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Associations between screen exposure, pain, postural alignment, physical activity, and quality of life in young adults: A cross-sectional study

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MAIN POINTS

- Increased screen exposure is significantly associated with higher levels of pain and neck disability in young adults.
- High screen use is linked to postural deterioration, reduced spinal flexibility, and lower physical activity levels.
- Excessive screen time adversely affects both the physical and mental components of quality of life, underscoring the need for preventive strategies.

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ABSTRACT

Aim: To examine the associations between screen exposure and pain, postural alignment, spinal flexibility, physical activity level, and quality of life in young adults.

Materials and Methods: Of the 283 young adults included in the study, 213 (75.3%) were female and 70 (24.7%) were male. Screen exposure was evaluated using the Screen Time Exposure Form, while addiction levels were assessed using the Smartphone Addiction Scale--Short Form and the Young Internet Addiction Test--Short Form. Pain and disability levels were measured using the Numeric Pain Rating Scale (NPRS) and the Neck Disability Index (NDI). Postural assessment was performed using cranio-cervical angle (CCA) measurement and a scoliometer, while spinal flexibility was determined using the forward reach test and the lateral bending test. Physical activity levels were assessed using the Short Form of the International Physical Activity Questionnaire (IPAQ), and quality of life was evaluated using the Short Form-36 Quality of Life Survey (SF-36).

Results: Of the participants, 4.2% had very low, 37.1% low, 42.1% high, and 16.6% very high screen exposure. Strong, statistically significant positive correlations were found between screen exposure and both the NDI and NPRS ($p<0.05$). In contrast, strong negative correlations were observed between screen exposure and IPAQ scores, and between screen exposure and the physical and mental health subscales of the SF-36 ($p<0.05$). Additionally, screen exposure showed strong negative correlations with CCA and with the results of the trunk rotation, forward reach, and lateral bending tests ($p<0.05$).

Conclusion: Increased screen exposure in young adults was significantly associated with higher pain and neck disability, postural deterioration, reduced spinal flexibility, lower physical activity levels, and decreased quality of life. These findings highlight the importance of preventive strategies aimed at limiting excessive screen use.

Keywords: Screen exposure, Posture, Physical activity, Quality of life
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INTRODUCTION

With the rapid advancement of digital technologies, the duration of smartphone, tablet, and computer use has markedly increased, particularly among young adults [1]. This trend is further amplified by the growing digitalization of both academic and social environments. The World Health Organization and multiple international studies report that daily screen time among young individuals has doubled in recent years, with potentially substantial consequences for behavioral, physical, and psychosocial health [2]. In this context, young adults are considered a high-risk population owing to prolonged sedentary behavior and intensive screen exposure [3].

Recent national studies indicate that smartphone use has become highly prevalent among adults in Turkey, with a substantial proportion reporting prolonged daily usage, as evidenced by research showing that 85.6% of young adults have used a smartphone for at least three years and 77.3% use it for more than four hours per day [4]. Spending long periods of time in front of screens, especially smartphones and the internet, has become a current health issue affecting all segments of society, leading to many negative physical and mental effects [5]. Increased screen time in young adults is identified as a significant risk factor for the development of musculoskeletal disorders [6]. Spending long periods in front of a screen contributes to the development of poor posture, inadequate ergonomics, neck pain, and other related symptoms [7]. Increased screen time, especially in the cervical region, leads to tension in the muscles, triggering pain and causing individuals to adopt different head positions, thus predisposing them to postural disorders [8]. In a study, an increase in daily screen time was reported to be associated with a significant increase in the risk of neck, shoulder, and back pain [9]. Spinal flexibility is a fundamental determinant of spinal health, as it ensures appropriate load distribution and preserves normal biomechanical function of the vertebral segments. However, prolonged screen exposure and sedentary behaviors have been proposed to reduce spinal flexibility, lead to impaired postural control, and increase susceptibility to musculoskeletal pain and functional limitations [10, 11].

Increased screen exposure is closely associated with reduced physical activity levels in young adults. Prolonged screen use, a significant indicator of sedentary behavior, reduces daily energy expenditure and limits the time dedicated to physical activity. This situation not only negatively affects musculoskeletal health but can also lead to adverse outcomes for cardiovascular endurance, muscle strength, and overall functionality [12]. Low levels of physical activity affect not only physical performance but also various dimensions of quality of life. Studies point out that increased screen time among young adults may be associated with lower quality of life, reduced physical functioning, and higher levels of psychosocial problems [13].

Despite the growing body of evidence demonstrating the independent effects of screen exposure on musculoskeletal symptoms, physical activity, and quality of life, most existing studies have focused on a limited number of outcome variables and have evaluated these relationships separately [14,15]. There is a lack of comprehensive research simultaneously examining pain, postural alignment, spinal flexibility, physical activity level, and quality of life within the same population. Moreover, few studies have integrated objective postural and flexibility measurements with subjective health-related quality of life and addiction-related parameters [16].

Understanding the multidimensional impact of screen exposure is crucial for identifying early risk factors and developing preventive strategies aimed at reducing long-term musculoskeletal and psychosocial problems in young adults [17]. A holistic evaluation that includes biomechanical, behavioral, and psychosocial components may provide stronger evidence for clinical interventions and public health policies targeting excessive screen use [18].

Therefore, using reliable and validated measurement tools, this study was designed to investigate the relationships between screen exposure and pain intensity, neck disability, postural alignment, spinal flexibility, physical activity level, and quality of life in young adults. In this context, it has been hypothesized that higher screen exposure and smartphone/internet addiction among young adults may be associated with (i) increased pain intensity and neck disability; (ii) poorer postural alignment and reduced spinal flexibility; (iii) lower physical activity levels; and (iv) lower quality of life.

MATERIALS AND METHODS

Study design and ethical approval

This research was designed as an observational, cross-sectional study. This study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional observational studies. Before starting the study, ethical approval was obtained from the Karamanoğlu Mehmetbey University Health Sciences Scientific Research and Publication Ethics Committee (Decision No: 04-2024/55, Date: 18.12.2024). The ethical principles outlined in the Declaration of Helsinki were adhered to throughout the research process. All participants were informed in detail about the study, and voluntary written and verbal consent was obtained before their inclusion in the research.

Participants

A total of 283 young adults aged 18–35 who volunteered to participate in the study and had no history of chronic diseases (orthopedic, neurological, cardiac, rheumatological, etc.) were included. Individuals who were not volunteers, who had chronic illnesses, who had a history of regular medication use, or who had undergone spinal surgery or any surgical procedure affecting the musculoskeletal system in the past year were excluded from the study. A non-probability convenience sampling approach was employed, and participants were selected from among young adults who met the inclusion criteria and provided informed consent during the data collection period. Our study was carried out using the snowball sampling method [19]. Initially, researchers reached out to individuals residing in Karaman province who met the inclusion criteria and were identified among their friends, relatives, and work colleagues, inviting them to participate in the study. The sociodemographic information, records and assessments of individuals who volunteered to participate in the study and met the inclusion criteria were performed at the Karamanoğlu Mehmetbey University Faculty of Health Sciences Department of Physical Therapy and Rehabilitation laboratory. To assess screen exposure, the Screen Time Exposure Form, the Smartphone Addiction Scale-Short Form (SAS-SF), and the Young Internet Addiction Test-Short Form (YIAT-SF) were used. Pain and disability status were assessed using the Numeric Pain Rating Scale (NPRS) and the Neck Disability Index (NDI). The cranio-cervical angle (CCA) measurement and a scoliometer were used to assess

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postural alignment. Spinal flexibility was assessed using the forward reach and lateral bending tests. Physical activity levels and quality of life were assessed using the Short Form of the International Physical Activity Questionnaire (IPAQ) and the Short Form-36 Quality of Life Survey (SF-36), respectively.

Sample size

In this study, the sample size was predetermined based on a correlation analysis of the relationship between levels of telephone and internet dependency and the CCA. Previous studies [5] conducted in similar age groups have generally reported low correlations (small effect sizes) between screen or smartphone use and postural parameters; therefore, the expected correlation coefficient in this study was set at $r = 0.18$, representing a small effect. Under this assumption, and with a two-tailed significance level of $\alpha = 0.05$ and a statistical power of 80% ($1-\beta = 0.80$), the required sample size for the correlation analysis was calculated using G*Power 3.1 software. The calculations indicated that at least 240 participants were needed to detect a statistically significant relationship. To account for potential missing data, exclusions, and non-response, an estimated dropout rate of 15% was assumed, resulting in a total of 283 individuals included in the study.

Data collection tools

The primary outcome measure of the study was the screen-exposure score, while the secondary outcome measures were smartphone- and internet-addiction scores, pain intensity, neck disability, postural alignment, spinal flexibility, physical activity level, and quality of life.

Screen time exposure form

To determine screen exposure, the time participants spent in front of various digital devices in their daily lives was recorded from their self-reports. The activities examined within the scope of the evaluation were defined as (i) working on a computer or tablet, (ii) playing games on a computer or tablet, (iii) Internet use, (iv) watching video or television content on a computer or tablet, and (v) using a smartphone. For each activity, individuals were asked to select one of six time ranges, ranging from "I don't use it at all" to "more than 8 hours a day."Scores corresponding to time intervals range from 0 and 5. The total score participants received from all activities was calculated to reflect their overall level of screen exposure, and these total scores were classified into four levels: "very low," "low," "high," and "very high" [20].

Smartphone Addiction Scale-Short Form (SAS-SF)

To determine participants' tendencies toward smartphone addiction, the Turkish version of the SAS-SF, developed by Kwon et al. [21], was used. This ten-item scale includes a scoring system ranging from 1 to 6 for each item. The total score obtainable from the scale ranges from 10 to 60, and an increase in the score indicates a higher risk of smartphone addiction. SAS-SF has been adapted into Turkish by Şata et al. [22], and the Turkish version has been found to be valid and reliable. The Turkish version of the SAS-SF has been reported to have high construct and content validity. Additionally, Cronbach's α was calculated to assess the scale's reliability and found to be 0.90 [22].

Young Internet Addiction Test-Short Form (YIAT-SF)

To determine participants' levels of internet addiction, the Turkish version of the YIAT-SF developed by Pawlikowski et al. [23], was utilized. This scale, consisting of 12 items, is a five-point Likert-type scale in which each item is scored from 1 and 5. The total score obtainable from the scale ranges from 12 to 60, with an increasing score indicating a rise in the individual's tendency toward internet addiction [23,24]. The Turkish version of the YIAT-SF, adapted by Kutlu et al. [24], has been found to be a valid scale with high reliability (Cronbach's alpha = 0.91, intraclass correlation coefficient-ICC=0.93).

Numeric Pain Rating Scale (NPRS)

The presence and intensity of pain were assessed using the NPRS. On this scale, individuals rate their pain levels from 0 (no pain) to 10 (the most severe pain possible). The NPRS has been reported to be a reliable scale for assessing pain intensity (ICC=0.76 for test-retest reliability) [25].

Neck Disability Index (NDI)

The level of disability related to the neck region in participants was assessed using the Turkish version of the NDI developed by Vernon and Mior [26]. The scale includes a total of 10 sub-dimensions: pain intensity, personal care, lifting, reading, headache, concentration, work, driving, sleep, and leisure activities. Each item is scored between 0 and 5 points, and high score obtained from the test indicates a high level of disability [26,27]. The NDI, adapted into Turkish by Aslan et al. [27], has been noted to be a valid and reliable (ICC= 0.98) scale.

Postural alignment assessment

Individuals' neck posture was assessed using CCA measurements. CCA is the angle between a horizontal reference line passing over the spinous process of the C7 vertebra and a line extending to the tragus of the ear. This parameter is considered a reliable indicator of head and neck posture, providing important information about the spatial position of the lower cervical segments. In the present study, CCA measurements were performed using a standard goniometer while participants stood in a relaxed, upright posture with their arms at their sides. All measurements were conducted by the same trained examiner to ensure measurement consistency. To minimize potential measurement error, each measurement was repeated twice and the mean value was recorded for analysis [28].

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To assess deviations in the horizontal plane and asymmetry of trunk rotation associated with postural disorders, trunk rotation was measured with a scoliometer, a specialized inclinometer. Measurements were performed with participants standing upright, with their feet together and parallel. Participants were then asked to assume Adam's forward-bend test position with their arms loosely joined and to bend forward until the trunk reached the horizontal plane. In this position, the angle of trunk rotation was recorded using the scoliometer [29].

Forward Reach Test

The sit-and-reach test was administered using a reach box to assess spinal flexibility. In standing flexibility tests, variables such as pelvic tilt, spinal rotation, and posterior pelvic displacement can affect the measurement. Therefore, this study was conducted in a seated testing position. Participants were asked to position themselves in a long-sitting position with their knees straight, their feet 15 cm apart, and their feet touching the support surface of the coffee table. Individuals were instructed to push the moving indicator on the coffee table as far forward as possible without bending their knees or straightening their elbows. The maximum distance reached by the guide was recorded as 30 centimeters [30].

Side Bending Test

In the side-bending test administered to assess spinal lateral flexibility, the participant was positioned with their back against the wall to minimize compensatory movements. The feet were placed 20 cm apart and parallel to each other; the individual was positioned approximately 10 cm from the wall. Before starting the measurement, the position of the distal end of the third finger on the thigh was marked. Then, the participant was asked to bend their torso laterally and slide their hand down their thigh. The final point reached was re-marked, and the distance from it to the starting point was measured with a tape measure and recorded. During the application period, care was taken to ensure that the body did not engage in flexion, hyperextension, or rotational movements [31].

International Physical Activity Questionnaire-Short Form

The Turkish version of the IPAQ-Short Form developed by Craig et al. [32] was used to determine individuals' levels of physical activity. The Short Form of the IPAQ consists of 7 items that assess sitting time, walking, and physical activities of varying intensities. Physical activity level is assessed based on the total metabolic equivalent (MET-min/week), which is calculated from the weekly frequency and duration of each activity. The total weekly duration for each activity is multiplied by the MET coefficient defined for that activity to obtain the individual's total MET score. An increase in total MET points indicates a higher level of physical activity. The physical activity level classified as high (>3.000 MET-min/week), moderate (600-3.000 MET-min/week), and low (<600 MET-min/week) [32,33]. The Turkish version of the scale, adapted by Sağlam et al. [33], has been shown to be valid and reliable (ICC= 0.78).

Short Form-36 Quality of Life Survey

To determine individuals' health-related quality of life levels, the Turkish adaptation of the SF-36 developed by Ware and Sherbourne [34] was used. The SF-36 is a 36-item scale that assesses quality of life across multiple dimensions and comprises eight subdomains. In practice, the physical component score and the mental component score are calculated by averaging the scores obtained from four subscales related to physical and mental health, respectively. Both components are scored on a scale of 0-100, with higher scores indicating a better quality of life [34,35]. The Turkish adaptation of the SF-36, carried out by Koçyiğit et al. [35], has been shown to be valid and reliable (Cronbach's α values between 0.73 and 0.76).

Statistical analysis

In this study, all statistical analyses were performed using SPSS (Version 24.0, IBM Corp., Armonk, NY, USA) . The means and standard deviations of individuals' demographic characteristics and clinical assessments are reported. Whether the data were normally distributed was examined using visual methods (histograms and probability plots) and analytical methods (Kolmogorov-Smirnov test). All the data were normally distributed. Descriptive statistics for numerical variables were expressed as mean±standard deviation, whereas categorical variables were summarized using frequencies and percentages. The relationships between the parameters were evaluated using Pearson correlation analysis. A correlation coefficient greater than 0.60 was considered a strong relationship, between 0.30 and 0.60 was considered a moderate relationship, and less than 0.30 was considered a weak relationship [36]. The level of statistical significance was set at $p<0.05$.

RESULTS

A total of 283 young adults were included in the study; 213 (75.3%) were female and 70 (24.7%) were male. When screen exposure levels were examined, it was determined that 12 (4.2%) of the participants were in the very low exposure category, 105 (37.1%) were in the low category, 119 (42.1%) were in the high category, and 47 (16.6%) were in the very high category. Detailed data on the demographic and clinical characteristics of the participants are provided in Table 1.

The relationships between individuals' Screen Time Exposure Form scores, SAS-SF scores, and YIAT-SF scores and the NDI and NPRS are given in Table 2. Statistically significant strong positive relationships were found between screen exposure and NDI ($r=0.79$) and between screen exposure and NPRS ($r=0.74$) ($p<0.05$). In addition, strong, statistically significant positive correlations were found between SAS-SF and YIAT-SF scores and NDI and NPRS ($r>0.60$, $p<0.05$).

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Table 1. Findings regarding the demographic and clinical characteristics of the participants.

		Mean ± Standard Deviation	
Age (years)		27.48±2.91	
Body Mass Index (kg/m^2)		25.74±3.04	
NPRS (cm)		4.82±1.17	
Neck Disability Index (score)		19.12±3.72	
Screen Time Exposure Form (score)		11.73±2.14	
SAS-SF (score)		31.19± 5.58	
YIAT-SF (score)		28.54±4.37	
SF-36 physical health (score)		65.28±10.05	
SF-36 mental health (score)		59.45±9.16	
IPAQ (MET value)		1686.30±241.12	
CCA (°)		43.24± 4.18	
Forward Reach Test (cm)		17.21±3.25	
Side Bending Test (cm)		15.64±2.87	
Trunk Rotation (°)		3.69±0.85	
		n	%
Gender	Female	213	75.3
	Male	70	24.7
Screen Exposure Category	Very low	12	4.2
	Low	105	37.1
	High	119	42.1
	Very high	47	16.6
Physical Activity Level	Low	73	25.8
	Moderate	152	53.7
	High	58	20.5

NPRS: Numeric Pain Rating Scale, SAS-SF: Smartphone Addiction Scale - Short Form, YIAT-SF: Young Internet Addiction Test – Short Form, SF-36: Short Form-36 Quality of Life Survey, IPAQ: Short Form of the International Physical Activity Questionnaire, CCA: Cranio-cervical angle.

Table 2. Relationships between scores of Screen Time Exposure Form, SAS-SF, YIAT-SF NDI, and NPRS.

		Screen Time Exposure Form	SAS-SF	YIAT-SF
NDI	r	0.79	0.69	0.67
	p	**p<0.001**	**0.005**	**0.002**
NPRS	r	0.74	0.65	0.63
	p	**p<0.001**	**0.011**	**0.016**

NPRS: Numeric Pain Rating Scale, NDI: Neck Disability Index, SAS-SF: Smartphone Addiction Scale - Short Form, YIAT-SF: Young Internet Addiction Test – Short Form, r: Pearson correlation coefficient, p<0.05.

The relationships between the Screen Time Exposure Form, SAS-SF, and YIAT-SF scores and the IPAQ and SF-36 physical and mental health scores are presented in Table 3. Strong, statistically significant negative relationships were observed between screen exposure and IPAQ scores and SF-36 physical and mental health scores, with magnitudes from -0.75 to -0.78 (p<0.05). In addition, strong, statistically significant negative relationships were found between SAS-SF and YIAT-SF scores and the IPAQ and SF-36 physical and mental health scores (r<-0.60, p<0.05).

Strong, statistically significant negative relationships were detected between screen exposure and CCA, forward reach test, and side-bending test scores, with magnitudes ranging from -0.77 to -0.86 (p<0.05). In addition, a statistically significant moderate relationship was found between screen exposure and trunk rotation (r=0.40). Strong negative correlations were found between SAS-SF and YIAT-SF scores and CCA, forward reach test, and side-bending test scores (r=-0.60-0.69), whereas moderate positive correlations were found between these scores and trunk rotation (r=0.34-0.36) (p<0.05) (Table 4).

Table 3. Relationships between scores of Screen Time Exposure Form, SAS-SF, YIAT-SF, IPAQ, and SF-36 scores.

		Screen Time Exposure Form	SAS-SF	YIAT-SF
IPAQ	r	-0.75	-0.69	-0.67
	p	**p<0.001**	**0.013**	**0.006**
SF-36 physical health	r	-0.78	-0.66	-0.72
	p	**p<0.001**	**0.010**	**0.002**
SF-36 mental health	r	-0.76	-0.65	-0.74
	p	**0.004**	**0.011**	**0.002**

SAS-SF: Smartphone Addiction Scale - Short Form, YIAT-SF: Young Internet Addiction Test – Short Form, IPAQ: Short Form of the International Physical Activity Questionnaire, SF-36: Short Form-36 Quality of Life Survey, r: Pearson correlation coefficient, p<0.05.

Table 4. Relationships between Screen Time Exposure, SAS-SF, and YIAT-SF scores with CCA, trunk rotation, forward reach test, and side bending test scores.

		Screen Time Exposure Form	SAS-SF	YIAT-SF
CCA	r	-0.86	-0.69	-0.67
	p	**p<0.001**	**0.002**	**0.005**
Forward Reach Test	r	-0.80	-0.65	-0.63
	p	**p<0.001**	**0.015**	**0.020**
Side Bending Test	r	-0.77	-0.60	-0.64
	p	**p<0.001**	**0.024**	**0.014**
Trunk Rotation	r	0.40	0.36	0.34
	p	**0.019**	**0.026**	**0.022**

SAS-SF: Smartphone Addiction Scale-Short Form, YIAT-SF: Young Internet Addiction Test – Short Form, CCA: Craniocervical angle, r: Pearson correlation coefficient, p<0.05.

DISCUSSION

This comprehensive study evaluated the effects of screen time on pain levels, neck disability, postural parameters, spinal flexibility, physical activity levels, and quality of life in young adults using a multifaceted approach. The findings revealed that increased screen time had significant negative effects on both biomechanical and psychosocial indicators. Among the most notable findings were increased neck pain, higher cervical disability scores, deterioration in quality-of-life components, decreased physical activity levels, and deterioration in postural alignment.

One of the most striking findings of our study was the strong positive correlation between screen exposure and both NPRS and NDI scores. This result demonstrates that screen use in

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young adults is directly related to musculoskeletal symptoms. The literature indicates that prolonged computer and smartphone use places mechanical stress on the cervical spine, leading to pain and functional limitations [10].

Our findings also revealed significant positive correlations between smartphone- and internet-addiction scores and both pain severity and neck disability. This supports the notion that not only screen time but also addiction levels have a decisive impact on musculoskeletal health. The concept of "problematic phone use," in particular, has been discussed in occupational therapy and physiotherapy in recent years, and the relationship between screen addiction and postural disorders is increasingly being investigated [37].

Our study revealed significant negative correlations among screen exposure, physical activity levels, and quality-of-life components. These findings suggest that increased screen exposure may contribute to reduced physical activity and poorer health-related quality of life in young adults. Similar results were reported by Saltan et al. [38], who demonstrated that lower physical activity levels were associated with decreased functional capacity and increased symptom burden. Together, these findings highlight the potential role of sedentary behaviors in the development of musculoskeletal symptoms and reduced quality of life among young adults. The World Health Organization recommends that adults engage in at least 150 minutes of moderate-intensity physical activity per week; however, screen addiction complicates implementation of this recommendation [39]. Furthermore, the literature reports that sedentary behavior predisposes to the development of obesity, cardiometabolic disorders, and psychosocial problems in the long term [40]. The literature consistently indicates that increased sedentary behavior and lower physical activity levels are associated with higher pain intensity, greater functional disability, and reduced quality of life in young adults [38]. However, most studies are cross-sectional and rely on self-reported measures, which limits causal interpretation and introduces potential reporting bias [15-18,38]. These recurring limitations emphasize the need for longitudinal designs and objective assessment methods in future research.

When postural alignment and spinal flexibility parameters were evaluated, significant negative correlations were observed between screen exposure and the CCA, the forward-reach test, and the side-bending test. This finding suggests that long-term screen use disrupts the cervical lordosis angle, limits trunk range of motion, and predisposes individuals to postural deformities. In particular, the forward-tilted head position, known as "text neck," has been associated with chronic tension in the cervical muscles and increased mechanical loading on the spinal joints [11].

The present study demonstrated moderate positive correlations between trunk rotation and scores for screen exposure, smartphone addiction, and internet addiction. This finding suggests that prolonged screen use may lead to compensatory postural adaptations. Although limited data exist on this topic, our study makes a unique contribution by examining the relationship between trunk rotation and digital addiction. Although the findings of the present study are in agreement with those reported by Şentürk et al. [4], important methodological distinctions underscore the added value of the present study. Whereas Şentürk et al. [4] predominantly examined self-reported musculoskeletal complaints in relation to smartphone addiction, the present study implemented a comprehensive and multidimensional evaluation framework incorporating both subjective indices (pain intensity, neck disability, quality of life, and addiction scales) and objective biomechanical parameters (cranio-cervical angle, trunk rotation, and standardized spinal flexibility tests). Furthermore, by assessing screen exposure, smartphone and internet addiction, physical activity levels, postural alignment, and spinal flexibility within a single analytical model, this study provides a more integrative and mechanistic perspective on the biomechanical and functional consequences of prolonged screen-based behaviors in young adults.

One of the strengths of our study is its multidimensional assessment of screen exposure. We combined addiction and quality-of-life scales, and biomechanical tests (postural measurements and flexibility tests). This holistic approach reveals not only the psychosocial effects of screen exposure but also its physiological consequences.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design precludes causal inference; therefore, the observed relationships between screen exposure, spinal flexibility, postural alignment, pain, physical activity, and quality of life should be interpreted as correlational rather than causal. It remains unclear whether prolonged screen exposure leads to musculoskeletal impairments or whether individuals with existing pain and postural problems are more likely to engage in excessive screen use. Second, participants were recruited from a single geographic region using convenience and snowball sampling methods. These non-probability sampling approaches may introduce selection bias and reduce sample representativeness, thereby limiting the generalizability of the findings to broader populations with different sociodemographic characteristics. In addition, although validated instruments were used, the reliance on self-reported questionnaires may have introduced recall bias and social desirability bias. The long-term clinical implications of reduced spinal flexibility and postural deterioration associated with prolonged screen exposure warrant further investigation, as these factors may contribute to the development of chronic musculoskeletal disorders and functional limitations over time. Future research should, therefore, focus on longitudinal and intervention-based studies involving more diverse populations and employing probability-based sampling

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methods to better clarify causal pathways and to evaluate the effectiveness of preventive and rehabilitative strategies, such as ergonomic education, posture-correction programs, and structured physical-activity interventions, aimed at mitigating the adverse biomechanical and psychosocial effects of excessive screen use.

CONCLUSION

In conclusion, increased screen exposure among young adults is strongly associated with greater pain and neck disability, lower quality of life, reduced physical activity levels, and a higher prevalence of postural disorders. These findings highlight the importance of improving ergonomic settings, limiting screen time, encouraging regular exercise habits, and increasing digital health awareness among university students. Future longitudinal studies will demonstrate more clearly the long-term effects of screen use and provide opportunities to evaluate the effectiveness of early interventions.

Ethics Committee Approval: Ethical approval was obtained from the Karamanoğlu Mehmetbey University Health Sciences Scientific Research and Publication Ethics Committee (Decision No: 04-2024/55, Date: 18.12.2024).

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