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## Embracing the Dawn of Blue Light

### Clinical Strategies to Protect Your Patients

Jennifer L. Stewart, OD

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## Jennifer Stewart, OD

- Chief Vision Officer: OD Perspectives
- Co-founder/Chief Vision Officer: Performance 20/20
- Executive Board: International Sports Vision Association
- Professional Affairs Team: Coopervision
- Speaker/KOL: MacuHealth
- Sports Vision Consultant
- Delegate, NECO Alumni Board of Directors
- Adjunct Assistant Professor: NECO
- Thelia Award for Innovation 2019 – Women in Optometry
- Emerging Leader Award: Optical Women's Association

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*"From the moment people get up until the time they go to bed again – including when they are eating, exercising and reading – they are using one digital device after another and thus exposing themselves to risks related to prolonged exposure to light emitted by screens."*

• Mike Daley, Former CEO Vision Council

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## UV versus Blue Light

Which is more damaging and harmful to the eye:

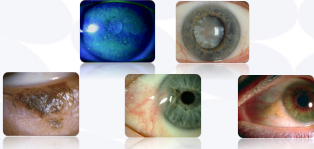
### UV Light or Blue Light?

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## UV Light

- Defined as: electromagnetic radiation with wavelengths of 10nm to 400nm (longer than X-rays, shorter than visible light)
- Blocked by the cornea and lens
- No sunglass police!
- UV light causes:
  - Cancers of ocular adnexa
  - Pterygia
  - Pinguecula
  - Photokeratitis
  - Cataracts

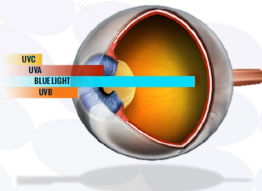


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## What Is Blue Light?

- HEV (high energy visible light)
- Short wavelengths, higher energy
- Penetrates deeper into the eye



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- Blue light is part of the visible light spectrum (400-500nm)
- Digital devices/LED lights emit from 430 to 500 nm (spike around 455nm)

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### Ocular Light Transmission

- Cornea absorbs wavelengths below 300nm
- Lens absorbs wavelengths less than 400nm
- Retina absorbs light over 400 nm
- Ocular exposure to light around 435nm (+/-20nm) can induce irreversible cell death in the RPE

<https://www.optometrimatters.com/view/blue-light-why-it-matters>

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Effects of blue light on the circadian system and eye physiology

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Light-emitting diodes (LEDs) have been used to provide illumination in industrial and commercial environments. LEDs are also used in TVs, computers, smart phones, and tablets. Although the light emitted by most LEDs appears white, LEDs have peak emission in the blue light range (440–490 nm). The accumulating experimental evidence has indicated that exposure to blue light can affect many physiological functions, and it can be specifically associated with sleep disturbance. However, blue light can also induce photoreceptor damage. Thus, it is important to consider the spectral output of LED-based light sources to minimize the damage that may be associated with blue light exposure. In this review, we summarize the current knowledge of the effects of blue light on the regulation of physiological functions and the possible effects of blue light exposure on ocular health.

**Keywords:** Blue light; Circadian rhythm; Eye physiology; LED; Sleep; Visual fatigue

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**Abstract:** The role of the light exposure in human health has attracted increased research attention. Blue light, with wavelengths ranging from 400 to 500 nm, is a component of the visible light spectrum. Exposure to blue light can affect many physiological functions, and it can be specifically associated with sleep disturbance. However, blue light can also induce photoreceptor damage. Thus, it is important to consider the spectral output of LED-based light sources to minimize the damage that may be associated with blue light exposure. In this review, we summarize the current knowledge of the effects of blue light on the regulation of physiological functions and the possible effects of blue light exposure on ocular health.

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### Research progress about the effect and prevention of blue light on eyes

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gradually realized by the public, eye discomfort related to blue light is becoming a more prevalent concern. Because of blue light's short wavelength, the focus is not located in the center of the retina but rather in the front of the retina, so the long exposure time to blue light causes a scattering of visual fatigue and maculopathy. Symptoms such as dizziness and inability to concentrate can affect people's learning and working efficiency<sup>[1]</sup>. What is the specific damage mechanism of blue light? This article will review the mechanisms causing damage to the cornea, lens, and retina by blue light in order to have a better understanding of blue light-induced ocular injury.

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### Sources of Blue Light

- Sunlight (largest source)
- CFL (compact fluorescent light) bulbs
- LED (light emitting diode) bulbs
- TVs
- Computer monitors
- Smart phones
- Tablet screens

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### Blue Light- benefits?

- Boost alertness
- Helps memory and cognitive function
- Regulates circadian rhythm
- Sunlight needed for growth and development of eyes/vision

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## Blue Light Exposure

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MAY result in:

- Damage to the retina
- AMD/cataracts
- Melatonin suppression/sleep disruption

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## Sleep

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Excessive blue light exposure MAY result in:

- Impact to circadian rhythms
- Trouble sleeping
- Waking during the night
- Reduced alertness the next day
- Reduced productivity/concentration


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STAYING HEALTHY

**Blue light has a dark side**

July 7, 2020

What is blue light? The effect blue light has on your sleep and more.

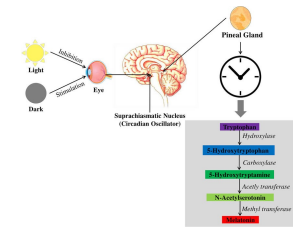


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## Blue light and melatonin

- In the absence of blue light, ganglion cells in the retina stimulate the pineal gland to release melatonin
- Blue light suppresses melatonin production
- Suprachiasmatic nucleus- "Master Clock of the Brain"

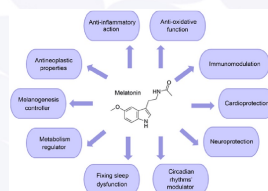


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## Melatonin

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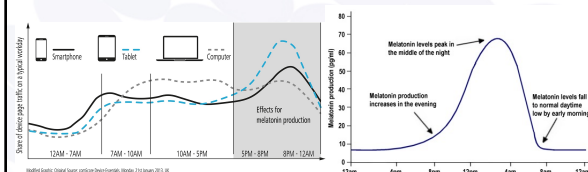
- Helps regulate circadian rhythm
- Synchronizes our sleep/wake cycle with night and day



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## Melatonin/Circadian Rhythm

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## Smartphone Use By Generation

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- Millennials (born 1981 and 1996): 3.7 hours/day
- Gen X (born 1965 and 1980): 3 hours/day
- Boomers (born 1946 and 1964): 2.5 hours/day

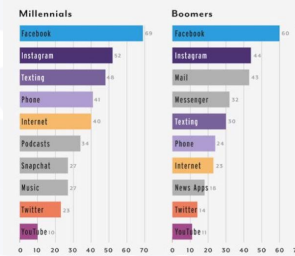
[www.eyegame.com](http://www.eyegame.com)

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## HOW SCREEN TIME IS SPENT

Ranked by average minutes per day

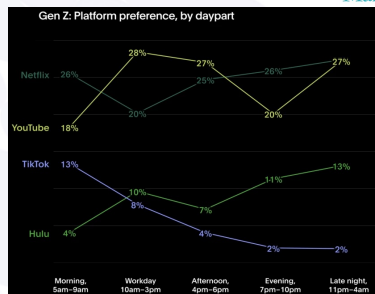
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## Gen Z: Platform preference, by daypart

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## Impacts of Blue Light?

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- Retinal health (AMD)
- Daily vision – glare (light scatter) and blurred vision (chromatic aberration)
- Overall well-being (sleep, chronic health issues)

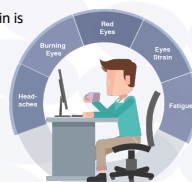
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## Eye Strain?

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- 49% of American adults don't know what digital eyestrain is
- >80% of adults use a screen for 2+ hours/day
- Nearly 67% use 2 or more devices at the same time
- 55% look at a screen within an hour of waking up
- 80% use a screen in the hour before going to sleep

<https://thevisioncouncil.org/blog/vision-council-shines-light-protecting-sight-and-health-multi-screen-era>



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## Adults and Digital Eye Strain- more than eyes!

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- More than 60% of American adults report digital eye strain symptoms!
- Neck/shoulder pain (35 percent)
- Headaches (27.7 percent)
- Eye strain (32.4 percent)
- Blurred vision (27.9 percent)
- Dry eyes (27.2 percent)



<https://thevisioncouncil.org/blog/vision-council-shines-light-protecting-sight-and-health-multi-screen-era>

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## Opportunity!

- 68.5% of Americans do not discuss their digital device use with their eye care provider
- 78.3% of parents are concerned about the impact of digital devices on their children
- Only 29.1% of children have an annual comprehensive exam as part of their back-to-school preparation

Vision Council 2021

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## Children and Digital Eye Strain

Kids favorite pastime?

- Digital Device Time (23.1%)
- Watching TV (20.1%)



<https://visioncouncil.org/blog/vision-council-shines-light-protecting-eyes-and-health-multi-screen-era>

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## Children and Screen Use

After effects?

- Reduced attention span (15.2%)
- Irritability (13.5%)
- Poor behavior (13.3%)
- Eye strain, dry or irritated eyes (9.1%)
- Headaches (8.8%)
- Neck/shoulder pain (5%)



<https://visioncouncil.org/blog/vision-council-shines-light-protecting-eyes-and-health-multi-screen-era>

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## Solutions

- Blue Light Blocking Lenses (Blutech)
- Blue Light Lens Coating
  - Crizal Previncia (Essilor)
  - SeeCoat Blue (Nikon)
  - Recharge (Hoya Vision Care)
  - DuraVision BlueProtect UV (Zeiss)
- Supplements (Macuhealth, EyePromise)
- Contact Lenses??



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## Implementation

### • In Office Implementation

- Staff and Doctors
  1. All educated
    - online COPE and ABO CE
    - Onsite "Lunch and Learn"
  - All staff and doctors capable of educating patients
- 2. All staff wear eyewear – part of the uniform



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## Implementation

### Setup in practice management system

- Check lab pricing and setup lens price, options, etc. in your system
- Name/Bundle/package strategy
  - Digital protection
  - Blue light protection
  - Indoor protection
  - Outdoor protection

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## Implementation

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- Blue light questions added to patient history
- Add Blue Light options to 'super bill' or 'routing form'

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## Blue Light Questions

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Do you use a smart phone or tablet device? **circle Yes or No**

- If yes, for how many hours per day? \_\_\_\_\_
- Do you use these device(s) at night/in bed? circle Yes or No

Do you often find it difficult falling and staying asleep or find you have more frequent restless sleep cycles?

- **Circle Yes or No**

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## Pre-test Strategies

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- Macular testing- if applicable
- OCT
- Continue discussing blue light dangers
- Incorporate blue light questions into patient history



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## Exam Room

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- Discuss retinal scan if applicable
- Continue discussing blue light dangers – relate to lifestyle information gathered in history form
- Prescribe blue light protection

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## Optical Strategies

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- Optical or Exam Room
  - Handoff from doctor to optician
- **Optician**
  - Discuss doctor's Rx for blue light protection
  - Demonstrate effectiveness of blue light lenses



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## Optical Strategies cont.

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- Optical - Blue light practice tools
  - Blue light Lens Demonstrator
  - Blue light laser penlight
  - Patient brochures
  - Blue light symptoms poster
  - Blue light Dispensing Mat

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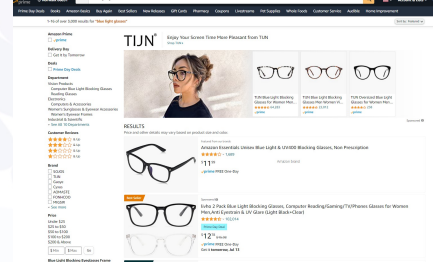
## What Else Can We Do?

- Annual comprehensive eye exams for adults and children
- Take frequent breaks (20/20/20/20 rule)
- Visual hygiene (posture, lighting)
- Ask good questions!



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## Be The Expert!



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## Blue Light- Summary

- Understand the impact of blue light
- Understand which patient groups are best suited for blue light protection
- Educate & go through the implementation process with your team using all the tools available

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## Questions?



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