# AWARENESS ABOUT THE OCULAR EFFECTS OF SMARTPHONES: A STUDY OF KNOWLEDGE AND PRACTICE AMONG SCHOOL CHILDREN

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**ABSTRACT**

**BACKGROUND**

There is an increasing number of children who use smartphones in urban India. They use smartphones mainly for playing various games and sometimes for study purpose. Many of them use their parent's phones without any awareness about the ocular side effects of smart phone. We wanted to determine the number of school children using smartphones, their knowledge regarding the ocular effects of smart phones, preventive measures and as to whether they are practicing such methods.

**METHODS**

This is a cross sectional study based on questionnaire. A total of 142 school children in the age group of 9 to 16 were included in the study. They along with their parents were asked to answer the questionnaire.

**RESULTS**

142 school going children were included in the study with a mean age of 14.3. There were 67 male children and 75 female children. 68.31% of school children use smart phones with an average of 10.30 hours per week. 71.12% of children are not aware about the ocular effects of smart phones. There is no significant difference between adolescents and pre adolescents ($p>0.05$). 25.35% consider good lighting prevents ocular ill effects and 10.56% felt taking a break helps in good eye health. Compared to pre adolescents, adolescents are better aware about preventive measure ($p<0.01$).

**CONCLUSION**

68.31% of urban school children are using smartphones with an average time spent is 10.30 hours per week. 71.12% are not aware about the ocular effects of smart phones and 64.08% donot know how to prevent it.

**KEYWORDS**

Smartphones, Ocular Effects, School Children.

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## BACKGROUND

Smartphone is a term used to distinguish mobile phone with advanced features from basic function phones. Modern smart phones have all features of laptop including web browsing and various applications. There is rapid increase in smartphone users in urban India due to better technology and fast internet connection. Both children and adults use smartphones for prolonged period of time. Many school going children use smartphones phones for playing various games, study related projects and internet surfing. The massive growth in digital device usage can lead to visual fatigue which is called digital eye strain. Digital eye strain (DES) can cause external symptoms like eye irritation, burning sensation in eyes, and watering whcih is due to development of dry eyes. Dry eyes are due to prolonged staring at the screen with decreased maximum blink interval. DES can cause internal symptoms like eye strain, head ache, and eye pain which are mainly due to accommodative excess. But many children and sometimes even adults are unaware about various ocular ill effects of long period usage of smartphones. Parents are unable to control the time spent in smart phones by their children. This smartphone addiction can lead to serious physical and psychological problems and have a negative impact on lives of young children.

The use of smart phones among school children is rapidly increasing from 5% in 2012 to 25% in 2014[1] but prolonged use of smart phone like any other video display terminal can cause decreased maximum blink interval and can lead to dry eyes.[2,3] In addition it can cause ocular fatigue which will manifest as eye pain, tiredness in eyes and blurred vision.[4]

This study is initiated to find the hours spent in smartphone among school children in urban India and their knowledge regarding the ocular effect of prolonged use.

### Aims and Objectives

It is an observational study based on questionnaire.

- The aim of the study is to assess the number of school children between the age group 9 years to 16 years who are using smart phones.
- Duration of time spent with smart phone.

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- Their knowledge regarding ocular effect of prolonged usage.
- Awareness about preventive measures.
- Practice of preventive measures.

## METHODS

This is a cross sectional observational study conducted in September to October 2018.

A total of 142 school children in the age group of 9 years to 16 years who attended ophthalmic op in a private clinic in Chennai were included in the study. They were divided in to two groups. Children from 9 years to 12 years were included in pre-adolescent group and children between the age of 13 years to 16 years were included in adolescent group.

A seven-point questionnaire in the form of multiple choice were given to the children and their parents. Duration of smartphone use per week in number of hours (less than 5 hours, 6 to 10 hours, 11 to 15 hours, more than 15 hours), present symptom for which they attended the op, awareness about the ill effects of smartphone usage (yes or no), symptoms due to smartphone use (dry eyes, watering, eye strain, head ache), can it be prevented (yes or no), methods of preventing (taking a break, good lighting, decreasing number of hours, applying eye drops) whether they practice such methods (yes or no) were included in the questionnaire.

Consent from parents were obtained.

Both parents and children were asked to answer the questionnaire.

Since school children spend more time during week end than working days in smart phones, the hours spent were noted per week.

Data collected were analysed using SPSS software.

## RESULTS

A total of 142 school children who attended ophthalmic op were included in the study. The age ranges from 9 years to 16 years with a mean age of 14.3. There were 67 male children and 75 female children. They were divided in to 2 groups. Children between the age of 9 to 12 years are grouped under pre adolescents and from 13 to 16 years were under adolescent group. 88 children were adolescents and 54 were pre adolescents.

The number of hours spent with smartphone per week were divided in to 5 categories. Group A when the hours are less than 5, group b consist of time spent between 6 to 10 hours, group c between 11 to 15 hours, group d more than 15 hours and group e where there was nil usage.

Out of 142 children, 36(25.35%) were using smartphones for less than 5 hours per week. 34(23.94%) were using between 5 to 10 hours per week and 12(8.45%) were using between 11 to 15 hours per week. 15 (10.56%) children spend more than 15 hours per week. 45(31.69%) of them do not use smart phones. A comparison between adolescents and pre adolescents were shown in the table 1. There is no difference between the two groups. On an average, school children spend 10.30 hours per week in smart phones.

The complaints for which the children attended the ophthalmic op are summarized below. 27(19.01%) had head ache, 19(13.38%) had eye pain, 36 (25.35%) had irritation and watering 59(41.54%) had defective vision, 8 (5.63%) had other complaints like frequent blinking, 18(12.67%) came for routine ophthalmic check-up as a part of school health screening.

Questionnaire regarding awareness about ocular effect and computer vision syndrome showed that 41(28.87%) students are familiar with the ill effect of prolonged use of smart phones. 101(71.12%) children were not aware (table 2). Comparison between adolescents and pre adolescents is not significant with p value >0.05

Out of 142 school children 36(25.35%) consider good lighting is important for preventing ill effects of smart phone on eyes, 15(10.56%) felt taking a break helps and 91(64.08%) did not know. A comparison between adolescents and pre-adolescent is shown in the table 3. Awareness about prevention of ill effects of smartphone use is more among adolescents than pre adolescents (P<0.01).

19(13.38%) children follow either one of the methods to prevent ocular effect of smart phones and 123(86.61%) do not use any preventive measures (Table 4). Even though adolescents are better aware about prevention of ocular side effects of smart phones, they do not practice it. (Table 4)

**Crosstab**

| | | | GROUP | | |
|---|---|---|---|---|---|
| | | | ADOLESCENTS | PREADOLESCENTS | Total |
| HOURS | < 5 HOURS | Count | 21 | 15 | 36 |
| | | % within GROUP | 23.9% | 27.8% | 25.4% |
| | 6 - 10 HOURS | Count | 23 | 11 | 34 |
| | | % within GROUP | 26.1% | 20.4% | 23.9% |
| | 11 - 15 HOURS | Count | 9 | 3 | 12 |
| | | % within GROUP | 10.2% | 5.6% | 8.5% |
| | > 15 HOURS | Count | 10 | 5 | 15 |
| | | % within GROUP | 11.4% | 9.3% | 10.6% |
| | NIL | Count | 25 | 20 | 45 |
| | | % within GROUP | 28.4% | 37.0% | 31.7% |
| Total | | Count | 88 | 54 | 142 |
| | | % within GROUP | 100.0% | 100.0% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 2.458[a] | 4 | .652 |
| Likelihood Ratio | 2.507 | 4 | .643 |
| Linear-by-Linear Association | .217 | 1 | .642 |
| N of Valid Cases | 142 | | |

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 4.56.

**P > 0.05 NS**

***Table 1. Hours Spent in Smart Phones***

**Crosstab**

| | | | GROUP | | |
|---|---|---|---|---|---|
| | | | ADOLESCENTS | PREADOLESCENTS | Total |
| AWARENESS | YES | Count | 29 | 12 | 41 |
| | | % within GROUP | 33.0% | 22.2% | 28.9% |
| | NO | Count | 59 | 42 | 101 |
| | | % within GROUP | 67.0% | 77.8% | 71.1% |
| Total | | Count | 88 | 54 | 142 |
| | | % within GROUP | 100.0% | 100.0% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 1.877[b] | 1 | .171 | | |
| Continuity Correction[a] | 1.391 | 1 | .238 | | |
| Likelihood Ratio | 1.921 | 1 | .166 | | |
| Fisher's Exact Test | | | | .187 | .119 |
| Linear-by-Linear Association | 1.864 | 1 | .172 | | |
| N of Valid Cases | 142 | | | | |

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 15.59.

**P > 0.05 NS**

***Table 2. Awareness About Ocular Effect of Smart Phones***

**Crosstab**

| | | | GROUP | | |
|---|---|---|---|---|---|
| | | | ADOLESCENTS | PREADOLESCENTS | Total |
| PREVENTION | Good lighting | Count | 26 | 10 | 36 |
| | | % within GROUP | 29.5% | 18.5% | 25.4% |
| | Taking a break | Count | 14 | 1 | 15 |
| | | % within GROUP | 15.9% | 1.9% | 10.6% |
| | Not aware | Count | 48 | 43 | 91 |
| | | % within GROUP | 54.5% | 79.6% | 64.1% |
| Total | | Count | 88 | 54 | 142 |
| | | % within GROUP | 100.0% | 100.0% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 11.151[a] | 2 | .004 |
| Likelihood Ratio | 12.867 | 2 | .002 |
| Linear-by-Linear Association | 5.821 | 1 | .016 |
| N of Valid Cases | 142 | | |

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.70.

**P <0.01 SIG**

***Table 3. Known Preventive Measures***

**Crosstab**

| | | | GROUP | | |
|---|---|---|---|---|---|
| | | | ADOLESCENTS | PREADOLESCENTS | Total |
| PRACTISE | YES | Count | 14 | 5 | 19 |
| | | % within GROUP | 15.9% | 9.3% | 13.4% |
| | NO | Count | 74 | 49 | 123 |
| | | % within GROUP | 84.1% | 90.7% | 86.6% |
| Total | | Count | 88 | 54 | 142 |
| | | % within GROUP | 100.0% | 100.0% | 100.0% |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 1.277[b] | 1 | .258 | | |
| Continuity Correction[a] | .768 | 1 | .381 | | |
| Likelihood Ratio | 1.335 | 1 | .248 | | |
| Fisher's Exact Test | | | | .317 | .192 |
| Linear-by-Linear Association | 1.268 | 1 | .260 | | |
| N of Valid Cases | 142 | | | | |

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.23.

**P > 0.05 NS**

***Table 4. Children Using Preventive Measures***

## DISCUSSION

Availability of cheaper smartphones in the market and also affordable and faster internet connection has increased the number of smartphone users in urban India. It is estimated to be 478 million mobile phone users by 2018. There are 291 million urban smartphone users and 187 million rural internet users in India according to internet and mobile association of India (IAMAI) and Kantar IMRB.[5]

Both children and adults are hooked to smart phones for long hours. Children use their parents' phones with or without supervision. Many times, parents do not have control over them and could not restrict prolonged usage by their children. There is no definite age limit for start using smartphone and a recent survey found that one in four children under the age of six in Britain has smartphone. Now a days, even in India the age at which a child using smartphones is getting younger. Mothers use smartphone to distract young ones while feeding and keep them occupied. This becomes habitual and weaning out of smartphones is a challenge. Apart from playing and internet surfing, school children use online for many projects and study related materials. Traditional teaching is slowly giving way to the technology and computer play a major role in teaching curriculum. The awareness about ocular ill effects of smartphones is poor and parents are worried about how to cut down screen time to create healthy balance between work and play.

Only 5% of people in age group 16 to 18 years were using smartphones in 2012 and it increased to 25% in 2014. The annual rate of smartphone use in India is increasing and it is even more than China.[6]

When computer screen is used for extended period of time many people will get eye strain a phenomenon referred to as computer vision syndrome (CVS). Pronged use of smartphones and other digital devices(video display terminal) can also cause symptoms like computer vision syndrome and recently referred as digital eye strain.[7] Use of video display terminal for long hours has been associated with decreased maximum blink interval, hence the development of dry eye diseases. CVS symptoms have been classified broadly in to four catagories.[8]

1. Asthenopia–eye strain, tired eyes.
2. Ocular surface related DED (dry eye diseases).
3. Visual-blurred vision, double vision.
4. Extra ocular-neck pain, back ache.

According to the study done by Common Sense Media in U.S, the age between 8 to 12 years spend 6 hours per day in phones and teens spend 9 hours per day.[9] The average time spent in smartphones by school children is 10.30 hours per week in this study. 86% of children between the ages of 12 to 15 years in UK are regular users of smart phones.[10] In this study 68.31% of school children between the age of 9 to 16 years are using smart phones. All children in this study do not own a smart phone. Many of them use their parents' smart phones especially during weekends. Prevalence of asthenopia among gadget users is estimated to be 55 to 81%[11] Visual fatigue caused by smart phone use has a negative impact on balance function.[12] Visual fatigue is also due to holding smartphones too close to face and survey suggest that people hold mobile phones two to nine inches closer than while holding books. Digital eye strain can cause external eye problems like irritation, dryness and burning which are due to dry eyes (DED). Internal symptoms like head ache, eye pain, eye strain is due to accommodative or binocular vision stress.[13] While digital eye strain is a common

problem, there is poor awareness about its various health related issues in the public and among general health professional.[14] Only 28.87% of the study group is aware about the ocular effect of prolonged use of smart phones.

Regarding prevention of symptoms caused by smart phone use, 25.35% consider good lighting is important and 10.56% think taking a break from touch screen relieves symptoms. 64.08% are not familiar with the preventive measures. Only 13.38% practice such preventive measures. A study conducted in computer users between the age 18 to 40 years showed that 40% are not aware and only 27% had knowledge regarding prevention.[15]

Many children grow up with digital technology and use tablets or mobile phones for study related projects. High end schools have started teaching using digital devices. Whether this type of teaching is beneficial to learning is debatable. Students have access to wide collection of study related materials and better learning environment. While these sounds promising there is another side of this two-edged sword. The physical and psychological impact of long-term usage of smartphones is alarming.

Light Emitting Diodes (LED) have been used to provide illumination in smart phones and tablets. LEDs have peak emission in the blue light range (400-490 nm). Accumulating evidence suggest blue light can cause photoreceptor damage.[16] Hence long-term usage of smart phones especially among children should be discouraged.

## CONCLUSION

Present study reveals that 68.31% of school children in urban India use smart phones and the average time spent is 10.5 hours per week. 71.12% are not aware about the ill effects of long-term use and 64.08% do not know as to how to prevent such effects on eyes. There is no significant difference between adolescents and pre-adolescents regarding duration of time spent, awareness about ocular effects, and practice pattern. Awareness about prevention is more among adolescents than pre adolescents but practice pattern is same among two groups. Digital technology is evolving rapidly and the number of children using smart phones will increase in the future. There is an urgent need to educate the children on how to interact safely with digital technology and develop healthy eye habits.

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