Do computer screens damage eyesight?

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PLAN

Introduction
Is there a radiation risk from computer screens?
Is there an eyestrain risk from computer screens?
Will computer use cause short-sightedness?
Top tips for comfortable & safe computer use
Conclusions

Full handout of slides from www.bruce-evans.co.uk

The human eye

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Radiation from computers?
- Public Health England measured light emitted from LED light bulbs and computers (desktop, laptop, smartphones).
- None of the sources assessed approached the exposure limits, even for extended viewing times.
- Natural exposure (e.g. sky) is far higher than computers.
- But note that children will need computer screens to be dimmer than adults.
- Conclusion: safe, but let children adjust for comfort.

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Digital eyestrain (DES)/computer vision syndrome (CVS)

- “Ocular complaints as a result of looking at a computer monitor” Blehm et al (2005)

What is DES?

- Validated questionnaire CVS-Q Segui et al (2015)
- Score of 6 or more taken to be indicative of DES. E.g.,
  - 6 of these if occasional & moderate
  - 3 symptoms if often & intense

Sheedy et al. (2003) Not about computers

- Is all eyestrain the same?
- Found 2 different types of eyestrain
  - External – mostly related to dry eye
  - Internal – mostly related to eye co-ordination & focusing problems
- Eyestrain first described over 100 y ago

Are computers the latest thing to be blamed for eyestrain?

- To some extent, DES may simply be a manifestation of eyestrain associated with intense use of the eyes (Evans, 2018)

Case study

- 52 year old design engineer
- Visual requirements in different eras:
  - 1970s: would have needed reading glasses & eye exercises
  - 1990s: would have needed bifocals & eye exercises
  - 2017: no spectacles & no symptoms

Computers cause eyestrain!
Computers cure eyestrain!
Reading computers c.f. paper

- More incomplete blinks with computers
  
  - Portella et al. (2012)
  
- More symptoms with computers
  
  - Chu et al. (2011)
  
- Slightly slower with computers
  
  - Hua et al. (2014)
  
- Differences between different displays
  
  - Hua et al. (2014)
  
- For some, symptoms with computers reduced by coloured filters
  
  - Rosenfield et al. (2015)

- Little evidence to support the use of blue-blocking filters
  
  - Cohen et al. (2017)
  
  - Rosenfield & Kehoe (2006)

More incomplete blinks with computers
More symptoms with computers
Slightly slower with computers
Differences between different displays
For some, symptoms with computers reduced by coloured filters
Little evidence to support the use of blue-blocking filters

What about children & teenagers?

- Study of 715 adolescents found
  
  - Hua et al. (2014)

  - More symptoms with computers

  - More incomplete blinks with computers

- Slightly slower with computers

- Differences between different displays

- For some, symptoms with computers reduced by coloured filters

- Little evidence to support the use of blue-blocking filters

Differences between different displays

What to do about DES?

- Regular eye exams

- Regular breaks that involve viewing far objects

- 20:20:20 rule – proposed by Anshel in 1991

- Lacks an evidence-base

- Ergonomics

  - Low light – avoid bright light or window behind computer

  - Feet on floor or box, top of screen at eye level, keyboard straight in front

- Other

  - Radiation/anti-glare filters over the screen not helpful

  - Dry eyes can be helped by artificial tear drops or blinking exercises

Circadian rhythm, blue light, computers

- Our body clock (circadian rhythm) responds mostly to blue light

- Naturally, blue light peaks at mid-day, drops in evening

- Smartphone LEDs more blue than is natural in the evenings

- It is argued, viewing blue light from smartphones & tablets at night interferes with circadian rhythm causing poor sleep

- Growing support for this view, but small effects

- Ok et al. (2013), Oosue et al. (2014), Oh et al. (2017), Park et al. (2017), Rahman et al. (2018)

- What about children & teenagers?

  - Study of 715 adolescents found

  - More symptoms with computers

  - More incomplete blinks with computers

- Slightly slower with computers

- Differences between different displays

- For some, symptoms with computers reduced by coloured filters

- Little evidence to support the use of blue-blocking filters

- Distinguish between different displays

- What to do about DES?

  - Regular eye exams

  - Regular breaks that involve viewing far objects

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  - Ergonomics

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  - Other

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- PLAN

  - Introduction

    - Is there a radiation risk from computer screens?

  - Is there an eye strain risk from computer screens?

    - Will computer use cause short-sightedness (myopia)?

    - Top tips for comfortable & safe computer use

  - Conclusions

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Myopia is increasing

- Common and increasing prevalence
  - 92% of Taiwanese medical students are myopic (Lin et al., 1996)
  - Prevalence of myopia in UK has more than doubled in last 30y (McCulloch et al., 2016)
- 50-53% of UK university students are myopic (Logan, 2005)

What causes myopia?

- There is no one cause
- Partly genetic
- Partly environmental
- Too little time outdoors
- Too much near vision

Time outdoors

- Time spent outdoors protects against myopia development
  - but probably not helpful to control myopia progression or termination
- 2% reduction in the odds of myopia for every extra hour per week spent outdoors
- Urban environment triples risk of myopia
- Independent of other risk factors (parental myopia, time reading)
  - Recommendations: 1 to 3 hours a day outdoors
  - Mechanism involves light levels, looking in the distance

Near work

- Most studies find weak association between near work and myopia, independent of time outdoors
- Closer viewing distance linked with myopia prevalence
- Resting after 30min near vision reduces risk
- Additional risks: smaller TV, more TV, more computer games

What to do?

- Huang et al (2019, BJO) find the following reduced myopia prevalence & progression:
  - near vision >30cm
  - distance vision >30m
  - spending school breaks outdoors
- Simplified to patients as “30:30:60 rule” & “balanced vision”
- No strong evidence that digital screen time contributes to myopia

Caveats

- No one thing has a large effect on myopia
- A diagnosis of myopia is not very bad news
  - But, it carries a slight risk of eye diseases in later life
  - The higher the myopia, the higher the risk
- This talk has concentrated on environmental factors

Myopia control is a growing specialty in optometry

- Specialist contact lenses slow myopia progression by ~50%
- Myopia control eye drops & spectacles are likely to come to the UK soon
- …but that’s another story!
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The setup

- Fit the workstation to the child, not the child to the workstation
- Room lighting: Avoid reflections & glare
- Computer lighting: let the user adjust
- No prolonged near vision closer than 30 cm
- Larger screens may make 50 cm possible
- Likely to be better than reading a book in class
- Computer games of more concern than schoolwork
  - More engrossing
  - Often, closer distances

Breaks & balanced vision

- 30-30-out
  - Near vision at >30 cm
  - Discontinue near vision every 30 mins to look in the distance
  - Breaks Outdoors
- We all know about balanced diet…consider balanced vision
  - Balance time indoors with time outdoors
  - Balance near vision with distance vision
  - Outdoor lighting is good, but use sunglasses if bright
- If sports and outdoor play didn’t exist, we would invent them!
- Brentwood Prep Forest School initiative is good for eyes

Conclusions

- Computers are not radiation hazards, but use Night Shift/Night Light
- Eyestrain can result from any intense use of the eyes
- Regular eye exams (after lockdown!)
  - 1. Keep prolonged near vision at least 30 cm from the eyes
  - 2. Vary the distance you look at – balance near with distance vision
  - 3. Spend breaks outdoors, especially during lockdown
  - 1-3 have a small effect individually, but together may reduce eyestrain and the risk of myopia

Questions?