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### RESEARCH ARTICLE

#### EFFECT OF DIGITAL ELECTRONIC DEVICES ON EYE HEALTH IN SCHOOL CHILDREN.

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**Key words:** Digital electronic devices, myopia, asthenopia, dry eye.

#### Abstract

**Purpose:** To study the effect of electronic screen devices on eye health of school children in the form of refractive errors, dry eye, asthenopia etc.

**Methods:** 200 children from the age group 5-15 years were included in the study out of which 100 were from the urban area and 100 from the rural area with comparatively lesser exposure to computer or cellular smartphones. History regarding the use of electronic devices was asked in detail and examination was carried out including vision, refraction, slit lamp and fundus examination.

**Results and conclusion:** Children from the urban subpopulation were found to have easy access to digital screen devices and hence were found to spend excessive amount of time using these devices. Also, refractive error found in this subpopulation was myopia more than hypermetropia. Astigmatism was also observed commonly in urban children using digital devices more frequently than rural children.

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#### Introduction:-

As technology continues to evolve, children are becoming even more inseparable from their computer devices. Many schools are incorporating tablets into their daily routine and computers are now there in every room. Although we may be happy about the increased amount of information children have access to, it's important to be aware of how much time they spend in front of computer and devices screen.

Too much time spent on these electronic devices come with vision related risks. Besides causing digital eye strain, computer vision syndrome, macular degeneration and myopia is also linked to computer use. To see clearly, eye has to exert a focus. Over long period of time, eyes can become fatigued and subsequently it may lead to myopia or nearsightedness.

Statistics show that 80 percent of what we learn is through our eyes, which can have a dramatic influence on children as well as adults who suffer from digital eye strain. Existing eye conditions may play a key role in digital eye strain. Common ocular conditions—such as myopia, hyperopia, astigmatism, and presbyopia—can be major contributing factors to digital eye strain. Any of these conditions, coupled with the nature and effects of consistent use of digital devices, increases the chances that the individual will have discomfort.

Extensive viewing of the computer screen can lead to eye discomfort, fatigue, blurred vision and headache, dry eyes and other symptoms of eyestrain. These symptoms may be caused by poor light condition, glare, an improper work station set-up, vision problems of which the person was not previously aware of, or a combination of these factors. In most cases, symptoms occur because the visual demands of the task exceed the visual abilities of the individual to

comfortably perform the task.<sup>1,2</sup> However, some unique aspects of how children use computers may make them more susceptible than adults to the development of these problems.

### **The limited degree of self-awareness of children**

Most of them keep performing an enjoyable task (e.g. playing video games) with great concentration for many hours until exhaustion, with few, if any breaks. Prolonged activity without a significant break can cause accommodation problems and eye irritation.

Accommodation problems may occur as a result of the accommodative apparatus “locking in” to a particular target distance. In some cases, this may cause accommodation spasm.<sup>1</sup>

Eye irritation may occur because of poor tear distribution over the eye due to reduced blinking. Blinking is often inhibited by concentration and staring at a computer or video screen. Compounding this, computers usually are located higher in the field of view than traditional paperwork. This results in the upper eyelids being retracted to a greater extent. Therefore, the eye tends to experience more than the normal amount of tear evaporation resulting in dryness and irritation.<sup>3</sup>

In this study, we evaluated 200 children from the age group 5-15 years. Out of the 200, 100 were from the urban subpopulation having minimum exposure of 5 to 8 hours daily to computer and related devices. Rest 100 were from the rural subpopulation with comparatively lesser exposure to computer or cellular smartphones.

### **Aims and objectives :**

1. To study the effect of electronic screen devices on eye health of school going children from 5-15 years age.
2. To determine the errors of refraction in these children.
3. To determine other eye problems like dry eye syndrome, asthenopic symptoms, neck and back pain etc.

### **Inclusion criteria :**

Children between age 5 to 15 years.

### **Exclusion criteria :**

1. Children less than 5 years of age and above 15 years of age.
2. Children having any previous ocular disorder apart from refractive error.
3. Children having undergone any previous ocular surgery.

### **Materials and methods:-**

200 school children from a district in Maharashtra were included in this study. Study was carried out in a tertiary care hospital. 100 children were from urban subpopulation whereas 100 were from rural subpopulation. For convenience purpose these groups were labeled as Group U (urban) and Group R (rural).

History was asked regarding the visual and associated asthenopic symptoms. History of use of electronic devices was asked in detail including the time spent per day on use of the devices and number of devices to which the child was exposed.

Examination was carried out which involved visual acuity-uncorrected and best corrected, refraction, slit lamp examination, dryness evaluation was done. Lid examination was done to look for any signs of eye rubbing like blepharitis, stye or chalazion. Fundus examination was done using indirect ophthalmoscopy.

### **Results:-**

**Table 1:-Visual Acuity**

Uncorrected visual acuity	Group U	Group R
<6/60	10	6
6/60 -6/18	56	39
6/18-6/6	34	55

**Table 2:-Children with Smartphone devices**

	Group U	Group R
Children having their own smartphone	70	33
Children not having their own smartphone	30	67

**Table 3:-Duration of use of electronic screen devices per day**

	Group U	Group R
< 2 hours	13	22
2-4 hours	22	35
4-6 hours	38	17
6-8 hours	12	15
> 8 hours	15	11

**Table 4:-Refractive error**

	Group U	Group R
On cycloplegic refraction-		
No of kids having myopic refractive error	33	25
No of kids with hyperopic refractive error	20	12
No of kids with Astigmatic refractive error	27	15
No of kids with no refractive error	20	48

**Table 5:-Asthenopia**

	Group U	Group R
Children having only asthenopic symptoms	21	15
Children with no asthenopic symptoms	79	85

**Table 6:-Lid signs of eye rubbing**

	Group U	Group R
With Lid manifestations of eye rubbing	15	9
Without any lid manifestations	85	91

**Discussion:-**

Digital eye strain (DES) or computer vision syndrome (CVS) is a group of eye and vision related problems that are due to extended computer or digital device use. Digital eye strain sufferers routinely exhibit eye strain, redness, and dryness due to decreased blinking; blurry vision due to screen glare; headache from prolonged eye strain; and neck, shoulder, back pain that is caused by poor posture and sub-optimal screen position. These symptoms are typically caused by the use of a digital screen for two or more hours per day. Digital eye strain is, in fact, a combination of some or all of the symptoms listed above.

Viewing a computer screen is different than viewing a typewritten or printed page. Often the letters on a computer screen are not as precise or sharply defined, the level of contrast of the letters to the background is reduced and the presence of glare and reflections on the screen may make viewing more difficult.<sup>4,5</sup>

Uncorrected or undercorrected farsightedness, astigmatism, presbyopia and binocular vision (eye coordination and eye focusing) problems can be major contributing factors to computer related eye stress.<sup>6,7</sup>

Like most electrical appliances, computers emit both ionizing and non-ionizing radiation. These include visible light, ultraviolet, infrared, x-ray and radio frequency emissions.

Virtually every digital device, as well as light emitting fixtures and appliances including fluorescent lamps, has light emitting diodes (LED) that radiate blue wave-length light. Blue light penetrates deeper into the eye compared to

ultraviolet light, so the exposure may damage the retina by exposing the eye to hidden spikes in intensity. The wavelengths within the blue-violet portion of the light spectrum that are considered potentially most harmful to retinal cells range from 415 nm to 455 nm, and most of our devices emit a high level of blue light, typically around the wavelength starting at 400 nm. Cumulative blue light exposure is linked to slow degeneration of the retina, which could accelerate long-term vision problems such as age-related macular degeneration (AMD) and cataracts.<sup>8</sup>

While not technically a form of radiation, most computers build up an electrostatic charge in the vicinity of the screen surface. Static charges can cause the attraction and accumulation of dust and other airborne particles on the face of the computer screen.

Although there is no conclusive evidence, it has been suggested that these charges may be related to the development of skin rash or eye irritation in some very sensitive people.<sup>9,10</sup>

The use of computers is associated with a decreased frequency of blinking and an increased rate of tear evaporation, each of which contributes to dry eyes.<sup>11,12,13</sup>

Apart from visual symptoms, asthenopic symptoms and musculoskeletal discomfort has also been reported due to prolonged use of digital devices.

Neck or head rotation away from the midline has been linked to increased discomfort or musculoskeletal symptoms among computer users.<sup>14</sup>

Lighting and glare can be sources of visual discomfort during computer use. Placing the computer display perpendicular to windows, using indirect lighting sources, window treatments and anti-glare screens can all be used to limit glare,<sup>15</sup> although mesh anti-glare screens are not recommended.<sup>16</sup>

The display technology may influence clarity, stability and adjustability of the display. Older style cathode ray tube displays are currently being replaced in many adult and child workstations with thin film transistor (or LCD) displays. These thinner and lighter weight displays provide for greater flexibility of positioning and may have a clearer, more stable image. It is recommended that a good quality display with good contrast be used and be free of flicker. Based on the available evidence, it is recommended that computer displays should be placed so that the top of the display is at or below eye height, at about arm's length away and directly in front of the user. A good quality display with a clear stable image should be used.

There are many easy ways for individuals to decrease their daily digital eye strain. Primarily, children should have annual eye exams to check for potential refractive error. If glasses are prescribed, they should wear them. Decreasing the brightness of a device is beneficial, as is installing an anti-glare screen protector on the devices. Decrease the amount of external lighting, thereby reducing the amount of glare on the devices. The monitor should be just inside arm's length. It should sit approximately even with the wrist with the arms extended straight out. The monitor should also be slightly lower, approximately 20 degrees below eye level. Use the digital device's accessibility features, including increasing the font size, using zoom features, and choosing different fonts or background colors. Most of the screen station settings consider adults as users, making them uncomfortable for a child's use.

Because using digital devices decreases blink rate, children should remind themselves to blink often while working on a computer or other device. Also, artificial tears are essential for prolonged computer use. The 20-20-20 rule for computer use is beneficial in educating your children on decreasing eye strain. Every 20 minutes, take a 20 second break and look at something at least 20 feet away. This will help relieve eye strain and also decrease generalized fatigue.

Although there are some risks associated with the use of electronic devices, they are not all bad. Few of these prevention tips can be implemented so that children can enjoy the use of electronic devices without worrying about any computer-related vision problems.

1. Limit screen time. Since most school-aged children use electronic devices at school, try limiting their use to the weekends. Use it as a reward. Always remember to end use at least one hour before bedtime (preferably two hours).

2. Use a screen filter. Most desktop computers have a filter that reduces the amount of emitted blue light from computer screen. Some tablets have films that act in the same way. Researching what options are available based on what equipment you own could be helpful for children.
3. Wear glasses. Special computer glasses are designed to block the blue light when looking at a computer screen. They use a yellow tint that significantly reduces eye strain. Anti-reflective lenses reduce glare and increase contrast to make it easier on your eyes to focus.

Regardless of showing any symptoms, every child should undergo a comprehensive eye exam every year to ensure proper eye health. It is important to test their visual acuity, eye tracking, and focusing skills on an annual basis to ensure proper development.

These are some guidelines which can be followed. But there is no harm in taking your child back to the era where communication was better even without the use of these digital devices !

#### Age Suggested Time Limit

1. Under 10 -30 minutes a day
2. 10–13 -1 hour a day
3. 14–15 -2 hours a day
4. 16–18 -Parents best judgement.

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