Impact of electronic devices on vision in children

Jannie Ferreira

Been made aware of developments in China with regards to the use of electronic devices by children under the age of eighteen years prompted me to write this article. In August 2021 the Chinese Communist Party passed a new law forbidding children from playing video games for more than three hours per week [1].

For years, [Chinese authorities have sought to control](https://apnews.com/article/lifestyle-technology-entertainment-business-china-69c2f1a0323707d4b3fb79eed06ae651) how much time kids can spend playing games online, to fight “internet addiction.” They’ve claimed success in curbing the problem but are taking no chances. In 2019, authorities restricted minors to playing 90 minutes a day on weekdays and banned them from playing between 10 p.m. and 8 a.m. In 2021, they issued [even harsher restrictions as mentioned above:](https://apnews.com/article/technology-business-china-media-b48e08c16d0c299a970fda6acd7bcc79) Minors are allowed to play online games for only an hour a day and only on Fridays, weekends and public holidays. Game approvals were halted for eight months. In November 2022 more than a year after the stricter game controls were introduced — a government-affiliated industry group, Game Industry Group Committee, issued a report declared the gaming addiction problem among minors was “basically resolved,” even as the three-hour weekly limit for Friday, Saturday and Sunday stayed in place [2].

Overall, the Game Industry Group’s report said, more than 75% of minors in China played online games for less than three hours a week and most parents expressed satisfaction with the new restrictions. A report by games market intelligence firm Niko Partners in September 2022 found that the number of youth gamers declined to 82.6 million in 2022 from its peak of 122 million in 2020 as a direct result of China’s regulations [3].

The obvious question is: What prompted China to introduce such harsh regulations. According to Reuters [4] the education authorities said they wanted to protect young people’s eyesight, improve their concentration, and prevent internet addiction. The incidence of myopia in China has increased significantly in recent years. Some pointed out that 20% to 50% of the students in primary school, 35% to 60% of the students in middle school, and 50% to 75% of the students in college are myopic in China in 2018 [5].

Therefore, if a country like China can introduce a law to protect their children’s vision against the excessive use of electronic devices, we as optometrists are obliqued to take this matter far more seriously. As the custodians of vision, we have an almost moral obligation to inform parents about these negative effects. This is not going to get better because the worldwide trend to introduce electronic devices even at the foundation phase in schools may have serious consequences. I shall deal with this topic in another article.

Although the Chinese studies only focussed on an increase in myopia, the authorities did notice a significant effect on the children’s ability to sustain their concentration. We know that the impact on the visual system extends well beyond an increase in myopia. It is the other aspects of vision that is just as important because it can have a negative effect on our ability to sustain our concentration [6]. This is a question that you may get asked every single day. It is not that simple to answer because it does not refer to one specific problem but may include a whole range of visual problems. Research shows that between 50% and 90% of people who work at a computer screen have at least some symptoms. But most vision experts say we can rest assured, as long as we apply common sense rules then there is really nothing to be concerned about. Herein lays the problem since many people have jobs that require staring at a computer screen for hours at a time. Add to this the introduction of handheld devices such as tablets and smart phones and also 3D screens and common-sense flies out of the window [6].

We do know that these negative effects do not only apply to children but is applicable to anyone spending a significant amount of time on electronic devices. Since the introduction of concepts such as **Computer vision syndrome (CVS)** and **Visual Fatigue Syndrome (VFS)** in the early 1990’s, that warned against eye strain and general visual fatigue, we have seen a dramatic increase on time spend on these devices. Janvier sums it up quite nicely when he states: “Most of us work at least eight hours a day and during this time many of us spend five to six of those hours staring at a computer screen. Now we get home, and what do we do? Check our e-mails, WhatsApp’s, pay bills online, shop online, and go to Facebook. Add to that a few more hours at the video games (X-box, Wii, PlayStation, etc.). So now we have been staring at some type of computer or hand-held visual screen for 10-12 hours. The point here is that we spend a great deal of time on any given day staring at some type of visual screen, whether for work or entertainment. This not only applies to working adults, but also the children: computers at school, smart phones in hand, and hours on the entertainment screen of choice. The large computer screens are bad enough, but now we are also using much smaller visual screens with smaller displays, and not well-formed lettering (fewer pixels). This is placing even greater strain on the eyes and visual system” and more so in young children where the visual system is still in a developing phase [7].

Thus, the question remains: How does all of this affect our eyes, and is it detrimental to the visual system? **CVS** and **VFS** is considered to be similar to other repetitive motion injuries, such as [carpal tunnel syndrome](http://www.webmd.com/pain-management/carpal-tunnel/default.htm). Working on computers involve continuous focus and refocus as well as tracking and convergence activities. The eyes need to constantly adjust to changing images on the screen to allow the brain to process what you’re seeing. All these activities require a lot of effort from your eye muscles. And to make things worse, unlike a book or piece of paper, the screen adds contrast, flicker, and glare. Computer work gets even harder as we age and reach presbyopia [6].

**General signs and symptoms associated with the use of handheld devices and computers**

• Headaches

• Eye Strain

• Fatigue

• Burning, Itchy, Red and Watery Eyes

• Loss of Focus

• Blurred Vision at near and at distance [NITM]

• Double Vision

• Neck/Shoulder Pain

• Sensitivity to Lights (Photophobia)

Headaches, Eye Strain and Fatigue are mostly associated with squinting and repetitive ocular muscle actions. Burning, Itchy, Red and Watery Eyes results mainly from staring at a screen. The result is a significant reduction in blink rate causing a dry eye. This seems to be the most common symptom reported by children and adults. Add to this that quite often we work in places that are running air conditioning and the dry eye only gets worse, more so for people wearing contact lenses. Loss of focus and blurred vision at near relates to fatigue in the accommodative system. Blurred vision at distance may be a little bit more complex. The literature suggests that this is the result of a short-term myopic far point shift immediately following a sustained near visual task. This is known as near work-induced transient myopia (NITM). Overall, studies reported myopic shifts, with a mean of approximately 0.40 D and a range from 0.12 to 1.30 D While the precise aetiology remain unclear, I am quite convinced that this “pseudo myopia” can evolve in a more “permanent” myopia and that this is a significant factor in the global increase in myopia. The Chinese studies serve as a strong confirmation of this [6].

Double vision relates to a fatigue in the convergence system [more so in children with significant phorias] and because of the near triade [convergence, accommodation, and pupil response] often appears with blurred vision and photophobia. From my own experience this aspect is the major reason why children may find it difficult to sustain their concentration. Neck and shoulder pain simply results from poor posture. There are also studies that suggest electronic devices give off high-energy, short-wavelength, blue and violet light, which may affect vision and even prematurely age the eyes. Early research shows that overexposure to blue light could contribute to eye strain and discomfort and may lead to serious conditions in later life such as age-related macular degeneration (AMD). There is no real hard evidence yet, but “blue light coatings” is becoming common practice [6].

**Guidelines for use of electronic devices:**

Providing guidelines to parents and children on the use of electronic devices should form an integral part of our visual examination. In line with a more holistic approach in dealing with visual problems our emphasis should be to prevent rather than cure [or compensate]. In addition to the risk of computer vision syndrome, visual fatigue syndrome and myopia, we should be aware of the concerns that excessive use of hand-held devices may have on our general everyday life. Several organisations have now reviewed the current scientific literature about this and published a number of guidelines to minimise the effect on the visual system. Although the literature tend to focus more on adults, these guidelines are just as applicable to children. As a matter of fact we should consider these guidelines as compulsory when it comes to children and should also be applied in the school system[ 6,8].

1. Try mix of tasks throughout the day. People should take frequent breaks from computer use and take part in a variety of activities that involve postural changes and physical movement. Performing sedentary tasks using electronic media (computer use, watching TV, texting, etc.) should be accompanied with regular breaks. To be safe we should take a 60-second break every 20 minutes and at least 10 minutes after two hours of staring at a screen. Because dry eyes seem to be such a common symptom, people should be encouraged to blink regularly, especially if they wear contact lenses. Tear supplements will also work wonders, but the dry, irritated eye actually serves as a good warning sign that it is time for a break.

2. Encourage the use of proper postures when working at a desktop computer. Workstations should be designed to suit the user’s size and enable a range of suitable postures. Feet should be able to rest comfortably on the floor; desk height should be at elbow height; document holders should be used to position paper materials near the computer screen. The screen should be below eye level [20 cm] because it is much more comfortable and less strenuous looking down.

3. Encourage a comfortable working distance i.e. Harman’s distance for all hand-held devices and at least 50cm for desk top screens. The closer the screen the more strain there will be on the accommodative and convergence systems resulting in double vision and/or blurred vision. If possible, increase the font size and adjust the screen resolution and contrast.

4. Ensure that proper lighting is provided. Distant or frontal light can cause a great deal more glare off screens, which makes focusing even more challenging. If possible, use ambient overhead lighting which provides good results. The screen should also be positioned and angled to avoid glare. And remember to clean your screen once in a while!

5. Teach yourself and children computing skills, including how to touch type with minimum force and how to use keyboard shortcuts to reduce mouse use.

6. Although the use of “computer glasses” is considered to be ineffective and controversial by some researchers, I have no doubt that they work well in reducing several symptoms. I also believe that they prevent NITM and even proper myopia. From my own experience single vision lenses works far better than multifocal or low plus lenses [+0.50]. As a rule of thumb add +1.00 to the distance script to obtain the required power of the lenses [6,9].

Computers and handheld devices will dominate our lives for the foreseeable future and dealing with these signs and symptoms effectively will greatly enhance the ocular health of your patients.

**References :**

1. https:/singularityhub.com. China’s cracking down on kids screen time. 29 Sept. 2021
2. https:/www.chinadaily.com. Screen time message taken seriously in China. 2 May 2019
3. Zhang, Y. [2022] Screen time and health issues in Chinese school-aged children. http:/bmcpublic health.
4. https:/www.reuters.com. Explainer why and how China is drastically limiting screen time for children. 31 August 2021
5. [Yao Yin](https://pubmed.ncbi.nlm.nih.gov/?term=Yin%20Y%5BAuthor%5D),  [Cheng Qiu](https://pubmed.ncbi.nlm.nih.gov/?term=Qiu%20C%5BAuthor%5D), and Yunfei Q. [2022]  Myopia in Chinese Adolescents: Its Influencing Factors and Correlation with Physical Activities. Comput. Math Methods Med 2022: 4700325
6. American Optometric Association. Computer vision syndrome. Access on 21 March 2023.
7. Blehm, C., Vishnu, S., Khattak, A., Mitra, S., & Yee, R. W. [2005]. Computer vision syndrome: A review. Survey of Ophthalmology, 50, 253- 262.
8. Randolph, S. [2017] Computer Vision Syndrome. Workplace Health and Safety. Pubmed. p 328
9. http:/www.allaboutvision.com Ten tips for computer eye strain relief. 27 February 2019