Physical-Health Impacts of Prolonged Screen Use in Children and Adolescents

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The present era of computers, smartphones, iPads and video games is impacting our health. Musculoskeletal conditions, sleep disturbances, changes in vision and behaviour, are being correlated with prolonged use. Of greatest concern is that effects on children's and adolescents' physical health due to prolonged device use, seems to be greater than that of adults. The smaller the electronic device being used and the more frequent the usage, the greater the impact.[1]

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Children and adolescents use computers differently than do adults; children and adolescents show a greater tendency to spend hours fixated on video games or texting and are also more likely to ignore uncomfortable postures, symptoms of overuse and computer glare.[2] Although musculoskeletal (MSK) complaints, sleep disturbances, headaches and vision changes are common in all age groups, the recent rise of these complaints in younger populations deserves attention and further investigation.

iPosture

The term "iPosture" is being used to describe the stooped body shape adopted by those texting, emailing or playing games on small electronic devices, such as iPad or Smartphones.[3] "iPosture", also referred to as "iHunch", is a syndrome associated with excessive time hunched over mobile electronic devices and is associated with an increased risk for back pain and other physical symptoms. There is even a device called iPosture, which is an intuitive electronic device that automatically sense when the body slouches and alerts the user with brief vibrations in order to assist in correcting posture.[4]

Normal sleep duration is seven to eight hours per night.[5] What is alarming is that almost all age groups are tending to spend as much time in front of a personal computer, laptop or tablet screen as they do asleep in bed. A survey by the British Chiropractic Association found that 73 percent of children aged between 11 and 16 spent between one and six hours looking at a laptop, tablet or computer. The typical young adult spends 8.83 hours a day in front of a screen and older individuals spend an average of 6.64 hours a day on electronic devices.[6]

With the tremendous amount of time that individuals spend on electronic devices it is not surprising that prolonged use is resulting in symptoms. For example, the statistics for back pain are staggering: 84 percent of 18-24 year-olds have admitted to suffering back pain in the past twelve months.[3]

The cumulative effects of repetitive stressful movements or postures, such as those associated with computer use, are associated with a physical injury syndrome referred to as cumulative trauma disorders (CTD). This disorders affects the hands, wrists, shoulder and neck resulting in symptoms such as carpal tunnel syndrome, neck tension or headaches.[7] Until recently CTD was only associated with adults, but with the increased usage of computer-related activities in children and adolescents it is becoming more common in these younger age groups. A survey conducted on 212 children, between the ages of 11 and 16, found that 73 percent of children spend between one and six hours looking at a laptop, tablet or computer.[7] Thirty-seven percent of those reported having eye discomfort, thirty-one percent had fatigue, thirty percent wrist pain, nineteen percent head pain and 15 percent back pain.[7] In another study conducted in 2001 of 152, 6th grade students more than half the children reported musculoskeletal discomfort.[1] Back pain and eye pain were the most closely correlated with increased usage.[7]

The most consistent factor associated with iPosture is the amount of time spent on a computer or electronic device.[8] Other factors contributing to the new phenomenon of iPosture include:

- Rounding of the shoulders, bringing wrists together, and a forward neck posture which makes the chest contract.

- Specific computer activities, such as using a joystick or playing non-educational games were significantly predictive of physical discomfort and had a higher association with changes in posture.

- Corresponding lack of exercise resulting in undeveloped back and core abdominal muscles. A healthy upright posture requires adequate muscle tone.[8]

There are a number of multivariant risk factors associated with computer use and the risk of musculoskeletal symptoms in children. Factors such as gender, age, TV exposure, computer anxiety, sustained attention, socio-economic status and somatic complaints, such as headache and stomach pains, were all found to effect the likelihood of musculoskeletal symptoms in children.[9] There is growing research to support the need for computer use in children to be managed more closely.[9]

Guidelines for computer use in children:[10]

- Children should be encouraged to use computers for moderate amounts of time (2-3 days a week for an hour or two per day),

- children's use of computers should include non-violent action-based computer games as well as educational games,

- the use of computers should not displace social or physical activities and should instead be arranged to provide opportunities for social engagement with peers and family members and physical activities, ideally outside and

- the use of computers should involve content with pro-social and non-violent themes.

- Any unexplained symptoms warrant medical/naturopathic attention.

Link Between Computer Use and Behavioural Changes

The link between computer use and behaviour changes appears to be related to duration of use and posture during use. In this context, the adage "structure governs function" is proving to be true.

Working on larger computer systems, such as a laptop, allows a person to adopt a "high-power pose" with their shoulders square and their chest open. Smaller devices results in a "low-power pose" with the chest contracted. Research conducted by Harvard School Working Group illustrated that high-power poses increased the feeling of power, raised pain threshold and improved job performance. There was also a corresponding increase in testosterone and cortisol.[11] Although participants working on smaller devices behaved less aggressively, there is a concern that working on smaller devices, which result in a collapsed chest, are more strongly associated with feelings of depression and lack of self-confidence.[11] Exploring the emotional impact of smaller electronic devices on users is an area that warrants further investigation.

In a study of 212 adolescents, parents reported that their child's computer use was associated with them having reduced activity and exercise (35.2%), social withdrawal (24.6%), aggression (16.5%), hyperactivity (15.2%) and depression (8.5%).[7] Many other studies show linkages between behavioural change and changes in posture as a result of computer use.

A study conducted in October 2013 of 4747 college students showed some of the subjects had psychological symptoms positively correlated with duration of screen time and poor sleep quality, such as anxiety (16.3%), depression (15.9%) and psychopathological symptoms (17.3%). The study noted that low physical activity and high screen-time were independently and interactively associated with increased risks of mental health problems and poor sleep quality.[12] In a study of 126 young adolescents it was found that higher levels of depression were strongly associated with prolonged TV watching and electronic-device use.[13] The same study found that implementing household rules around duration and content was beneficial in reducing depression in young adolescents.

Research also indicates that psychological changes, such as aggression, social isolation and addiction are associated with the type and degree of musculoskeletal discomfort[7] and with the type of posture that an individual has while engaged on electronic devices.[11]

Sleep Disturbances

Adolescents tend to spend a prolonged amount of time, both during the day and before bed, on electronic devices. Both daytime and bedtime use is associated with increased risk of short sleep duration, long sleep onset latency and increased sleep deficiency.[14,15] In 2014 a cross-sectional survey of 3,067 eighth-graders compared Internet use to somatic complaints, including backache, overweight, headaches, musculoskeletal pain, sleep problems and sight problems. The most significant issue noted was chronic sleep problems.[16]

Adolescents that own a smartphone are more likely to call/send messages and spend time online before bed. This behaviour is more common with smartphone technology than with conventional mobile phones.[17] The use of electronic media in bed is association with decreased sleep duration and with increased risk of sleep difficulties. This change in sleep behaviour was also associated with an increased risk of depressive symptoms.[17]

A survey conducted with 532 students aged 18-39 years indicated a positive association between insomnia and computer usage for playing, web-surfing, texting and Internet reading. Those same behaviours were also associated with lack of energy in the morning.[18]

Headaches

Headaches are commonly associated with extended periods of time spent using computers/video games, especially if fixed on a given task. The causes of the headaches may be associated with eyestrain, lack of sleep, postural changes or dehydration.

In 2005/2006 there was study of 31,022 adolescents that looked at the association between screen-based activity and physical complaints such as backache and headache. The research indicated that the accumulated time spent on computer use, computer gaming and TV viewing was strongly associated with the frequency and severity of backache and headache. Although the results of this study did not find any difference between genders,[19] another study of high-school

students indicated that headaches were more commonly associated with females who spent a lot of time on a computer.[20]

One research study looked at postural angles as a predictor of upper quadrant musculoskeletal pain (UQMP), including headaches. Tenth-grade high-school students, with no previous UQMP, were assessed using 3D Posture Analysis as they engaged in desktop computer activities over a six month period of time, then followed up one year later. Posture was reported as five upper quadrant angles (head flexion, neck flexion; craniocervical angle, trunk flexion and head lateral bending). The degree of UQMP and psychosocial factors were determined using the Computer Usage Questionnaire, the Beck Depression Inventory and the Multidimensional Anxiety Scale for Children. Over 34 percent of the students complained of seated-related UQMP during the follow-up period. The highest degree of pain was associated with increased head flexion (HF). The pain score increased 0.22 points per 1° increase in head flexion.[21]

Other Physical Conditions

Computer and electronic device use affects the physical, cognitive and social development of children and adolescents. Whether that impact is positive or negative depends on the duration of time that children spend on these devices, the activities they engage in and the posture and ergonomics that they have while using these devices. Some of the research links extended time on these devices to obesity as computer usage is displacing exercise and other more physical activities.[22] Yet the research between the current obesity rates and time spent engaged in sedentary behaviours such as watching TV, computer use or playing video games is controversial; most research shows an inverse relationship, but the results are not conclusive or consistent across studies.[23]

Research linking MSK conditions such as carpal tunnel syndrome and tendonitis are variable. There is speculation that there would be a positive link between repeated use and activities such as texting, but the results between various studies are inconclusive.[24] There is agreement in the literature that both of these areas warrant further study.

Computer Vision Syndrome

Extensive time on a computer can lead to a number of symptoms of eyestrain including eye discomfort, fatigue, blurred vision and headaches and dry eyes. The factors that contribute to eye strain and computer vision syndrome include prolonged time spent staring at a screen or monitor, poor lighting, computer glare and poor ergonomics.[25]

Children are at greater risk when they are engaged in enjoyable tasks, such as playing video games, as there is a tendency to engage with great concentration, for many hours without few or no breaks. Prolonged activity without a significant break can cause the eyes to lock into a particular distance resulting in accommodative

problems. Focused concentration results in a lack of blinking which can result in dryness of the eyes and overall eye irritation.[26]

Children are more adaptable than adults. They are more likely to ignore computer glare and an uncomfortable viewing position and hence, are more likely to end up with eyestrain. Whether due to blurred vision or uncorrected hyperopia, eyestrain should be addressed as it can lead to long-term vision problems.[25]

Recommendations to Reduce Computer Vision Syndrome[27, 28]

- For regular computer users, at least an annual eye examination. If necessary, include refractive correction and/or eye exercises to correct for accommodation concerns.

- Reduce the amount of time on the computer.

- Ensure frequent breaks. At least a ten-minute break for every hour on the computer. During the break, it is best to stretch and move around and to look at something beyond the point where any focusing is required, in order to give the eyes a rest.

- The computer monitor and the keyboard should be positioned and adjusted according to child's body parameters. The screen should not be positioned at too high a level in the child's field of view; the chair should not be positioned at too low a level and the desk not at too high a level. An adjustable chair is a good solution. A foot stool may be necessary to support the child's feet.

- Windows or other light sources could create glare on the screen. When this occurs, the desk or the computer screen should be turned to another direction.

- In some cases, a dimmer light is preferred instead of the bright overhead light.

Ergonomics

The importance of proper ergonomics when engaged in computer activities, unfortunately, is primarily associated with adults. To-date there is little recognition or appreciation for the importance of addressing the ergonomic considerations of children and adolescents as it relates to computer use.

The average family has three computers in their home and generally does not have furniture specifically designed for computer use.[1] Most computer workstations are arranged for adult use. Therefore, a child using a computer on a typical office desk often must look up further than an adult. Since the most efficient viewing angle is slightly downward, about 15 degrees, problems with binocular vision can occur. In addition, children may have difficulty reaching the keyboard or placing their feet on the floor, causing arm, neck or back discomfort.

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Although not researched extensively, having furniture designed for the computer and touch typing was associated with less musculoskeletal discomfort.[1] Ensuring proper ergonomics, both at home and in the classroom can help reducing head flexion angles and postural changes among computing children and adolescents.[21]

Working on smaller computerized devices causes another set of problems as users are often hunched over their device resulting in the iHunch posture (a collapsed chest and other contracted body postures). The lack of back support, the contortions of the hands and wrists and the repetitive movements are problematic. Addressing the ergonomic factors of computerized devices for children and adolescents is overdue.[20]

Tips for healthy use of mobile devices[3, 17]

- Show children and adolescents how to sit comfortably and with good posture, with back supported and two feet on the floor.

- Place a beanbag or pillow on the child's lap, so he or she can rest their arms on the beanbag and support their tablet or portable gaming device in a comfortable position, enabling them to see the device and use it without hunching forward

- Check on your children every half hour to make sure they are sitting comfortably without being hunched forward.

- Schedule breaks from screen-time at least every hour.

- Schedule screen-free exercise times, encouraging games and active play so that core strength muscles are used and strengthened.

- Use a separate, synchronized keyboard when typing on the tablet, with the screen propped up so it can be seen without craning your neck.

- Discourage the use of electronic devices before bedtime. Electronic devices should not be kept in the bedroom. They should definitely not be put under a pillow or beside the head of someone who is sleeping.

- There are a number of devices designed to improve posture including iPosture[20] and LUMOlift.[29] Both of these electronic devices vibrate when the user slouches in order to provide them with feedback and allow them to correct their posture.

As computer and electronic device use is ubiquitous in the everyday lives of most of our patients, it is important for naturopathic doctors to assess the musculoskeletal, sleep, vision and physical effects that excessive computer use may be having on the health of children and adolescent patients. Educating parents and patients on proper ergonomics and the need for non-sedentary activities is becoming increasingly important. As a naturopathic doctor, I am greatly concerned about the long-term impact of these physical changes occurring so early on in life. ✎

About the Author

Iva Lloyd, ND is a naturopathic doctor, board certified polarity practitioner and educator and reiki master. In 2002 she founded Naturopathic Foundations, health care clinic with four naturopathic doctors. In 2011 she established www.ndhealthfacts.org a website that focuses on identifying the causes of diseases and the natural treatment options available.

Dr. Lloyd is the author of four books: *Building a Successful Naturopathic Practice, Messages from the Body, a guide to the Energetics of health, The Energetics of Health, a naturopathic assessment* and *History of Naturopathic Medicine, a Canadian perspective.* She teaches part-time at the Canadian College of Naturopathic Medicine, writes for various journals and magazines and gives seminars on naturopathic assessment, the psychological aspects of health and disease, and the energetics of health. She is editor-in-chief of the *Vital Link* – the journal for the CAND and sits on the editorial boards for the *Natural Medicine Journal* and the *International Journal of Naturopathic Medicine.* She is Past-Chair of the Canadian Association of Naturopathic Doctors and in 2014 she became the Interim President of the World Naturopathic Federation.

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