The Physiological Effects of Screen-time

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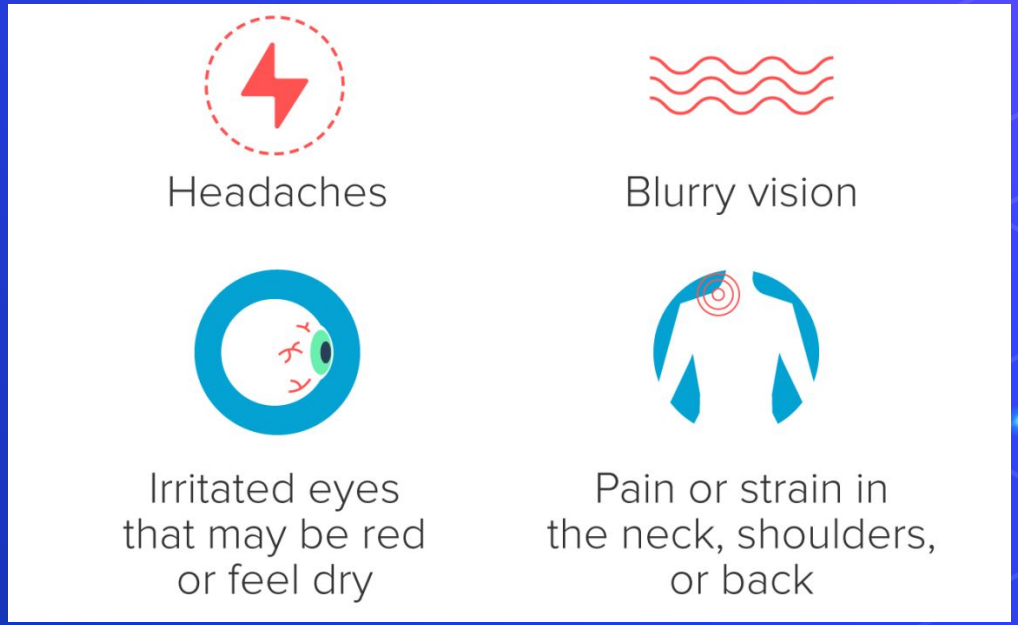
Introduction

- Technology can be an amazing thing!
  - But how can it be harmful to us?
  - How much screen time is too much?

Effects on the Eyes

- ***Digital Eye Strain (DES) / Computer Vision Syndrome:***



Dry Eyes Caused by Decreased Blink Rate

Relaxed

22 blinks/min

Reading a book

11 blinks/min

Viewing a screen

7 blinks/min

(Tsubota & Nakamori, 1993)

Blue Light Exposure

- Blue is a high-energy color due to its short wavelength (400-500nm)

High-energy photons hit the retina and interfere with chemical reactions in the eye

Bonds may be broken = formation of free radicals

OXIDATIVE STRESS!

Free radicals can cause protein and DNA damage due to oxidative stress which can eventually drive cells, such as photoreceptors, into *apoptosis*

Treatment & Prevention

- Main treatment = Proper Rest!
- Lubricating/Hydrating eye drops to alleviate dry eyes

The American Optometric Association

Structural Abnormalities of the Brain

- Gray and white matter atrophy
- Reduction in cortical thickness
- Lower brain volume and tissue density
- Areas affected are also impacted by drug addiction
- Delayed microstructure development

Functional Abnormalities of the Brain

- Decreased functional connectivity
  - Specifically in the cortico-striatal areas
- Lower efficiency of white matter networks

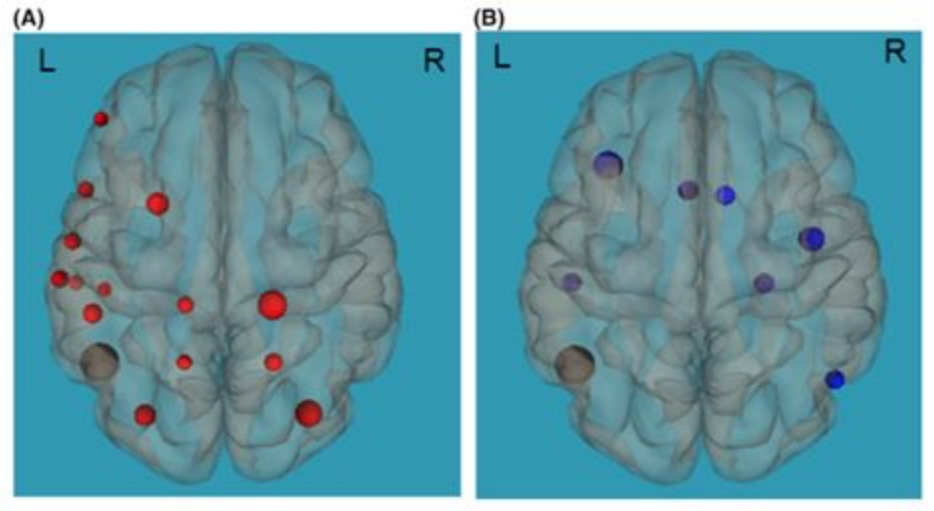


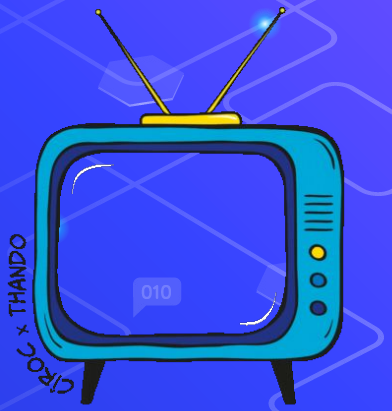
Image: (Horowitz-Kraus & Hutton, 2018).

Neuroreceptor Abnormalities of the Brain

- Reduced dopamine D2 receptors
- Lower dopamine transporters (DAT)
- Blunted striatal dopaminergic function
- Decreased glucose metabolism

Effects on Sleep

- Adolescent sleep problems on the rise
  - Electronic media use plays a role
- Gain in popularity of smartphones and similar devices

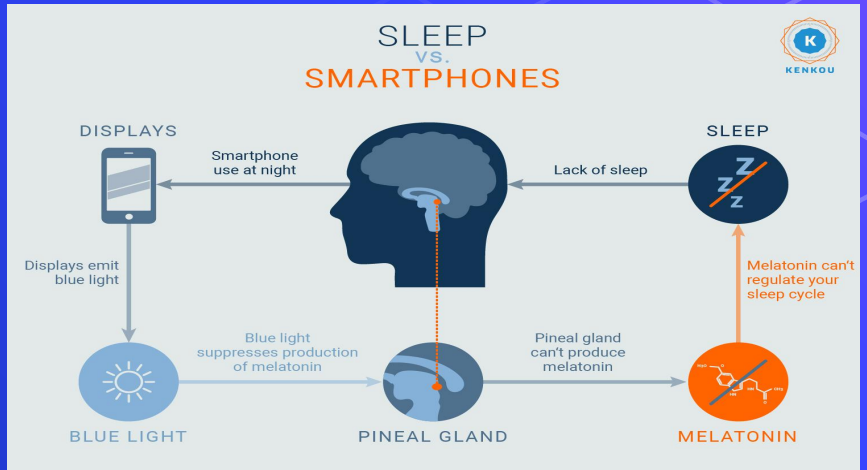


Emission of Short-Wavelength Blue Light

- Disruption in circadian rhythms
- Shorter wavelengths (specifically 460-480 nm)→ more melatonin suppression
  - Clear vs. orange-tinted glasses
- Delayed onset of drowsiness

Effects on Acute Evening Alertness and Morning Sleepiness

- Delayed REM sleep onset
- Indirect effect on morning tiredness
- Longer wake-up times, decreased alertness



Preventative Strategies

- Sleep episode and circadian clock alignment
- Avoid blue-light exposure 2-3 hours before bedtime
- Orange-tinted glasses
- Filter on screen

Sedentary Behaviour Due to Screen Time

- Screen time < 2 hours a day
- Decrease in physical activity
- Time spent on television
  - Overall time spent looking at screens
- Association with depression

Mental Disorders

- 5-7 hrs of daily screen usage
  - Doubled from 10 years ago
- 7+ hours of usage = twice as likely to have anxiety and depression

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