Blue Light and Digital Eye Strain
Educating Patients and Providing Solutions

Anne-Marie Lahr, OD
Dangers of Blue Light

- Dangers of blue light
  - Ocular discomfort
  - Interruption of sleep patterns and circadian rhythms
  - Link between blue light exposure and macular degeneration

- Increased prevalence of blue light

- Solutions for Protection
What Is Blue Light?

Visible Light Spectrum 390 nm to 750 nm

Increasing energy

Increasing wavelength

Gamma Ray | X-Ray | UV Ray | Visible Light | Infrared | Radio Waves

Blue Light
380 nm - 500 nm
High Energy Visible
HEV
Blue Light is All Around Us
The Tablet Revolution

- April 2010: First iPad released
- A family portable computer
- Held at 12-24 inches from eyes
- Backlit display
- Moving into schools
- Outselling computers
- Same apps as the Smartphones
- Easier to read on than iPhone
- 35% of Americans own a tablet
Digital Usage

86% of mobile internet users are using their devices while watching TV.

Women aged 35 to 54 are the most active group in mobile socialization.

On average, Americans spend 2.7 hours per day socializing on their mobile device. That’s over twice the amount of time they spend sleeping each day.
The Age of Digital Devices

SIMULTANEOUS USAGE INSIGHTS

**Tablets and TV**

**Skews Older**
Age groups 25-34 and 55-64 are the most likely to use their tablets multiple times per day while watching TV.

**Typical Activities**
- **Seeking Information** 36% of people 35-54 and 44% of people 55-64 use their tablets to dive deeper into the TV program they are currently watching.
- **Surfing and e-Mailing** 55-64 are the heaviest web surfers and email checkers on tablets during commercial breaks and programs.
- **Sport Scores** Nearly a third of all tablet users aged 25-64 check sports scores on their tablets while watching TV.

**Smartphones and TV**

**Skews Younger**
Nearly half of 18-24 year olds use their smartphones while watching TV at least once per day.

**Typical Activities**
- **Social Media** 44% of 18-24 year olds and close to 50% of 25-34 year olds are visiting social networking sites on their smartphones during both commercials and programs while watching TV.
- **e-Mailing** is the heaviest simultaneous smartphone activity across all demos, with over 50% of users checking during commercials and programs.
- **Shopping** 29% of 25-34 year olds shop on their smartphones while watching TV.

Source: Nielsen
Typical Viewing Distances for New Media Devices

2 to 4 ft

12 to 24 in

12 to 18 in

As the day progresses...we actually move closer to the back lit devices because our focusing system begins to 'lock-up'...bringing the device closer in order to keep the muscle in focus.....In turn, adding even more stress!
Effects of Chromatic Aberration

When light from a small white object is refracted by a prism, it is dispersed into its monochromatic constituents, the blue wavelengths being deviated more than the red.

To an eye viewing through the prism, the image of the object appears fringed with blue on the apex side of the prism.
Chromatic Aberration
Our Eyes and Digital Devices

- Our eyes can properly focus on images and print on back-lit digital devices.
- The closer an object, the more the eye has to focus or accommodate.
- When we view a backlit surface, our eyes try to focus on the screen, fluctuating focus behind and in front of the plane of light.
- The focusing muscle fatigues, trying to find where in space to lock focus on.
- Over time the focusing muscle spasms and ocular symptoms begin.
“Bad blue/good blue” light radiation

Associated with AMD

Scatter, haze

Sleep patterns/Circadian rhythm

Blue Light 380 - 500 nm

Adapted from Mark Mattison-Shupnick
Blue Light

- Some blue light is necessary
  - Sleep patterns
  - Melatonin regulation
  - Pupillary light reflex
  - Mood
  - Memory
Blue light and Melatonin

- Blue light suppresses Melatonin production, which is important to the sleep cycle
- Night time viewing of back lit devices stimulate the brain to stay awake and not prepare for sleep
- Over time, prolonged amounts of artificial Blue light can have effects on the immune system
Circadian Sleep Patterns

Blue Light

Melatonin

Sleep Pattern

What is the link?
How it works

When there is an absence of blue light, our eyes sense it through the retinohypothalamic tract. Specialized retinal cells—intrinsically photosensitive retinal ganglion cells (ipRGGs)—stimulate the pineal gland to release melatonin, a hormone that lets our bodies know it's time to sleep.
When blue light is present...

- Melatonin production is suppressed and our bodies are alert, energized, and ready to work.
- Blue-turquoise light is good if exposed in reasonable doses during the daytime.
- Exposure at night can lead to trouble sleeping and health problems.

From an article by Cheryl G. Murphy, OD.
Sleep Patterns in Turmoil?

Night time viewing of back lit devices stimulates the brain to stay awake and not prepare for sleep.

Blue light suppresses the production of melatonin - in turn, disrupting sleep / wake cycles.
We are all aware of the need to protect our eyes and skin from UV:
UV damages the anterior structures of the eye (and the skin) because it is absorbed by those tissues.
Blue Light and AMD

There is a growing body of evidence that cumulative lifetime exposure to visible light, in particular blue wavelength light, increases the risk of AMD.
The visible wavelengths - which include the harmful blue wavelengths - pass right through the pupil and are absorbed by the retina.
Why is blue light harmful to the retina?

- Blue light is short wavelength visible light and generates the highest energy of all visible light.
- Unlike UV light which is absorbed by the cornea and crystalline lens, when blue light enters the eye it reaches the retina.
- When blue light hits the retina, its high energy mixes with oxygen creating a destructive force that destroys photoreceptor and retinal pigment epithelium cells (RPE).
- Over time, this process can lead to Age-related Macular Degeneration, (AMD).
Children and Blue Light: Are Children at greater risk?

- Exposed to digital devices at a very early age
- Shorter arms - shorter working distance
- No natural protection - crystal clear crystalline lenses!
The Age of Digital Devices

Pixels

- Thousands of tiny dots
- Lack uniform density and defined borders
- Less distinct than printed page
The Age of Digital Devices

Vision Watch Survey 2012 and 2013

- 70% of American adults experience some form of digital eye strain
- 6-9 hours a day
- Number of adults spending 10+ hours rose 4%
- Digital eye strain is the most common computer-related repetitive strain injury
Symptoms of Digital Eye Strain

- Eye redness or irritation
- Dry eyes due to reduced blinking
- Blurred vision
- General fatigue
- Back pain
- Neck pain
- Headaches
Symptoms of Digital Eye Strain

- How many of the symptoms do your patients complain about?
- Do they willing volunteer information?
Education of the Patient

Sample Eye Exam/Pre-exam Questions

- How much time are you spending on smartphones, tablets, laptops, e-readers, computers, etc?
- Is that more or less than the last time we talked?
- Are you experiencing any issues (eye fatigue or stress, dry eye, headaches, trouble sleeping)?
- Do you notice a correlation between your use of electronics and any of the issues you mentioned?
- What other activities do you engage in that may be affecting your vision?
Education of the Patient

Patient Questions to better understand Digital Media use.....

Do you use a: Smartphone____, Tablet (iPad or Android)____ or e-Reader______

How many hours a day are you awake or are your eyes opened?______________

What part of your day are you looking at something at any distance?__________

How many hours are you spending viewing a......
   Smartphone or Tablet?_____  E-Reader?_____ (Distance 12-24 inches)

How many hours are you spending viewing a computer?______ (Distance 18-36 inches)

Do you alternate focus between distances? ____ If so, what do you alternate between?
   TV & Smartphone_____  TV & Tablet_____  TV & e-Reader_____ or Other?_______

Hobbies?_______________________________________________________________
How can we help protect our patients from the dangers of blue light and provide relief from Digital Eye Strain?
Educating the Patient

Hoya Vision Care consumer research study

- Respondents had either never heard of blue light or only associated it with sleep patterns, rather than eye health
- Respondents said dispensing opticians tend to focus only on frame selection
- Respondents wondered why their eye doctors weren’t informing them about the harmful effects of blue light
- Respondents said they would listen to their eye doctor’s recommendations with regard to blue light protection
Education of the Patient

Introduce blue light related issues

- The latest electronic devices all emit blue light waves
- Blue light is a natural part of the light spectrum
- Overexposure can cause eyestrain, fatigue, headaches, and trouble sleeping
Education of the Patient

How to discuss blue light

► Negative reaction to messaging that positioned blue light as extremely harmful
► Scare tactic not compelling reason
► Associate message with current symptoms
► Validation of information
Digital Media Solutions

- Products for digital device use
- With or without prescription
- Help the eye adjust to intermediate distance objects
- Selective Anti-reflective treatments
Digital Media Solutions

Lens options
- Single Vision
- Progressive Addition Lenses
- Computer or “Work-Specific” Lenses
Digital Media Vision Solutions

- Single vision lens
- Aspheric design plus additional support for visual demands at various distances
- Reduces eye strain and fatigue
- Easy adaptation
Digital Media Vision Solutions

- Tact Progressive Lenses
- Specifically for prolonged near visual tasks
- Wider intermediate with full distance Rx at top of lens
Standard Indoor Progressive Lens
Blue Light Solutions

An anti-reflective treatment that reduces blue light that reaches the eyes emanating from tablets, smartphones and other back lit devices, as well as the new energy-efficient bulbs and the sun.
Blue Light Solutions

Present benefits

- “What this means to you” factor
- Take notes and refer back to them
- Help them tell the story
Conclusion

- Ask
- Educate
- Respond
Thank you!
Hoya Vision Care