study inclusion criteria.

Correlation analysis showed a moderate negative correlation between perceived stress and pressure pain threshold of the upper trapezius muscle ($r = -0.585$, $p = 0.076$), suggesting that participants with higher perceived stress tended to have lower pressure pain thresholds. However, this association did not reach statistical significance.

A weak negative correlation was observed between perceived stress and pressure pain threshold of the sternocleidomastoid muscle ($r = -0.378$, $p = 0.281$), which was also not statistically significant.

The correlation between pressure pain thresholds of the upper trapezius and

sternocleidomastoid muscles was positive (r = 0.408, p = 0.241), indicating that participants with higher PPT in one muscle tended to have higher PPT in the other muscle; however, this relationship was also not statistically significant.

DISCUSSION

The present pilot cross-sectional study investigated the association between perceived stress and pressure pain threshold in the upper trapezius and sternocleidomastoid muscles among smartphone-addicted young adults.

The findings demonstrated a moderate negative relationship between perceived stress and pressure pain threshold of the upper trapezius muscle. This indicates that participants with higher perceived stress generally exhibited greater pain sensitivity, as reflected by a lower pressure pain threshold. A similar but weaker negative relationship was observed for the sternocleidomastoid muscle.

Although these relationships were not statistically significant, the direction of the correlations is clinically meaningful and agrees with previous evidence suggesting that psychological stress may influence pain perception through increased muscle tension, altered neuromuscular control, and central sensitization mechanisms.

Excessive smartphone use often results in prolonged forward head posture and sustained contraction of the cervical muscles, particularly the upper trapezius and sternocleidomastoid. These postural changes may contribute to muscle fatigue, tenderness, reduced pressure pain threshold, and neck discomfort. In addition, higher stress levels may further increase muscle activity and pain sensitivity.

The absence of statistically significant findings in the present study is likely due to the small sample size (n = 10), which limits statistical power. As this was a pilot study, its primary purpose was to assess feasibility and provide preliminary evidence for future research. Studies with larger sample sizes are needed to determine whether these observed relationships become statistically significant. Despite these limitations, the study provides valuable preliminary evidence that perceived stress may be associated with altered pain pressure thresholds among smartphone-addicted young adults and highlights the importance of considering both psychological and musculoskeletal factors in this population.

CONCLUSION

This pilot cross-sectional study found that smartphone-addicted young adults demonstrated moderate levels of perceived stress and reduced pressure pain thresholds in the upper trapezius and sternocleidomastoid muscles. A moderate negative correlation was observed between perceived stress and pressure pain threshold of the upper trapezius, while a weak negative correlation was observed for the sternocleidomastoid muscle. However, these associations were not statistically significant within this small pilot sample.

The findings suggest a possible relationship between psychological stress and increased pain sensitivity in smartphone-addicted young adults. Future studies with a greater sample size are recommended to verify the present findings and further investigate the relationship among smartphone addiction, perceived stress, and musculoskeletal pain sensitivity.

Declaration by Authors

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