

# Analytic study risk of dry eye in smartphone users in primary school children at tertiary hospital centre

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## Abstract

**Background:** Dry eye is disease of the tear film and ocular surface that results in symptoms of discomfort, visual problems, and tears film stability defects with damage to the ocular surface. Use of smartphone display for long hours has been associated with a decreased maximum blink interval, hence the development of dry eye symptoms. **Material and Methods:** 610 primary school children age from 6 to 12 years came for routine eye check up during month march 2019 to June 2019 for 4 months duration in ophthalmology department were included in our study. We are studying association between dry eye and use of smart phones in primary school going children. All children were examined for all general and local ophthalmic findings. TBUT was performed in children by same single ophthalmologist. **Results:** Among 610 children 30 never used smartphone. Among all primary school children 37.24 % were younger and 62.75% were older. Among children 26.89% using smart phone less than 1 hour, 45.68% using smart phone 1 to 2 hours and 27.41 % using smart phone more than 3 hours. Among 29 positive test results in all children we got following results. Among Children whose usage was greater than 3 hours per day has maximum number of dry eye which is 24. We found P value is less than 0.05 in dry eye children whom daily usage of smartphone greater than 3 hours. **Conclusion:** we found significant association between daily duration of usage of smartphone and presence of risk of dry eye in children. For this reason, it is important that parents and guardians become aware of this problem so that they can help to reduce the usage of smartphones in their children in order to reduce risk of dry eye.

**Key Words:** Dry eye, Smart phone, Tear breakup time(TBUT).

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## INTRODUCTION

Dry eye is condition in which tear film is abnormal which is caused by number of etiologies which alter its

composition and affects stability. Dry eye is disease of the tear film and ocular surface that results in symptoms of discomfort, visual problems, and tears film stability defects with damage to the ocular surface. It is also tends to increase problem of inflammatory changes on the ocular surface. Dry eye refers to disorders of tear film due to reduced tear production and/or excessive tear evaporation associated with symptoms of ocular discomfort.<sup>2</sup> Nowadays general use of smartphone drastically increase in all population across whole globe. In most of family children simultaneously getting increase exposure to smartphones. Pediatric dry eye disease tends to have a higher prevalence in younger ages.<sup>3</sup> Children creativity leads to more attraction towards smart phone increase. Average daily duration of

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smartphone use leads to risk of many eye conditions. Decrease blinking while using smartphone leads to risk of dry eye in children. Damage to the eye surface ultimately impairs visual function, eliciting the characteristic dry-eye symptoms of dryness and blurred vision, so these underlying causes of tear-film breakdown must be understood for particular Management. Blinking is decrease while using smart phones it leads to symptoms and sign of dry eye like reduce clear vision, reduction in tear film break up time [TBUT], ocular surface staining which reduces children visual functioning for learning and other daily activities.<sup>4</sup> Children with dry eye often complain irritation, redness, heaviness, foreign body sensation, redness and reflex watering.<sup>5</sup> Use of smartphone display for long hours has been associated with a decreased maximum blink interval, hence the development of dry eye symptoms.<sup>6,7,8</sup> While many parents are aware of the growing number of hours that children spend on their smart phones, there is little knowledge about the problem of dry eye among parents and family members. So it is important that parents become aware of this issue so that they can help to prevent the more use of smart phones in their children in order to keep them away from risk of dry eye.

## MATERIAL AND METHODS

This study was conducted at ophthalmology department at tertiary hospital centre. 610 primary school children age from 6 to 12 years came for routine eye check up during month march 2019 to June 2019 for 4 months. Duration in ophthalmology department were included in our study. Our study was cross sectional analytic case-control study at ophthalmology department at tertiary hospital centre. We performed statistical analysis of risk factor in primary school children divided into groups as follows: dry eye vs. control group and younger (6 to 9 years) vs. older (10 to 12 years) group. We used multivariate logistic regression analysis to assess Dry eye risk. Statistical analyses were performed using SPSS for Windows. The chi-square test was used to compare non-continuous variables between the two groups. P values less than 0.05

were considered statistically significant. Permission from ethics committee was taken for this study. All primary school children whom daily usage of smart phone less than 1 hour were considered as controls. We are studying association between dry eye and use of smart phones in primary school going children. Written informed Consents were taken from parents, teachers and guardians in their local language taken. Exclusion criteria : (1) Children with ocular surface allergies, infections, foreign body, trauma, eye surgery, congenital ocular disease, drug history, contact lens wear, acquired ocular disease and systemic disease. (2) children whom average duration of watching television and using computers more than 2 hours daily. (3) children whom average duration of learning at home greater than 5 hours. (4) Outdoor activity greater than 2 hours daily. The questions asked in smart phone user children parents and guardians was include (1) daily duration of usage of smart phones and watching television to parents, teachers and children (2) dryness, burning, irritation, heaviness, watering and grittiness. Subjective ocular symptoms were measured with the modified ocular surface disease index score. This index was an objective parameter for dry eye problem.<sup>9</sup> All things was asked by single same ophthalmologist in local patient language with detailed all ocular examinations and tests for dry eye. Tear break-up time (TBUT) was measured with a fluorescein strips coated with one drop of balanced salt solution. After applying the strip to the inferior Conjunctival fornix, the participant resumed normal blinking for several seconds. After the fluorescein solution spread across the corneal surface, the participant was asked to keep his or her eye open until the first defect of the tear film occurred. TBUT was defined as the interval between the last complete blink and the first appearance of a dry spot on the pre-corneal surface of the tear film.<sup>10</sup> A reduced tear breakup time (TBUT) may indicate an unstable tear film with normal aqueous tear production, and there may be minimal or no dye staining of the ocular surface break-up times less than 10 seconds are considered abnormal.<sup>11</sup>

## RESULTS

After complete analysis of 610 primary school children for dry eye at Tertiary Hospital Centre we got following results. 30 children never used smartphone. Among rest of 580 we got following results.

**Table 1:** Distribution of children (n=580)

Age	Sex		Total (%)
	Male (%)	Female (%)	
Younger	131(22.58)	85(14.65)	216(37.24)
Older	213(36.72)	151(26.03)	364(62.75)
<b>Total(%)</b>	<b>344(59.31)</b>	<b>236(40.68)</b>	<b>580(100)</b>

Among all primary school children 37.24 % were younger and 62.75% were older.

**Table 2:** Daily duration of smart phone use

Duration of usage of smart phone in hours.	Age				Total (%)
	Younger		Older		
	Male (%)	Female (%)	Male (%)	Female (%)	
Less than 1 hours	56(9.65)	39(6.72)	42(7.24)	19(3.27)	156(26.89)
1 to 2 hours	51(8.79)	29(5.00)	102(17.58)	83(14.31)	265(45.68)
More than 3 hours	24(4.13)	17(2.93)	69(11.89)	49(8.44)	159(27.41)
Total(%)	131(22.58)	85(14.65)	213(36.72)	151(26.03)	580(100)

Among all 26.89% using smart phone less than 1 hour, 45.68 % using smart phone 1 to 2 hours and 27.41 % using smart phone more than 3 hours.

**Table 3:** Dry eye findings in children

Age	Sex	Dry eye test result		Total (%)
		Positive (%)	Negative (%)	
Younger	Male	5(0.86)	126(21.72)	131(22.58)
	Female	2(0.34)	83(14.31)	85(14.65)
Older	Male	17(2.93)	196(33.79)	213(36.72)
	Female	5(0.86)	146(25.17)	151(26.03)
<b>Total(%)</b>		<b>29(5)</b>	<b>551(95)</b>	<b>580(100)</b>

Among all 5% had positive result for dry eye test in younger ones it is 1.2% and in older ones it is 3.73%.

**Table 4:** Daily duration of usage of smart phone and positive dry eye test

Duration usage of smart phone	Positive dry eye test				Total
	Younger		Older		
Less Than 1 hour	0(0)	0(0)	0(0)	0(0)	0(0)
1 to 2 hours	1(3.44)	0(0)	3(10.34)	1(3.44)	5(17.24)
More than 3 hours	4(13.79)	2(6.89)	14(48.27)	4(13.79)	24(82.75)
Total	5(17.24)	2(6.89)	17(58.62)	5(17.24)	29(100)

Among positive test results in all children which is 29 we got following results. Children whom usage was greater than 3 hours per day had maximum number of dry eye which is 24.

**Table 5:** Dry eye and duration of smart phone use

Daily duration usage of Smartphone	Dry eye	
	Present	Absent
Less than 2 hour	5	416
More than 3 hour	24	135

$\chi^2 = 46.99$ , P value < 0.05

## DISCUSSION

There is very less study about dry eye association with duration of usage of smart phones in primary school children. The recent increase in smartphone use caused an increase in reports of symptoms such as irritation, burning sensation, Conjunctival congestion, decreased visual acuity, strain, and fatigue.<sup>12</sup> The rate of smartphone use has rapidly increased in Indian populations, especially among primary school children. A reduced blink rate during continuous smartphone use causes faster evaporation of the tear film, which may then lead to dry eye. It is important to be aware of the effects of visual tasking on your eyes; take breaks, alternate tasks and otherwise try to reduce long stretches spent staring at a smart phone display. In a previous study, we noted video display terminal use and reading reduced the blink rate to

5–6/min (1/3 of the resting state rate) and promoted tear film evaporation and accommodation.<sup>13, 14, 15, 16</sup> we pose possibilities of smart phones usage and association with dry eye in primary school going children. According to table no 2 the rate of smartphone daily usage was 37.24% in younger groups compared to 62.75% in older groups which is comparable to 50.9% in younger and 65.1% in older age group in recent study.<sup>17</sup> Previous studies have focused on the causal relationships between dry eye and use of electronic visual media such as smartphones.<sup>18, 19, 20</sup> In dry eye children mean daily duration of smartphone usage was more than 3 hours in our study comparable to  $3.18 \pm 0.97$  hours in recent study.<sup>17</sup> According to table no 3 the prevalence of Dry eye was 1.2% in younger children and 3.73% in older children comparing to 4 % in younger graders and 9.1 % in older graders in recent study, and

also Dry eye problem was also found to be higher in boys than girls which was higher in boys than in girls in recent study.<sup>17</sup> There is significant association between risk of dry eye and use of smart phone greater than 3 hour daily as p value is less than 0.05 in association table no 5. Dry eye prevalence was higher in older children than younger children. The rate of smartphone use was higher and the mean daily duration was longer in older group, which may have led to the higher Dry eye prevalence in older group. All this discussion leads us to significant probability and risk of dry eye in smart phone using children. Longer duration and older age group has major risk than lesser usage duration and younger age group. In this days Parents not able to give full attention towards children due to family and financial responsibilities on them in fast daily routine life which leads to decrease attention towards children. Nowadays Smart phone availability across globe is very easy with so many loaded features which attract everyone including children. This two associative factors decrease attention and increase easy availability of smart phones drastically fast increase daily usage among children and in future this will increase faster speed. So this all leads to final point of risk of dry eye in smart phone users particularly whom daily usage was greater than 3 hours. We used subjective symptom criteria modified osdiscore and objective signs decrease TBUT to diagnose dry eye. These criteria were based on adults and subjective signs of Dry eye were not obvious. Thus, the true prevalence of dry eye in school children may be different due to the use of adult-targeted diagnostic criteria. We did not consider confounding factors such as socioeconomic status, family income and family structure. Dry eye and ocular allergies have similar symptoms and it was difficult to identify children with Dry eye from those with ocular allergies.<sup>21, 22</sup>

## CONCLUSION

Smartphone becomes important part nowadays in daily routine life style across globe. With fair advantages of smartphone it comes with many side effects on human eye including risk of dry eye. Those whose average daily duration is minimal to nil are at minimal risk of dry eye. As smartphone use increase in all age population children gets easy exposure of smartphone during daily life. Parents, family members, teachers and local guardian paying low attention towards this and easy availability of smartphones increases daily duration of usage in children. This daily increase duration for longer times became risk factor for children nowadays. The most obvious solution here is to reduce your smart phone use and insist that your children do the same. If you must use a smart phone, limit yourself to shorter periods of time and follow the 20-20-20 rule: Give your eyes a rest by looking at something

that is situated 20 feet off into the distance for 20 seconds after every 20 minutes of screen use. Healthy diet like carrots, spinach, broccoli, pumpkins etc can counteract eye damage by this smart phones. Diet alone is not likely to counteract the bad effects of these devices. There are plenty of other reasons to minimize smart phone use, from sleep disruptions to privacy issue, to the dangers of cell phone radiation.

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