

# Investigation of Cervical Posture, Sleep Quality and Perceived Health Risk in Technology Addicted Adolescents and Young Adults: A Comparative Study

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Received: 2023-08-14 / Accepted: 2023-09-09 / Published Online: 2023-09-09

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## ABSTRACT

**Objective:** The aim of this study was to compare the cervical posture, sleep quality, and perceived health risk of technology-addicted adolescents, young adults and their controls.

**Methods:** Adolescents and young-adults participants (n=160) were divided into four groups as addicted and non-addicted according to their age and Technology Addiction Scale scores. Cervical posture assessments were obtained by photographic analysis. Craniovertebral (CVA), craniohorizontal (CHA) and sagittal shoulder angle (SSA) values were recorded. Sleep quality was assessed with the Pittsburg Sleep Quality Scale. Participants' Perceived Health Risk was evaluated with a single-item, five-point Likert questionnaire.

**Results:** The addicted participants had worse CVA than both their controls (p=0.000). Participants' CHA and SSA angles were similar in addicted groups (p=0.710 and p=0.612, respectively). Addicted adolescents had worse sleep quality than addicted young-adults (p=0.005). Perceived Health Risk is low level in all groups and there were no significant differences (p=0.055).

**Conclusion:** Technology addiction affects the adolescent group more negatively than the young-adults. In the sample of adolescents and young-adults, individuals did not perceive excessive use of technological tools as a risk factor for their health. The degradation of CVA due to overuse of technological tools precedes the degradation of CHA and SSA. This can be explained by the fact that CVA is a more general angle that includes both the head-neck position and the vertebrae. It is necessary for public health and future health expenditures to educate and raise awareness of the more vulnerable adolescent group.

**Keywords:** Adolescent, Perception, Posture, Sleep quality, Technology Addiction



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## INTRODUCTION

Technology is a set of knowledge, including practical or technical information of a mechanical or industrial kind, which enables people to change natural conditions to make their lives more useful and enjoyable [1]. Due to technological developments, the use of technological devices such as smartphones, computers and tablets is becoming widespread among adolescents and young adults [2]. However, the level and form of technology use

(excessive and inappropriate) can sometimes potentially damage physical and mental health, which can lead to social problems not only for the individual concerned, but also for their families and communities [3].

While new technologies provide people with an unlimited world, it is accepted that addiction to behaviors that seem harmless in certain situations has negative consequences [4]. Addiction is

not only a condition that develops depending on a substance. Technology addiction is also considered in the category of behavioral addictions. In DSM-5, addiction was removed from the framework of substance addiction and started to be evaluated more behaviorally with the concepts of withdrawal and tolerance [5]. Technology addiction is one of such behavioral addictions associated with overuse and uncontrolled use of technology. Technological addictions are part of non-toxic addictions and constitute addictive processes that develop through overuse and inappropriate use of what the internet offers, such as videos, video games and social networks [2, 6]. Technology addiction is characterized by salience, mood changes, tolerance (the need to use longer), depression and irritability when technology is not used, interpersonal conflicts and relapse [4, 7].

Adolescents and young adults are among the most affected groups despite being born in the digital age. For many people of this age group, technological approaches were used as an emotional pacifier as they were very effective in keeping children calm and quiet during childhood [8]. Gornicka et al. [9] states that spending more time in front of the screens of devices creates a highly sedentary lifestyle with a lack of physical activity, which leads to obesity and chronic diseases. As technology and its accessibility have become more widely available, the need to evaluate the effects of technology on people has also increased.

Technology addiction creates a risk for health by bringing mental, social, familial, academic, and physical problems [9]. Especially, there are studies showing that musculoskeletal problems and postural impairment frequently associates with and is related to technology addiction [10]. When the variables

predicting addiction are considered, sleep quality is also an important variable [11]. At this point, the relationship between technology addiction, posture, sleep quality and perceived health risk is important in determining risk groups, risk factors and appropriate preventive treatment approaches. It is stated that individuals who are addicted to technology have impaired cervical posture, headaches or sleep problems [12, 13]. However, in these studies, individuals from different age groups were not investigated or the age of first meet with technology and exposure was ignored. It is not known how much posture or sleep quality is affected by the exposure of participants from different age groups to the same technological factors. Therefore, in this study, cervical posture, sleep quality and perceived health risk in technology-addicted adolescents, young adults and their controls will be compared.

## MATERIALS AND METHODS

This cross-sectional and non-interventional study was conducted on adolescents and young adults. Ethical approval was obtained from the ethical committee of Çukurova University (Ethics committee decision No: 2023/72 and Date: 04.02.2023). The participants were informed about the purpose and content of the study. Informed consent has been obtained from all participants included in the study.

The inclusion criteria were (a) volunteering to participate in this research, (b) having fluent Turkish speaking skill, (c) having sufficient communication skills without adequate hearing and speech problems. The exclusion criteria were (a) having drug use that may affect sleep duration, (b) having a history of trauma or pathology in the neck region that may affect posture, (c) having chronic or metabolic disease. The flow-chart diagram is given in Figure 1.

**Population and Randomization:** The research population consisted of 627 participants studying in a high school and a vocational school, and the sample consisted of 160 participants who voluntarily wanted to participate in the research. In order to determine the group of participants who matched the criteria for inclusion in the sample, they were randomly distributed to four groups with a computer program (<https://www.randomizer.org/>) without repeating the numbers from 1-160; 40 technology-addicted adolescents, 40 technology-addicted young adults, 40 non-technology addicted adolescents and 40 non-technology addicted young adults. The assessments were performed at the same time of the day to eliminate the effect of fatigue.

### Main Points;

- The CVA values of the addicted groups were worse than the non-addicted groups.
- The adolescent group in sleep quality was worse affected by excessive use of technological devices than younger adults,
- One of the cervical posture parameters, CVA is more general as it includes both head and neck and vertebrae, so it may be affected first order according to CHA and SSA.
- All participants in our sample had low and similar level awareness of the negative health effects of excessive use of technological tools.
- Raising awareness about technology addiction is very important in terms of public health and future health expenditures.

The data of the study were collected through the following forms and tools.

**Demographic Form:** Demographic data of the subjects were recorded on a form. The form included the age, gender, the year of meeting with the internet, duration of internet usage.

**Technology Addiction Scale:** This scale consists of 24 items and 4 sub-dimensions of 6 items each (using social networking, instant messaging, playing online games and using websites). It is aimed to determine the level of technology addiction on the scale prepared in a five-point Likert format. The scale is rated as 1 “never”, 2 “rarely”, 3 “medium frequency”, 4 “very often”, 5 “always”. In the evaluation of the scale, the total score is obtained by summing the answers given to the items. The maximum score of the scale is 120 and the minimum score is 24. A higher score means higher technology addiction. A score of 50 and above indicates moderate dependency. Individuals were divided into dependent and non-dependent groups based on the cut-off point of the scale [14].

**Cervical Posture:** Cervical posture assessments were obtained by photogrammetry technique. Photogrammetry shows good

validity for the analysis of cervical posture [15]. The digital camera was placed on a fixed surface at a distance of 1.5 meters. While the participant was in a standing position, the height of the digital camera was adjusted so that it was at the shoulder level of the participant. A marker was placed on the spinous process of C7 and photographs were taken from the left side of each individual. In order to ensure the correct posture of the participants, photographs were taken while looking at a fixed point in front of them. The craniovertebral angle (CVA), craniohorizontal angle (CHA) and sagittal shoulder angle (SSA) were determined on the photographs taken in the standard position [16].

**Craniovertebral Angle:** Craniovertebral angle value was used to determine the head posture. Craniovertebral angle (CVA) is the angle of the line connecting the midpoint of the ear tragus with the spinous process of the C7 with the horizontal line. CVA measurement is one of the most common angles used to assess anterior head posture and is a good indicator for anterior head posture, and its reliability and validity have been confirmed in previous studies [15]. CVA angle value 53.1°- 56.8° indicates normal head posture [15].

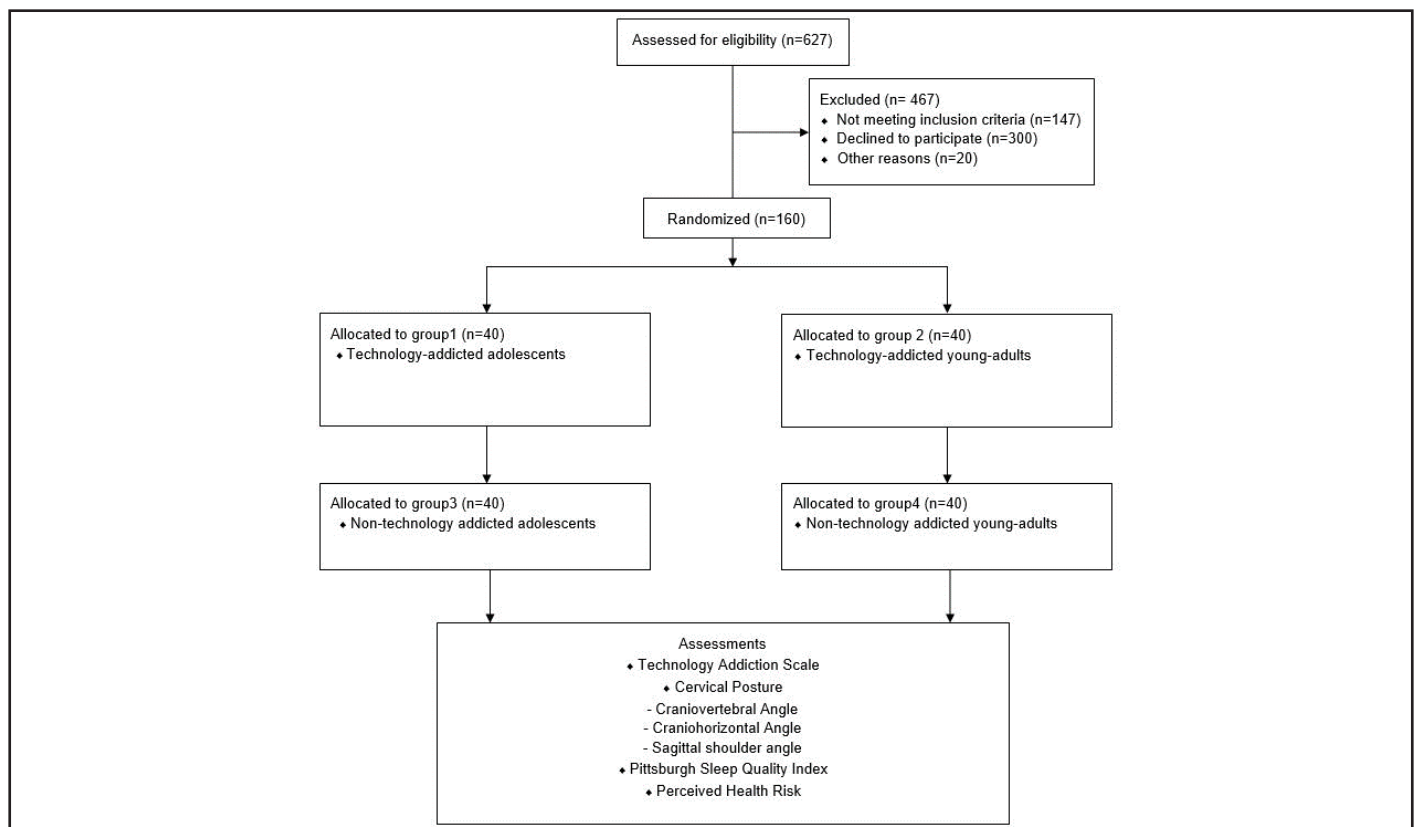


Figure 1. Flow-chart diagram

**Craniohorizontal Angle:** A horizontal line is drawn across the ear tragus to determine the craniohorizontal angle. Another horizontal line is drawn, starting from the lateral canthus of the eye and joining the tragus of the ear. The intersection of these two lines forms the craniohorizontal angle. This angle gives information about the position of the head and upper cervical spine relative to each other [17].

**Sagittal Shoulder Angle:** To determine this angle, a horizontal line is drawn through C7. This line is joined by another line joining the midpoint of the greater tuberculum of the humerus and the posterior aspect of the acromion. The angle of intersection of the two lines is the sagittal shoulder angle. This angle allows the forward shoulder position to be measured. A reduction in sagittal shoulder angle means that the shoulder is more anterior than C7. This results in a more rounded shoulder look [17].

**Pittsburgh Sleep Quality Index (PSQI):** PSQI is a 19-item scale that reports sleep quality and sleep disturbance in the last month with self-report. It consists of a total of 24 questions. 19 of these questions are answered by the person, and the remaining 5 questions are to be answered by the person's spouse or roommate, if any. The scale has 18 questions included in the scoring. These questions consist of 7 sub-components. Subcomponents are evaluated in the range of 0-3 points. The sum of the scores of the seven subcomponents gives the score of the index. The minimum score on the index is 0, and the maximum score is 21. A score of 5 or higher indicates poor sleep quality. It is valid and reliable in children and adolescents [18, 19].

**Perceived Health Risk:** Perceived health risk assessment will be evaluated with a five-point Likert type (1-strongly agree, 2-agree, 3-neither agree or disagree, 4-disagree, 5-strongly disagree). Participants will be asked to answer how true the

question “technology addiction is a threat to my health” is for themselves [20].

### Statistical Analysis

The Statistical Package for the Social Sciences version 22.0 software was used for statistical analysis. The frequency in percentage (%) and mean±standard deviation ( $X \pm SD$ ) of the study variables were presented. The normality of distribution was tested with the Kolmogorov-Smirnov test. Independent-t test was used to compare the parametric data among the groups. The statistical significance level was set at  $p < 0.05$ . G\*Power application was used for post-hoc power analysis. The post-hoc power analysis was calculated %80 with one-tail, 0.05 Type I error, and effect size 0.56 in accordance with PUKİ.

### RESULTS

The information of participants is shown in Table 1. The number of females in groups was higher than males, but not non-addicted young adults. The age of meeting the internet for the participants in the addicted group was younger than the other groups. The daily internet usage time was higher in the dependent adolescent group than in the other groups (Table 1).

When the CVA values in addicted and non-addicted groups were compared, there was a statistically significant difference (Table 2). The CVA of addicted adolescents and addicted young adults were similar ( $p=0.326$ ). Participants' CHA and SSA angles were similar in addicted groups ( $p=0.710$  and  $p=0.612$ , respectively) (Table 2). A significant difference was determined between adolescents and young adults in addicted participants' sleep quality ( $p=0.005$ ) (Table 2). Perceived Health Risk is low level in all groups and there were no significant differences according to addiction ( $p=0.055$ ) (Table 2).

**Table 1.** Characteristics and internet usage information of all participants

Variables	Addicted Adolescents	Non- Addicted Adolescents	Addicted Young Adults	Non-Addicted Young Adults
Age (years)	15.44±2.27	15.85±2.53	20.22±2.67	20.48±2.67
Gender (f/m) %	22/18 55/45	22/18 55/45	24/16 60/40	16/24 60/40
Technology Addiction Scale (Score)	66.72±18.28	44.70±13.84	55.37±18.07	41.77±15.60
Age of first Internet use (year)	9.62±2.73	10.89±2.63	11.95±2.28	12.50±3.28
Duration of Internet Usage (daily) (hours)	4.17±0.98	3.40±1.19	3.45±1.15	3.10±1.21

f: female, m: male.

**Table 2.** Distribution of cervical posture, sleep quality, and perceived health risk data according to group

Variable	Addicted Adolescents	Non- Addicted Adolescents	p <sup>1</sup>	Addicted Young Adults	Non-Addicted Young Adults	p <sup>2</sup>	p <sup>3</sup>
<b>Cervical Posture (°)</b>							
CVA	67.97±5.09	48.85±5.95	0.000*	66.97±3.48	46.69±5.07	0.000*	0.326
CHA	21.55±15.29	17.00±12.39	0.159	22.87±15.20	22.20±11.98	0.843	0.710
SSA	54.69±20.47	48.08±18.61	0.146	52.45±18.63	48.80±18.79	0.386	0.612
<b>Pittsburg Sleep Quality Index (Score)</b>	8.62±3.69	6.75±2.88	0.013*	6.37±3.28	6.95±3.03	0.419	0.005*
<b>Perceived Health Risk (Score)</b>	2.52±0.93	2.20±1.15	0.171	2.10±0.99	2.30±1.28	0.448	0.055

\*p<0.05 is statistically significant, independent t-test, p<sup>1</sup>: Comparison of adolescents, p<sup>2</sup>: Comparison of young adults, p<sup>3</sup>: Comparison of addicted groups, CVA: Cranio-Vertebral Angle, CHA: Cranio-Horizontal Angle, SSA: Sagittal Shoulder Angle

## DISCUSSION

The aim of this study was to compare the cervical posture, sleep quality, and perceived health risk of technology-addicted adolescents, young adults and their controls. The study shown that participant tech-addicted individuals had worse CVA and sleep quality than both their controls. While the posture effects of individuals in different age groups were similar, the sleep quality of addicted adolescents was worse than that of addicted adults. This shows us that meeting technology at an early age and being exposed to mass media in different positions impair the health of individuals in the adolescent group. Adolescent and young adult groups did not perceive this exposure as a health risk due to the fact that the developing technology is everywhere in our lives and is easily accessible. Our study is unique in terms of comparing addicted and non-addicted individuals in different age groups.

The use of the internet and technological devices is inevitable today and it affects individuals of all ages in society at different levels. Factors such as the widespread use of mass media such as tablets, televisions, smart phones and easy access to the internet trigger technology addiction. There are many studies in the literature investigating the negative effects of technology addiction in young individuals. The main ones of these effects can be listed as psychological factors, sleep disorders and posture disorders [21]. In particular, there are studies examining the relationship between smartphone addiction and cervical posture. In these studies, posture-related scales were generally used [21]. It has been shown that craniocervical posture is adversely affected by excessive, uncontrolled and damaging use of the smartphone [22]. It has been emphasized that temporomandibular joint pathologies may also develop due to the effect on the craniovertebral angle [23]. In a study

by Cetin et al., the relationship between smartphone use and cervical posture was investigated, and a strong relationship was found only between CVA and addiction [24]. The posture parameters we used in our study were compared for the cervical posture of individuals addicted and non-addicted smartphones in the young-adults population, and a significant difference was found only in CVA [25]. In our study, only the CVA was found to be significantly impaired in the posture analyzes of the addicted groups, consistent with the literature. We think that the fact that the CVA is similar in the addicted adolescents and addicted young adults can be explained by exposure similarity. In addition, another study compared postural changes after 5 minutes of mobile phone use and showed an increase in shoulder protraction on the non-dominant side, kyphosis, neck lateral flexion, and pelvic obliqueness. In other words, it has been discussed that postural deteriorations are not limited to the cervical region, but may spread throughout the body in the future [26]. Based on this view made specifically for the smartphone, although the technology-addicted individuals included in our sample frequently and especially use the phone, we think that the influence does not affect the shoulder position, since technology addiction includes different positions such as tablet and television. In addition, not knowing the sitting times or physical activity levels of the participants is one of the limitations of our study.

Excessive use of technology negatively affects sleep quality in adolescents and young adults. Anxiety and loneliness, which increase with the use of the Internet or technological tools, are an indicator of psychological problems in the same population, and the presence of psychological problems is also associated with sleep problems. In a study conducted by Coskun et al., it was stated that students often browse the computer or the Internet

and watch television before falling to sleep [27]. Exposure to blue light with technological tools reduces the release of melatonin, which plays an important role in sleep quality [28]. This causes difficulty in falling asleep, disruption of sleep rhythm and poor sleep quality [27]. When the sleep quality of young people addicted and non-addicted internet was compared, addiction and sleep quality were negatively correlated. [29, 30]. In another study investigating the causes of sleep problems in the adolescent group, it was emphasized that technology use was at the forefront [31]. Besides, it was shown that poor sleep quality is associated with a deterioration of posture [32]. In our study, sleep quality was worse in the addicted groups and sleep quality was affected more in the adolescent group than in the other groups. We are of the opinion that the sleep rhythm and quality can normalize over time by adapting the body to the use of technological tools at a young age. There is a need for longitudinal studies in which technology-addicted individuals are followed from a young age.

Although the negative effects of technological tools on health are known, it is important how much risk users perceive this factor. Because being aware of the negative effects of technology addiction will prevent adverse consequences. Technological tools have important effects on mental and psychological health and can change the daily activity routines of adolescents and children, especially in the most vulnerable group [33]. However, how this danger is perceived by users is even more important. Perceived disorders related to the use of digital technology in adolescents between the ages of 10-15 were investigated and 91% of adolescents reported that they had problems in their real lives due to the virtual environment [34]. In the study conducted by Buda et al., it was shown that the use of social media caused two times less sleep quality and life satisfaction in the child and adolescent group [35]. Individuals in our sample had low levels of awareness, regardless of their addiction level. It would be beneficial to provide trainings on the negative effects of excessive use of technological tools on health, especially for groups such as children and adolescents who are vulnerable.

According to the findings of the study, adolescents are more affected by technology addiction than young adults. Addicted adolescents have worse CVA and sleep quality than non-addicted adolescents. CHA and SSA were similar in groups. It may be due to the fact that the CVA angle, which leads to postural changes, is a more general parameter since it covers both the head-neck and the trunk. In addition, since the concept

of technology addiction is not limited to smartphone use, CHA and SSA exposure may be less in tablet and computer use. In our study, it was determined that the groups did not perceive technology use as a risk factor that could negatively affect health. Providing trainings that include the negative effects of excessive use of technological tools on health will prevent health expenditures in the future, especially in order to increase the awareness of adolescents.

### Limitations

This study has a number of limitations. Firstly, the physical activity or sports habits of the participants are unknown. Second, sitting time and sitting position, which are other factors that may affect the head-neck posture of individuals, were not recorded. Thirdly, since the data of our study were collected from a single center, the sample population representation is limited.

### CONCLUSIONS

It has been shown that technology addiction affects the adolescent group more negatively than the young-adults. In the sample of adolescents and young-adults, individuals did not perceive excessive use of technological tools as a risk factor for their health. The degradation of CVA due to the overuse of technological tools precedes the degradation of CHA and SSA. This can be explained by the fact that CVA is a more general angle that includes both the head-neck position and the vertebrae. Considering the negative effects of technological tools and the low awareness levels of the participants, it is necessary for public health to educate and raise awareness of the more vulnerable adolescent group. Actions such as trainings and informative brochures on topics such as head and neck posture, sleep quality and hygiene will prevent future health expenditures.

**Conflict of Interest:** The authors declare that they have no conflicts of interest.

**Informed Consent:** The participants were informed about the purpose and content of the study. Informed consent has been obtained from all participants included in the study.

**Ethical Approval:** Ethical approval was obtained from the ethical committee of Cukurova University (ethics committee decision No: 2023/72).

**Author Contributions:** Conception: TM - Design: TM - Supervision: TM - Fundings: x -Materials: TM, EİI- Data

Collection and/or Processing: EİI- Analysis and/or Interpretation: TM, EİI - Literature: TM, EİI - Review: TM, EİI - Writing: TM, EİI - Critical Review: TM, EİI

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***How to Cite;***

Maden T, Işık Eİ (2023) Investigation of Cervical Posture, Sleep Quality and Perceived Health Risk in Technology Addicted Adolescents and Young Adults: A Comparative Study. *Eur J Ther.* 29(3):629-637. <https://doi.org/10.58600/eurjther1784>