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Digital screen time and temporomandibular joint disorders in young students

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Abstract:
Excessive digital screen time is increasingly linked to musculoskeletal complaints in young adults. Therefore, it is of interest to evaluate the relationship between screen time and temporomandibular joint (TMJ) disorders among students. A cross-sectional study was conducted on 384 undergraduate and postgraduate students using a screen-time questionnaire and a joint pain index. A clear dose-dependent rise in TMJ pain, headache and jaw dysfunction was observed with increasing daily screen exposure. Screen-time reduction and ergonomic awareness are recommended as preventive measures for young students. This study provides evidence of a dose-dependent association between excessive digital screen time and temporomandibular joint (TMJ) symptoms among undergraduate and postgraduate students.

Keywords: Digital screen time, temporomandibular joint disorders, Bruxism, Musculoskeletal pain, young adults

Background:
The use of screens is becoming an increasingly important aspect of our lives in this era of modernity and the digital age **[1]**. Every decade of life involves the use of digital screens in one way or another, from social media and entertainment to online classes and academic presentations **[2]**. Digital screen time (DST) is defined as time spent using different digital devices such as mobile phones, computers, laptops, tablets and television **[3]**. This use of digital screens increased further after COVID-19 among teenagers and young adults, whether in the form of online classes, work-from-home arrangements or the use of social media to interact with the outer world **[4]**. Young adults' exponential increase in smartphone usage and increased use of digital platforms has raised major public health concerns, especially with the hazards of musculoskeletal pain **[5]**. Extensive screen time has been linked to musculoskeletal pain, particularly in the neck, shoulders and upper limbs, which also includes temporomandibular disorders according to existing literature **[6]**. In addition to poor postural ergonomics, spending too much time on digital screens can lead to stress and poor sleep, both of which are key contributing factors to temporomandibular disorders **[7]**. Numerous studies have showed the clear link between excessive smartphone use and temporomandibular joint disorders brought on by stress-related bruxism **[8].** Therefore, it is of interest to report the association between excessive digital screen time and the signs and symptoms of temporomandibular joint dysfunction among young students, so as to inform preventive strategies and raise awareness of this emerging public health concern.

Methodology:
Study design and setting:
The current cross-sectional study on digital screen-time usage was carried out over a six-month period among 384 undergraduate and post-graduate students enrolled at an institution. The study design analysed concurrent data on student exposure (digital screen habits) and clinical outcomes (TMJ disorder signs and symptoms). Before taking part in the study, each subject gave verbal consent. Eligibility required full completion of both a joint pain index evaluation and a screen-time questionnaire. The Institutional Review Board of I.T.S. Dental College, Muradnagar, Uttar Pradesh, accepted the study and granted ethical permission under protocol number ITSCDSR//IIEC/RP/2025/034.

Sample size estimation:
In order to examine the prevalence of temporomandibular disorders (TMD) and bruxism in students with and without stress associated with smartphone deprivation, the sample size was determined using OpenEpi software, assuming the following parameters: estimated frequency of stress and related bruxism/TMD, 50%; confidence limit, 5%; design effect, 1; and significance level (alpha) 0.05 (95% confidence level). The necessary sample size was calculated to be 384 based on an expected student population (where N > 1,000,000). A total of 405 questionnaires were issued in order to account for possible attrition or incomplete responses. A final sample of 384 was used for the final data analysis after samples with missing or inconsistent data were eliminated.

Sampling and eligibility:
A non-probability convenience sampling technique was employed to recruit participants who met the specific eligibility requirements. The participants ranged in age from 18 to 25 years. The goal of the study was explained to each student and confidentiality was secured. The study comprised both undergraduate and graduate students who were present during the examination and who regularly use at least one digital screen. The study excluded students who were reluctant to participate, was receiving orthodontic treatment, or had previously experienced temporomandibular issues for any other reason.

Statistical methods:
Quantitative variables were grouped into ordered intervals. A Chi-square test of independence was selected to evaluate the null hypothesis that gender distribution is independent of age-group distribution across the matching study population. A descriptive correlation analysis linked the categorical screen-time intervals directly with incremental health-outcome percentages.

Results:

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In this cross-sectional study a total of 384 matched participants were successfully validated and analysed. Out of the 384 students, 289 were females and 95 were males **(Figure 1).** The age composition spanned 18-25 years with a mean age of 21.73 years and the maximum number of participants was in the 21-year age group, with approximately 79 female participants **(Figure 2).** Approximately twenty to twenty-five percent of students reported having mild-to-moderate temporomandibular joint (TMJ) pain. With baseline scores ranging from two to three on a ten-point scale, the mean severity index for regional TMJ discomfort was comparatively modest. On the same scale, headaches were reported to be significantly more intense, averaging between five and six. Interestingly, 40-45% of participants reported having headaches, which were mostly focused in the frontal and temporal regions. Clinical manifestations such as clicking or popping sounds within the TMJ were frequently associated with active discomfort. Pain was not confined to the orofacial region alone but often radiated into the neck, shoulders and back, indicating a broader musculoskeletal involvement. Additionally, a number of subjects had concurrent joint issues, especially with the knees and cervical spine. Functional impairment was also documented, with nearly 15% of cases demonstrating moderate restriction in jaw movements. Regarding screen-time characteristics, smartphone use constituted the dominant mode of screen interaction across the cohort, with average daily usage ranging between three and six hours. Laptop and desktop computer engagement contributed an additional two to four hours per day, while television and tablet exposure was minimal. A secondary pattern of background screen utilisation was also observed, averaging two to three hours daily and was most frequently concentrated during evening hours. Within the overall cohort, a distinct high-exposure subgroup was identified. Approximately one-quarter of participants (≈25%) reported cumulative screen-time exceeding eight hours per day across all devices. This subgroup represents the highest exposure bracket and highlights the presence of sustained, multi-device engagement among a significant proportion of students. Analysis of daily screen-time tiers revealed a clear dose-dependent escalation in the prevalence and severity of TMJ pain and associated symptoms. Students reporting less than three hours of daily screen exposure demonstrated the lowest prevalence of TMJ pain (10-12%), with headache severity remaining mild (mean VAS 2-3/10) and clinical presentation largely asymptomatic. Those within the 3-6 hour exposure group exhibited a higher prevalence of TMJ pain (20-25%), accompanied by moderate headache severity (VAS 4-5/10) and incremental occurrence of joint clicking. The 6-8 hour exposure group showed further escalation, with TMJ pain prevalence rising to 30-35% and headache severity reaching moderate-to-severe levels (VAS 6-7/10); this group frequently reported concurrent neck and back discomfort, indicating broader musculoskeletal involvement. The highest exposure bracket, comprising individuals exceeding eight hours of daily screen-time, demonstrated the most severe outcomes, with TMJ pain prevalence reaching 40-45% and headache severity escalating to VAS scores of 7-9/10. Clinical findings in this subgroup included strong associations with headaches, teeth clenching and restricted jaw function, underscoring the compounded impact of prolonged digital engagement on craniofacial and cervical health **(Table 1).**

Table 1: Correlation Analysis of Daily Screen-Time Tiers vs. Physical Symptoms

Daily Screen-Time Group	TMJ Pain Prevalence	Headache Severity (Mean VAS)	Clinical Findings & Presentation
< 3 Hours	10-12%	Mild (2-3 / 10)	Mostly asymptomatic presentation
3-6 Hours	20-25%	Moderate (4-5 / 10)	Incremental occurrence of joint clicking noises
6-8 Hours	30-35%	Moderate-Severe (6-7 / 10)	Concurrent neck and back discomfort common
> 8 Hours	40-45%	Severe (7-9 / 10)	Strong association with headaches, teeth clenching and restricted jaw function

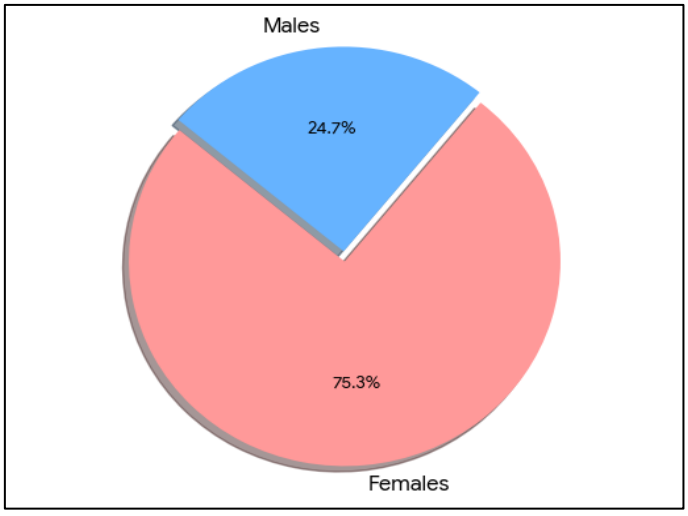


Figure 1: Gender distribution of population

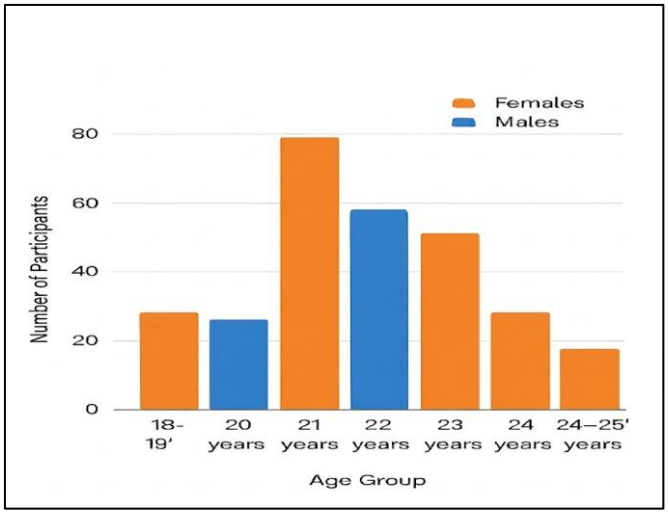


Figure 2: Age and gender distribution of participants

Discussion:

The present cross-sectional study, involving 384 validated participants, provides important insights into the relationship between digital screen-time exposure and (TMJ) temporomandibular joint pain among young adults. The demographic distribution, with a predominance of female participants (289 vs. 95 males), is consistent with prior epidemiological surveys that have reported higher musculoskeletal complaints in female cohorts, possibly due to hormonal and psychosocial factors influencing pain perception **[9].** This study demonstrates a clear dose-dependent association between prolonged screen-time and the prevalence of TMJ pain, headaches and musculoskeletal discomfort among young adults. Students with cumulative screen exposure exceeding eight hours per day exhibited the highest prevalence of TMJ pain (40-45%) and severe headache intensity (VAS 7-9/10), underscoring the compounded impact of sustained digital engagement on craniofacial and cervical health. Recent literature corroborates these findings. Pei *et al.* reported that problematic smartphone use (PSU) significantly increased the risk of pain-related TMD, with affected individuals experiencing more severe symptoms compared to non-PSU counterparts **[10]**. Their study found a prevalence of TMD symptoms in 66.4% of young adults, closely aligning with the elevated rates observed in our high-exposure subgroup. Similarly, emerging evidence suggests that excessive smartphone use contributes to musculoskeletal strain, particularly in the cervical spine and shoulders, due to sustained forward head posture and repetitive jaw clenching **[11].** The high prevalence of headaches (40-45%) in our cohort is consistent with recent reports linking digital device use to tension-type headaches and migraine exacerbation. Prolonged screen exposure has been shown to increase visual strain and cervical muscle tension, both of which are established headache triggers **[12].** The co-occurrence of TMJ pain with cervical and shoulder discomfort in our study supports the concept of a broader musculoskeletal involvement, echoing findings from biomechanical analyses that emphasise the interconnectedness of craniofacial and cervical systems **[13]**. Nearly 15% of subjects had functional disability, which emphasises the clinical significance of this relationship. In the high-exposure subgroup, restricted jaw motion and joint clicking were especially noticeable; indicating that prolonged digital use may worsen functional impairment. Similar correlations between extended computer use and decreased mandibular mobility have been reported in occupational studies, supporting the necessity of ergonomic interventions **[14].** The identification of a high-exposure subgroup (≈25% of participants) is especially concerning from a public-health perspective. The most severe results were seen in this cohort, with headache severity reaching VAS 7-9/10 and TMJ discomfort prevalence of 40-45%. These results demonstrate the compounding effects of extended digital use on cervical and craniofacial health, supporting focused preventive measures including early-intervention programmes, screen-time reduction and ergonomic awareness.

Conclusion:

We show the increasing prevalence of TMJ pain and related musculoskeletal problems among young adults who use screens. The dose-dependent escalation of symptom severity with increased screen exposure underscores the urgent need for preventive measures in academic and professional settings.

Limitations:

Causal inference is constrained by the cross-sectional design and the use of self-reported screen time raises the possibility of recall bias. However, the reliability of the findings is reinforced by the large sample size and the incorporation of clinical examination.

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