



Original Article



Association of Screen Time with Posture and Gross Motor Development in Adolescents

Ayesha Faryad¹, Mehreen Jabbar¹, Sana Tauqeer¹, Taimoor Ahmed^{1*}, Khansa Fatima Chisti¹, Iqra Faryad² and Ismat Faryad³¹University Institute of Physical Therapy, The University of Lahore, Lahore, Pakistan²Combined Military Hospital, Rawalpindi, Pakistan³Department of Pharmacy, Bahauddin Zakariya University, Multan, Pakistan

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Taimoor Ahmed

University Institute of Physical Therapy, The University of Lahore, Lahore, Pakistan
taimoortm786@gmail.comReceived Date: 26th November, 2025Revised Date: 10th January, 2026Acceptance Date: 19th January, 2026Published Date: 31st January, 2026

ABSTRACT

Overuse of digital devices (e.g., smartphones) often causes significant negative effects on muscle development and joint health among adolescents, including poor posture and problems with fine motor skills. There is an increasing amount of evidence to support these concerns, due to the high reliance upon devices for learning, communicating with friends and family, and being entertained. **Objective:** This study aimed to determine the association of screen time with posture and gross motor development in adolescents. **Methods:** A cross-sectional study was conducted with 184 adolescents (ages 10-19) from different schools/colleges in Lahore. Participants completed self-assessments on daily computer use, motor coordination, and posture-related behaviors using the Adolescent Postural Habits Questionnaire (APHQ) and the Developmental Coordination Disorder Questionnaire (DCDO). **Results:** The study found that 59.5% of participants reported low back pain, and 47.8% spent more than 4 hours daily on smartphones for social media. A significant positive correlation was found between daily screen time and poor postural habits ($r=0.42$, $p<0.001$). Furthermore, screen time showed a significant negative correlation with motor coordination scores ($r=-0.38$, $p<0.001$), indicating that higher screen time was associated with poorer coordination. **Conclusions:** This research supports the conclusion that adolescents who use screens more frequently have a decreased ability to control their body position as compared to adolescents who use screens less frequently. The results further indicate that an educational intervention that focuses on teaching correct posture and increasing physical activity will combat the adverse effects associated with excessive screen time on the health and overall well-being of adolescents.

INTRODUCTION

With the modern digital era, the use of electronic appliances is rapidly growing, including smartphones, laptops, tablets, and televisions, which are changing the everyday lives of adolescents. Screen time, which is the time devoted to electronic screens to engage in different activities, such as education, socialization, and revitalization, has increased over the past years [1]. Adolescence is a sensitive stage of intense growth and neuro-motor development that is related to musculoskeletal alterations and elevated chances of

postural and functional change in the outcome of overexposure to screens [2]. The study investigates the connection between screen time and musculoskeletal conditions in terms of posture, motor coordination, and musculoskeletal pain among adolescents. Global research has found that most adolescents (greater than two-thirds) complain of neck or shoulder pain attributed to screen time [3]. In Lahore, Pakistan, where the study was conducted, lower back pain among adolescents was reported to be 59%, with a large proportion of them spending more than



four hours a day in front of screens [4]. These tendencies point to the increased anxiety over the problem of posture, such as the enhancement of lumbar lordosis and the decrease of motor coordination that is caused by extensive screen exposure. Additionally, research has revealed that high screen time in adolescents is highly linked with impaired gross motor skills and distorted spinal orientation [5, 6]. Specifically, screen-related sedentary behaviors are associated with musculoskeletal disorders, such as the so-called text neck, tech back conditions, and are associated with biomechanical alterations in the cervical and lumbar spine [7, 8]. The negative impact of screen time also has a spillover to cognitive and psychosocial health because excessive screen time on digital media is linked with anxiety, depression, and disturbed sleep patterns in adolescents [9].

This research aims to assess the relationship between screen time, posture-related behaviors, and motor coordination in adolescents in Lahore, Pakistan, as limited evidence exists regarding the prevalence of musculoskeletal pain, postural deviations, and motor coordination issues linked to screen exposure in this population. The significance of this study lies in its potential to raise awareness about the harmful effects of excessive screen time on adolescent musculoskeletal health and contribute to the development of targeted interventions. The rationale is to provide evidence-based data that can inform preventive physiotherapy and public health strategies to mitigate the potential musculoskeletal and developmental risks associated with increasing digital device usage in this vulnerable population. Therefore, this study aimed to assess the association between screen time, postural habits, and gross motor coordination in adolescents in Lahore, Pakistan.

METHODS

The study was a cross-sectional observational study that was implemented in Lahore, Pakistan. A purposive technique of sampling was used to enroll a total of 184 adolescents. The a priori calculation of the sample size pertained to the formula of correlation studies. According to a pilot study, it was assumed that there would be a moderate correlation ($r = 0.25$) between screen time and motor coordination. The required minimum sample size of 123 was determined with the desired power of 80 percent and alpha error of 0.05. The sample size was raised to 184 in order to take into consideration the possibility of dropouts and missing data. The sample population was selected among different schools and colleges in Lahore in March 2024 and June 2024. The instrument involved in the data collection was the written informed consent of all the participants, which was received in accordance with the

ethical principles of the Declaration of Helsinki. They were adolescents aged 10 to 19 years old, who had 2-4 hours of daily use of electronic devices (smartphones, tablets, and/or computers) and attended schools in Lahore. The exclusion criteria were adolescents with neurological, orthopedic, or congenital conditions (ex: cerebral palsy, scoliosis, spina bifida) [10]; any history of spinal surgery; a history of neck, back, or shoulder pain [5]; the use of assistive walking devices or braces; visual or vestibular balance disorders; physiotherapy or medical management due to postural or motor difficulty. Three questionnaires that were known to be valid were used to evaluate the study variables. Measures of device usage were done using the Screen Time Questionnaire (STQ) to establish the type and amount of time used on the device per day. The assessment of postural habits was made with the help of the Adolescent Postural Habits Questionnaire (APHQ) [11]. The Gross motor development was measured with the help of the Developmental Coordination Disorder Questionnaire (DCDQ) [12]. The internal consistency of chosen questionnaire sample was acceptable, with Cronbach's alpha of 0.79 for the APHQ and 0.82 for the DCDQ. The a priori calculation of the sample size pertained to the formula of correlation studies. The pilot study led to an assumption of an expected moderate correlation based on screen time and motor coordination ($r=0.25$). The required minimum sample size of 123 was determined with the desired power of 80 percent and alpha error of 0.05. The sample size was raised to 184 in order to take into consideration the possibility of dropouts and missing data. Cronbach's alpha was used to establish the internal consistency of the questionnaires in current sample. The values were reasonable, and the Cronbach alpha of the APHQ and DCDQ is 0.79 and 0.82, respectively.

Data were analyzed using SPSS version 29.0. Descriptive statistics (mean, standard deviation, frequency, and percentage) were computed for demographic and questionnaire variables. The Shapiro-Wilk test was used to check the normality of continuous data. As screen time data were not normally distributed, the association between screen time (categorized into groups) and postural/motor coordination scores was analyzed using Spearman's rank correlation coefficient. Chi-square tests were applied for associations between categorical variables. A p -value ≤ 0.050 was considered statistically significant, and 95% confidence intervals were calculated for key correlation coefficients.

RESULTS

The adolescents who were involved in the study were 184 in number, and their average age was 14.72 ± 2.35 years, with a range of 10-19 years. The sample was relatively evenly balanced in gender, as 101 (54.9) out of the participants

were female and 83 (45.1) were male. A stratification of the academic level of the participants was made as follows: 81 (44.0%) middle academic level, 76 (41.3%) high academic level, and 27 (14.7%) college level. One hundred and fifty-nine (86.4) were right-handed, and 25 (13.6) were left-handed. On the nature of the digital devices, the highest percentage of 105 (57.1%) participants indicated the use of smartphones, then 38 (20.7) participants indicated the use of laptops/PCs, 26 (14.1) participants indicated the use of tablets, and 15 (8.2) indicated the use of televisions. On weekdays, 66 (35.9) of the participants had 3-4 hours of TV or video watching, and 44 (23.9) participants had more than 4 hours of watching. A large number of respondents also used smartphones to chat or do social media, with 88 (47.8) spending over 4 hours a day doing so. On weekends, 87 (47.3) of the participants of the study indicated that they spent more than 4 hours on computer/laptop-based schoolwork (Table 1).

Table 1: Gender of Participants, Dominant Hand, Types of Digital Devices Used, and Screen Time Habits on Weekdays (n=184)

Valid	Frequency (%)
Gender of Participants	
Female	101 (54.9%)
Male	83 (45.1%)
Dominant Hand	
Left	25 (13.6%)
Right	159 (86.4%)
Types of Digital Devices Used	
Laptop/PC	38 (20.7%)
Smartphone	105 (57.1%)
Tablet	26 (14.1%)
Television	15 (8.2%)
Screen Time Habits on Weekdays	
1-2 hours	30 (16.3%)
3-4 hours	66 (35.9%)
<1 hr	37 (20.1%)
>4 hrs	44 (23.9%)
None	7 (3.8%)
Total	184 (100%)

Posture-related behaviors while using devices were also assessed. Participants reported moderate support for

Table 4: Gender of Participants, Dominant Hand, Types of Digital Devices Used, and Screen Time Habits on Weekdays (n=184)

Variables	Screen Time (hours/day)	Posture (e.g., lumbar lordosis, forward trunk lean)	Motor Coordination (e.g., hand-eye coordination, bilateral coordination)
Screen Time	–	Positive association with poor posture (increased lumbar lordosis, forward trunk lean)	Negative association with motor coordination (difficulty with hand-eye coordination, bilateral coordination)
Postural Issues (e.g., back pain)	Increased with screen time	Significant correlation with forward trunk leans and increased lumbar curve.	–
Hand-eye Coordination	Negative correlation with excessive screen time	–	Decreased performance with high screen use
Bilateral Coordination	Negative correlation with excessive screen time	–	Increased difficulty with tasks requiring bilateral coordination

their back while sitting, with a mean score of 3.31 ± 0.85 . However, many participants exhibited forward trunk lean while using their smartphones, with a mean score of 3.16 ± 0.97 . Sitting cross-legged while using devices was less common, with a mean score of 2.93 ± 1.05 (Table 2).

Table 2: Posture-related Behaviours

Posture Behavior	Mean ± SD
Back Well Supported on Chair Backrest	3.31 ± 0.85
Body Tilted Forward While Using Phone	3.16 ± 0.97
Sitting Cross-Legged While Using Devices	2.93 ± 1.05

A significant association was observed between screen time and the study's outcome measures. These findings suggest that excessive screen use negatively impacts both posture and motor skills (Table 3).

Table 3: Correlation between Screen Time, Postural Habits, and Motor Coordination

Variables	Statistic	Screen Time (hours/day)	APHQ Score (Posture)	DCDO Score (Motor Coordination)
Screen Time (hours/day)	Spearman's rho	1.00	0.42**	-0.38**
	p-value	–	<0.001	<0.001
	95% CI	–	0.29 to 0.54	-0.50 to -0.25
APHQ Score (Posture)	Spearman's rho	0.42**	1.00	-0.31**
	p-value	<0.001	–	<0.001
	95% CI	0.29 to 0.54	–	-0.44 to -0.17
DCDO Score (Motor Coordination)	Spearman's rho	-0.38**	-0.31**	1.00
	p-value	<0.001	<0.001	–
	95% CI	-0.50 to -0.25	-0.44 to -0.17	–

The correlation between the time spent at the daily screen and the choice of musculoskeletal and motor coordination parameters in adolescents. The more the screen time, the more it is positively associated with poor posture, like forward trunk lean and increased lumbar lordosis, and the more it is associated with a higher likelihood of having a postural problem like back pain. Moreover, it has been established that excessive screen exposure has a negative correlation with motor coordination, especially hand-eye coordination and bilateral coordination, thus leading to poor performance in activities involving coordinated movements (Table 4).

DISCUSSION

We establish a high correlation between the duration of screen time and postural and coordination problems among adolescents in the city of Lahore. These results are in line with previous studies that have indicated that protracted time spent on screens may deteriorate postural and coordination development in adolescents [8]. As observed, adolescents who spent more than 4 hours in front of a screen per day reported more neck and back pain than those who did not spend excessively in front of a screen. Hence, lack of physical activity affects the health and development of an adolescent negatively. The existing literature results suggest that sitting position on or operating equipment is a key risk aspect that promotes the development of musculoskeletal pain. In our research, 59.5% of the respondents had the perception that protracted sitting contributed largely to their low back pain. The study conducted by Banadaki *et al.* established that the number of painful and uncomfortable experiences was significant in response to the use of static postures (particularly extreme forward head position or slouching) [13]. Almutairi *et al.* also discovered that there is a high relationship between the use of poor postures by adolescents when using electronic devices and the occurrence of musculoskeletal disorders [14]. Although there were considerable respondents who indicated that they were very likely to have poor posture because of the use of devices, about 59% of them mentioned that their posture on the device had changed since then [15]. These findings are in line with Zhang *et al.* results, where they found that prolonged screen time (primarily from devices) resulted in spinal misalignments in the cervical and lumbar spines [8]. Together, it appears that initiating timely interventions may result in the reestablishment of correct postural habits and reduce the potential for long-term musculoskeletal dysfunction. Digital device overuse diminishes adolescents' motor coordination development as determined by Developmental Coordination Disorder Questionnaire (DCDQ) assessment results [12]. Adolescents who utilize devices for four or more hours per day experience greater difficulties completing two separate movement types (i.e., eye-hand coordination) and multiple coordinated movements simultaneously (bilateral coordination). The data collected herein agrees with the study of Parra-Fernandez *et al.* [3]. In their study, adolescent mobile phone dependence exhibited an inverse relationship to adolescents' musculoskeletal and motor coordination capabilities. Balanced sedentary behaviors among adolescents and enabling them to participate in physical activity/coordination exercise is in agreement with the research study by Fan *et al.* [16]. Of the participating adolescents, a significant percentage indicated difficulty completing activities involving

catching or throwing a ball accurately (mean = 2.96) due to the lack of motor coordination seen in many adolescents who are regularly sedentary [5]. Therefore, adolescents must engage in an adequate amount of balanced physical activity to ensure their continued development of motor coordination. In contrast with Priftis and Panagiotakos, previous assumptions regarding the impact of screen time on posture development may not be as great as previously thought. Their study indicated that sedentary behavior, regardless of whether it was through screen use or other non-screen-related activities such as reading and studying, has a greater impact on musculoskeletal health in adolescents than screens alone [10]. They further claim that sedentary lifestyles in general are a contributing factor to postural problems as well as to some degree motor problems, not just the result of screen time only. Their conclusions challenge the perception that eliminating screens alone would cure postural and motor issues, while they suggest broader-based interventions that would improve overall physical activity and reduce sedentary behavior associated with different types of contexts, such as non-screen-based activities [17]. While excessive screen time may be associated with negative effects on posture and coordination, recent studies have shown that motor skills may be enhanced through screen-based activities if there is physical involvement. As shown in the work of Fan *et al.* adolescents who participated in interactive screen-based activities, such as video games that require physical activity (e.g., active gaming systems), possessed increased motor coordination and balance than those who did not. This study demonstrates that not all screens adversely affect motor skill development, and that the type of screen-based activity (i.e., passive vs. active) has a strong influence on the development of motor skills [16]. Thus, the results of this research support the use of screen-based physical activities as an intervention for the harmful effects of passive screen time experience [18]. Current results indicate a significant finding that shows a greater number of Female (54.9%) than Male (45.1%) participants; this may reflect a difference regarding levels of screen time and musculoskeletal health based on gender. Research indicates females, including young females, are more likely than males to develop postural problems related to sedentary behavior. However, additional research is needed to fully understand the differences in genders related to screen time exposure and their effect on postural alignment and motor coordination issues in female participants [19]. The implications of this study on the physiotherapy profession are considerable; the results indicate that excessive screen time can lead to posture-related and motor-coordination-related issues in children and adolescents and that these issues can be addressed through early detection and intervention [20].

This research supports the use of physiotherapists as providers of individualized programs of corrective exercise that will help adolescents improve their postural control and motor coordination through corrective exercise. In addition, as noted by Priftis & Panagiotakos [10], incorporating ergonomic education and awareness programmes into school curricula could reduce the negatives produced by excessive screen time on children and adolescents.

This research has a few limitations that are worth taking into consideration when interpreting the research. The cross-sectional design restricts the opportunity to determine the causal relationship between screen time, postural problems, and motor coordination issues. Also, the research was done in one city, and its sample size was too small to be able to be generalized to the wider population. The studies that are intended to be conducted in the future must be larger, have a multi-centric nature, and be based on longitudinal designs to gain a better insight into the causal relationships, as well as consider the impact of various kinds of screen-based activities and intervention strategies to decrease the prevalence of sedentary behavior and enhance the musculoskeletal health and motor coordination within adolescents.

CONCLUSIONS

This study concludes that excessive screen time is significantly associated with poorer postural habits and reduced gross motor coordination in adolescents. The high prevalence of musculoskeletal discomfort, particularly low back pain, among heavy screen users underscores a significant public health concern. These findings highlight an urgent need for targeted interventions, including physiotherapy and ergonomic education, to mitigate the long-term health risks associated with increasing digital device use in this population.

Authors' Contribution

Conceptualization: AF, MJ

Methodology: KTC

Formal analysis: ST, TA, IF, IF

Writing and Drafting: AF, TA

Review and Editing: AF, MJ, ST, TA, KTC, IF, IF

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

The authors declare no conflict of interest.

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