iStrain: What effect do today's tablets and devices have on vision?

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Associate Professor, Illinois College of Optometry

Chief, Pediatrics/Binocular Vision Department, Illinois Eye Institute
Lecture Goals

- Discuss digital media use and its effect on vision
- Discuss how we diagnose these issues
- Discuss how we treat these issues
- Develop “Device Advice”
  - How do we respond to the questions our parents and patients ask
Book Titles

Screenwise: Helping Kids Thrive (and Survive) in Their Digital World

iRules: What Every Tech-Healthy Family Needs to Know about Selfies, Sexting, Gaming, and Growing up

The Big Disconnect: Protecting Childhood and Family Relationships in the Digital Age

AND SO ON
“Wait a second...how are we supposed to play on this? It’s not a video game.”
Apps to Track Baby’s Milestones: Obsessive or Helpful?

How plugged into your baby and child’s development should you be?

Posted Sep 04, 2013

I remember a neighbor of mine who recorded her perfectly healthy infant son’s every bowel movement. I thought that was pretty intense and compulsive. It is decades later with digital apps replacing paper records. Are apps to track baby’s developmental progress a must-have?

Apps Mania

From apps that chart fetal development during pregnancy to those that track a newborn’s feeding and sleeping schedules, parents can follow and...
Are Screens “Drugging” Your Child’s Brain?

Your young child’s brain on “devices” and what you can do.

Posted Sep 02, 2014

Given the use of computers and tablets in school and for homework requiring Internet access, it is unrealistic for families to forego technology completely. But, allowing it to replace play, peer interaction and family time or to become the dominant form of socializing can be detrimental when digital device use is not kept in check.

Your child’s brain on “devices”

Parents face difficult choices about technology, but new research makes some decisions easier. If over-decorated classrooms distract and reduce learning, imagine what frenetic, fast-changing screen images do to young children’s minds.
The Big Disconnect: Parents’ Digital Dilemma

Technology’s insidious way of taking over your family.

Posted Aug 13, 2013

When I tried to explain the risks of too much screen time for young children, my friend balked. In fact, she hardly heard me. She wanted to tell me how adept her grandchildren, ages three and almost five, were at sliding their fingers across an iPad. She became defensive, explaining that her son and daughter-in-law limit the children’s time on devices.

She and others have argued that digital is the way of the world now—and that’s true. However, aspects of the device-era are increasingly worrisome. The majority of parents don’t seem to be paying attention
Migration of print sources such as newspapers and magazines to online

Rapid proliferation of websites led to delivery of abundance of informational and entertainment text online

Several years later development of small mobile devices (smartphones, iPod touches etc.) can read websites, magazines, newspapers and books on these devices

Birth of dedicated eReaders

Development of multi purpose tablets

Much of daily communication that took place on phone or in person now handles in short bursts of written text such as text messages, e-mails, Facebook posts or Tweets

All of this has led to a major disruption in HOW, WHEN, and WHAT we read
8 Reasons Why Children Should Not Use Handheld Devices Frequently

ASH

Free Printable Worksheets
Help Kids Build Critical Skills With Fun Worksheet Activities.
education.com/worksheets

Download This To PDF
It's Free to Download and Convert. Get It In Seconds, Download Now.
education.com/download
8 Reasons Why Children Should Not Use Handheld Devices Frequently

1. Children are not turning their brains on.
2. Children may be exposed to too much radiation.
3. Children are not getting enough sleep.
4. Children will take ages to do homework.
5. Toddlers’ brain development may be at risk.
6. Children may be at increased risk of mental illness.
7. Children may become couch potatoes.
8. Children may suffer from eye strain.
Vision Issues related to Near Point Stress
Near Point Visual Stress
Birnbaum theory

- Binocular Vision and Accommodative Disorders / Myopia onset
  - Often *stress induced* conditions
    - Motivation for academic achievement
    - Career stress
  - Results in:
    - refractive changes
    - disturbances of accommodation and convergence
  - Many disorders (CI, AI, myopia) not primary problems = adaptive changes to near point stress
    - CI and Myopia have been linked to personality and emotional factors which underlie heightened sympathetic arousal
Use Abuse Theory
Birnbaum theory

- NEI study December 2009 Archives of Ophthalmology
  - Prevalence of nearsightedness among Americans has increased from 25% to 41.6% of the population over the past 30 years
    - A 66% increase
- There is an adverse influence of the extensive near vision demands imposed by our society
- The visual system is biologically unsuited for the sustained near work demands of our culture
THE LEARNING HABIT

A Groundbreaking Approach to Homework and Parenting That Helps Our Children Succeed in School and Life

Stephanie Donaldson-Pressman • Rebecca Jackson
• Dr. Robert M. Pressman
Technology has become an ever present influence on our lives. Our children have the benefit of instant communication and easy access to information. This is a wonderful thing……

Except when it isn’t
- **Spring 2011**
  - Survey > 1000 participants in 12 pediatric offices
- **Fall 2011**
  - Replicated survey to determine if the results were consistent
  - Results were nearly identical
  - Gave proof that media habits in children had a clear impact on academic success
- **Summer 2012**
  - Developed an online study of family habits that explores the effect of a child’s emotional development and social adjustment and vice versa
- This generation's use of media is **EXPOENTIAL**

- According to common **Core State Standards Initiative**.....keyboards will soon replace pencils
“In return for an increase in my allowance, I can offer you free unlimited in-home computer tech support.”
"Without data, you are just another person with an opinion".

Andreas Schleicher
developer of the PISA, Program for International Student Assessment
Growing Up Mobile
In the two years since Common Sense Media first reported on the media use of 0- to 8-year-olds, our latest survey in the series, Zero to Eight: Children’s Media Use in America 2013, shows the media environments and behaviors of young kids have changed. More than ever, they’re growing up mobile.

3/4 of all kids have access to mobile devices at home.

Smartphones are still the most common device (63%, up from 41%), but tablet ownership is 5 times higher (8% to 40%) than it was in 2011.
Common Sense Media

The number of kids who’ve used mobile devices has nearly doubled since 2011 (38% to 72%).

Average daily use of mobile devices has tripled, from 5 to 15 minutes a day.

TECH SAVVY TODDLERS:

In 2011, 10% of kids under 2 had used a mobile device. Now, that's grown to 38% of all kids under 2.

Traditional screen time is down but mobile screen time is up.

↓:31  ↑:10
CONCLUSION: Young children in an urban, low-income, minority community had almost universal exposure to mobile devices, and most had their own device by age 4. The patterns of use suggest early adoption, frequent and independent use, and media multitasking. Studies are urgently needed to update recommendations for families and providers on the use of mobile media by young children.

RESULTS: Most households had television (97%), tablets (83%), and smartphones (77%). At age 4, half the children had their own television and three-fourths their own mobile device. Almost all children (96.6%) used mobile devices, and most started using before age 1. Parents gave children devices when doing house chores (70%), to keep them calm (65%), and at bedtime (29%). At age 2, most children used a device daily and spent comparable screen time on television and mobile devices. Most 3- and 4-year-olds used devices without help, and one-third engaged in media multitasking. Content delivery applications such as YouTube and Netflix were popular. Child ownership of device, age at first use, and daily use were not associated with ethnicity or parent education.
AOA surveys

- AOA American Eye-Q Survey 2014
  - **Children**
    - 85% of parents indicate their children use electronic devices up to 4 hours per day
    - 41% of children have their own smart phone or tablet
    - 32% of children are using ebooks as well as text books at school
  - **Adults**
    - 42% spend greater than 3 hours per day with computers / devices
    - 1/3 parents are concerned that hand held devices will damage their children's vision
    - 53% believe 3D viewing may be harmful

No evidence based study has reported that new technology causes vision problems other than asthenopia
5 year old male, only child

- Question: How many hours a day does your child use media?
- Answer: 2 hours

- Reminded parent of all media devices owned reconstructed patient day and asked more specialized questions......

5 hours and 55 minutes
Media Use guidelines

- American Academy of Pediatrics, October 2013

  The AAP recommends that parents establish "screen-free" zones at home by making sure there are no televisions, computers or video games in children's bedrooms, and by turning off the TV during dinner. Children and teens should engage with entertainment media for no more than **one or two hours per day**, and that should be high-quality content. It is important for kids to spend time on outdoor play, reading, hobbies, and using their imaginations in free play.
Computer Vision Syndrome
AOA definition

- Computer Vision Syndrome describes a group of eye and vision-related problems that result from prolonged computer use. Many individuals experience eye discomfort and vision problems when viewing a computer screen for extended periods. The level of discomfort appears to increase with the amount of computer use.
Computer Vision Syndrome
AOA definition

- *Let us not forget............... In addition to computer monitors*
  - Smart phones
  - Tablets
  - Hand held game systems
  - HDTVs
How much do you know about computer vision syndrome (CVS)?
How much do you know about computer vision syndrome (CVS)?

Gary Heiting, O.D., allaboutvision.com

1) What are the symptoms of CVS?
   a) Eye strain
   b) Headaches
   c) Blurred vision
   d) Neck and shoulder pain
   e) All of the above
How much do you know about computer vision syndrome (CVS)?

Gary Heiting, O.D., allaboutvision.com

2) According to the AOA, what % of Americans who use computers are affected by CVS?

a) 10-15%
b) 25-30%
c) 50%
d) 70-75%
How much do you know about computer vision syndrome (CVS)?

Gary Heiting, O.D., allaboutvision.com

3) The eye responds to a printed word similarly to the way it responds to a digital image?

a) true
b) false
How much do you know about computer vision syndrome (CVS) ?

Gary Heiting, O.D., allaboutvision.com

4) What is the primary reason for computer vision syndrome?

   a) Glare on the computer screen
   b) An inability to focus properly on the computer image
   c) Images that are too small
   d) Poor computer station ergonomics
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Vision and Digital Devices
Computer Vision Syndrome

AOA definition

- Computer Vision Syndrome describes a group of eye and vision-related problems that result from prolonged computer use. Many individuals experience eye discomfort and vision problems when viewing a computer screen for extended periods. The level of discomfort appears to increase with the amount of computer use.

- The most common symptoms associated with Computer Vision Syndrome (CVS) are:
  - Eyestrain
  - Headaches
  - Blurred vision (at near and/or slow focusing at distance)
  - Dry eyes
  - Neck and shoulder pain (“text neck”)
Computer Vision Syndrome Symptoms

- These symptoms may be caused by:
  - poor lighting
  - glare on the computer screen
  - improper viewing distances
  - poor seating posture
  - uncorrected vision problems
  - excessive near point tasks
  - a combination of these factors
Why do these symptoms occur?

In adults

- Traditional forms of vision correction may not be appropriate for computer use
  - Patient wearing bifocals, trying to look through near segment at computer
  - Patient wearing progressives with too narrow an intermediate or wrong power
Traditional Flat-Top Bifocals

Shamir Duo™ No-Line Bifocals
How we see the world

- How do our eyes (and brain) determine where something is in space?
- How far away it is?
- How does our brain determine how much the eyes need to focus?
The answer . . .

- The brain relies on basic visual clues
  - Depth perception provided by two eyes
  - Contrast between objects
  - Color change between objects
  - Well-defined edges of objects
Consider printed material

- Printed characters provide adequate visual information
- Good contrast from ink color to paper color
- Sharp transition - good edge definition
- Our vision system is programmed to understand normal printed material
What happens . . .

- When our eyes don’t find good contrast or well-defined edges?
Pixels

- Present entirely different kind of image
- Image is made up of pixels, not one full image
- Pixels - picture and text drawn in little “pieces”
- Pixels are brightest in center and dimmer towards edge
- Pixels are used on computers, iPads

New LCD Screens with higher resolution will likely cause fewer CVS problems
Computer Screen vs. Hardcopy

A comparison of symptoms after viewing text on a computer screen and hardcopy


Symptoms following sustained computer use were significantly worse than those reported after hard copy fixation under similar viewing conditions.
eInk

- Display used by eReaders (e.g. Kindle Paperwhite and Nook)
- More closely mimics the look of paper
- Less visual fatigue
The Pixel Density Race

iPhone 3G

iPhone 4
The Pixel Density Race

- PPD = Pixels per degree
  - A way to account for both distance from the display and the resolution of the display
  - Not limited to smart phones displays
  - Applies to any type of display

- Snellen acuity chart resolution is 60 PPD

- Smallest separation at which 2 lines can be perceived as two distinct lines is 120 PPD

- Current smart phone technology PPD at 1800 PPD
Retina Display

- Retina Display is a term coined by Apple to refer to their devices that have a pixel density so high that the naked eye can’t see individual pixels. These options offer a solution to pixelation, making them much “better for your eyes”.

Text on a non-Retina iPad versus a Retina iPad.

- Sharper text is much easier on the eye and much more pleasurable for reading.
One More thing....

Blue Light
What is Blue light?

Visible light emitted by the sun comprises a range of different colored light rays that contain different amounts of energy.

Rays on the **RED** end of the visible light spectrum have longer wavelengths and, therefore, **LESS** energy.

Rays on the **BLUE** end of the visible light spectrum have shorter wavelengths and, therefore, **MORE** energy.
What is Blue light?

- The portion of visible light spectrum with the shortest wavelengths and highest energy
Blue Light

- Blue light is everywhere
- Man made sources of indoor blue light
  - Fluorescent lighting
  - LED lighting
  - Flat screen TV
  - Screen displays of:
    - Computers
    - E Readers
    - Tablets
    - Smartphones

- Concern:
  - Amount of time spent on devices
  - Proximity of devices to the face
  - The eye does not block blue light well
Blue Light

- **Concern:**
  - Amount of time spent on devices
  - Proximity of devices to the face
  - The eye does not block blue light well

The cornea and lens block *UV rays* from reaching the retina

Most visible *blue light* passes through the cornea and lens and reaches the retina
Blue Light

- **Concern:**
  - Amount of time spent on devices
  - Proximity of devices to the face
  - The eye does not block blue light well

Blue light exposure may increase the risk of macular degeneration

Blue light contributes to digital eye strain
Blue Light

Preventative Methods:
- Blue light filters for digital devices
  - iLLumiShield - iPhone ($8-10)
  - retinaShield (tech Armour) - iPad ($12)
  - Retina Armor (tekide)
  - Frabicon - same as above
  - Cyxus - same as above
Blue Light

- Spectacle Lens technology:
  - amber lenses add additional contrast to define shapes and sharpen detail for easier viewing
  - lens tints filter high frequency blue light emitted from digital devices to protect eyes
  - lens focusing power helps you hold focus on your screens and minimizes eye muscle fatigue
  - wrap-around patented lens design prevents dry eyes and irritation to ease eyestrain
  - anti-reflective coatings on front and back of the lenses eliminate visual distractions and filter blue light to the
Blue Light Studies
Blue Light

Effects of blue light on the circadian system and eye physiology.
Tosini G, Ferguson I, Tsubota K.

Blue blocker glasses as a countermeasure for alerting effects of evening light-emitting diode screen exposure in male teenagers.

Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness.
Chang AM1, Aeschbach D2, Duffy JF3, Czeisler CA3.
RESULTS:

All the LE devices shared very similar enhanced short-wavelength peaks when displaying text. This included the output from the backlit Kindle Paperwhite device. The spectra when comparing text to the Angry Birds game were also very similar, although the text emissions were higher intensity. Both the orange-tinted glasses and the "sleep-aware" app significantly reduced short-wavelength emissions.

CONCLUSION:

The LE devices tested were all bright and characterized by short-wavelength enriched emissions. Since this type of light is likely to cause the most disruption to sleep as it most effectively suppresses melatonin and increases alertness, there needs to be the recognition that at night-time "brighter and bluer" is not synonymous with "better." Ideally future software design could be better optimized when night-time use is anticipated, and hardware should allow an automatic "bedtime mode" that shifts blue and green light emissions to yellow and red as well as reduce backlight/light intensity.
What visual disorders do optometrists encounter most due to increased near point demands on our population?

**Binocular Vision and Accommodative Disorders**

- Convergence Insufficiency
- Accommodative Insufficiency
- Convergence Excess
- Myopia
A Visual Efficiency Testing “Handbook”
Binocular Vision Disorders
Binocular Vision Disorders

- **EXO Deviations**
  - Convergence Insufficiency
  - Basic exo deviations
  - Divergence Excess

- **ESO Deviations**
  - Convergence Excess
  - Basic eso deviations
  - Divergence Insufficiency
**DUANE’S CLASSIFICATIONS**

<table>
<thead>
<tr>
<th>EXO Deviations</th>
<th>AC/A</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Convergence Insufficiency</strong></td>
<td>N&gt;F</td>
</tr>
<tr>
<td><strong>Basic EXO deviation</strong></td>
<td>N=F</td>
</tr>
<tr>
<td><strong>Divergence Excess</strong></td>
<td>F&gt;N</td>
</tr>
</tbody>
</table>

N = near fixation distance  /  F = far fixation distance
DUANE’S CLASSIFICATIONS

**ESO Deviations**

N = near fixation distance / F = far fixation distance

<table>
<thead>
<tr>
<th></th>
<th>&lt;D</th>
<th>AC/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convergence Excess</td>
<td>N&gt;F</td>
<td>High</td>
</tr>
<tr>
<td>Basic ESO deviation</td>
<td>N=F</td>
<td>Normal</td>
</tr>
<tr>
<td>Divergence Insufficiency</td>
<td>F&gt;N</td>
<td>Low</td>
</tr>
</tbody>
</table>
**Clinical Vergence Disorders**

**Soft Binocular Vision Problems**

*Scheiman/Wick*

---

### Phoria Norms
Cover test and phoropter measurements

<table>
<thead>
<tr>
<th>Distance</th>
<th>ortho - 2 Δ exophoria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near</td>
<td>ortho - 6 Δ exophoria</td>
</tr>
</tbody>
</table>
How to record Smooth Vergence Measurements

Blur / break / recovery

- **Blur** - patient reports blur
- **Break** - patient reports diplopia
- **Recovery** - patient reports fusion (diplopia is eliminated)
How to record Smooth Vergence Measurements

**Blur / break / recovery**

- **Blur**
  - Fusional vergence is used up
  - Accommodation adjusting to maintain fusion
    - Measures amount of fusional vergence free of accommodation
    - Should not be noted when testing distance vergences

- **Break**
  - Patient uses up all vergence sources
    - Measures total amount of fusional and accommodative vergence

- **Recovery**
  - Point where patient can re-access vergence system to regain single vision/fusion
    - Image may still be blurry
# Clinical Vergence Disorders

## Soft Binocular Vision Problems

*Scheiman/Wick*

<table>
<thead>
<tr>
<th>Vergences Smooth / Phoropter</th>
<th>Near</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base In</td>
<td>11/19/10</td>
<td>x/6/3</td>
</tr>
<tr>
<td>Base Out</td>
<td>14/18/7</td>
<td>7/15/8</td>
</tr>
</tbody>
</table>
## Clinical Vergence Disorders

**Soft Binocular Vision Problems**

*Scheiman/Wick*

<table>
<thead>
<tr>
<th>Vergences</th>
<th>Prism Bar Vergences/Step Vergence</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base In</td>
<td></td>
<td>x/13/10</td>
</tr>
<tr>
<td>Base Out</td>
<td></td>
<td>x/19/14</td>
</tr>
<tr>
<td>Distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base In</td>
<td></td>
<td>x/7/4</td>
</tr>
<tr>
<td>Base Out</td>
<td></td>
<td>x/11/7</td>
</tr>
</tbody>
</table>
### Clinical Vergence Disorders

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<table>
<thead>
<tr>
<th>Vergences</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prism Bar Vergences/Step Vergence</td>
<td>CHILDREN</td>
<td></td>
</tr>
<tr>
<td><strong>Near</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base In</td>
<td>x/12/7</td>
<td></td>
</tr>
<tr>
<td>Base Out</td>
<td>x/23/16</td>
<td></td>
</tr>
<tr>
<td><strong>Distance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base In</td>
<td>None established</td>
<td></td>
</tr>
<tr>
<td>Base Out</td>
<td>None established</td>
<td></td>
</tr>
</tbody>
</table>
### Near Point of Convergence Testing

**NPC**
**Near Point of Convergence**

<table>
<thead>
<tr>
<th></th>
<th>Break</th>
<th>6 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Children</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adults</strong></td>
<td>Accommodative target</td>
<td>5cm/8cm (break/recovery)</td>
</tr>
<tr>
<td></td>
<td>Red lens / transilluminator</td>
<td>7cm/10cm (break/recovery)</td>
</tr>
</tbody>
</table>
Worth 4 •dot• Sensory Fusion
Worth 4 dot

- 4 dots = **stable fusion** with no suppression

- Diplopia (5 dots) - Unstable Fusion
  - **decreased sensory-fusion**
    - cannot integrate 2 images
  - **insufficient motor fusional vergence**
    - add prism to \( \downarrow \) vergence demand
<table>
<thead>
<tr>
<th>Test Distance</th>
<th>Subtends</th>
</tr>
</thead>
<tbody>
<tr>
<td>16”</td>
<td>4.5°</td>
</tr>
<tr>
<td>36”</td>
<td>2°</td>
</tr>
<tr>
<td>6’</td>
<td>1°</td>
</tr>
<tr>
<td>10’</td>
<td>0.6°</td>
</tr>
<tr>
<td>20’</td>
<td>0.3°</td>
</tr>
</tbody>
</table>
Accommodative Disorders
Accommodative Disorders

- **Accommodative Insufficiency**
  - Insufficient amplitude of accommodation to afford clear imagery of a stimulus object at a specified distance, usually the normal or desired reading distance

- **Accommodative Excess**
  - Accommodation in excess of the amount required for sharpest imagery of the stimulus object

- **Accommodative Infacility** (inertia of accommodation)
  - Slow or difficult accommodative response to dioptic change in stimulus; especially sluggish accommodative response to changes in fixation distance
### Accommodative Testing

<table>
<thead>
<tr>
<th>Test</th>
<th>Normative Value</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Push up/Pull away amplitudes</td>
<td>15 - ¼ age</td>
<td>+/- 2.00D</td>
</tr>
<tr>
<td>NRA</td>
<td>+2.00 D</td>
<td>+/- 0.50 D</td>
</tr>
<tr>
<td>PRA</td>
<td>-2.37D</td>
<td>+/- 1.00 D</td>
</tr>
<tr>
<td>Minus lens amplitudes</td>
<td>15 - ¼ age – 2D</td>
<td></td>
</tr>
<tr>
<td>MEM (monocular estimation method)</td>
<td>+0.50 D</td>
<td>+/- 0.25 D</td>
</tr>
<tr>
<td>Fused X-cylinder</td>
<td>+0.50 D</td>
<td>+/- 0.25 D</td>
</tr>
</tbody>
</table>

- **Note:** for amplitudes always be aware of even a small difference between the 2 eyes that is repeatable
  - If this is backed up by symptoms there may be an accommodative problem
Blur reported at 8 cm = What is amplitude?
100/8 = 12.5 D OD
Pull Away OD
Pull Away OD
Read 20/20 letter at 9 cm = What is amplitude?
100/9 = 11 D OS
## Accommodative Facility

### Accommodative Facility Testing

<table>
<thead>
<tr>
<th>Test type</th>
<th>Population</th>
<th>Normative Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Binocular</strong></td>
<td>Children (7-12)</td>
<td>5.0 cpm</td>
</tr>
<tr>
<td></td>
<td>Adults</td>
<td>8.0 cpm</td>
</tr>
<tr>
<td><strong>Monocular</strong></td>
<td>Children 7-12</td>
<td>7.0 cpm</td>
</tr>
<tr>
<td></td>
<td>Adults</td>
<td>11-12 cpm</td>
</tr>
</tbody>
</table>
Binocular Vision Disorder Summaries
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<td>Normal accommodative amplitudes</td>
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## Fusional Vergence Dysfunction

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<tr>
<td>Asthenopia and headaches</td>
<td>Orthophoria or a low degree of eso or exophoria at distance and near</td>
</tr>
<tr>
<td>Intermittent blur</td>
<td>Reduced positive fusional vergence</td>
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<td>Burning and tearing</td>
<td>Low NRA and PRA</td>
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<tr>
<td>Inability to sustain and concentrate</td>
<td>Fails binocular accommodative facility testing with both plus and minus</td>
</tr>
<tr>
<td>Sleepiness when reading</td>
<td>Normal monocular accommodative facility</td>
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Accommodative Disorder Summaries
# Accommodative Insufficiency

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<td></td>
<td>BAR - Fails (+)</td>
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<tr>
<td>Intermittent blurred distance vision, worse after reading</td>
<td>Fails monocular accommodative facility with plus</td>
</tr>
<tr>
<td>Difficulty with attention and concentration with reading</td>
<td>Variable acuity findings</td>
</tr>
<tr>
<td></td>
<td>Variable retinoscopy and subjective findings</td>
</tr>
<tr>
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<td>Low degree of A/R astigmatism</td>
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## Accommodative Infacility

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<td>Low NRA/PRA</td>
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<td>Blurred vision when changing fixation form one distance to another</td>
<td>Low MEM</td>
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<td>Difficulty with attention and concentration with reading</td>
<td>Fails monocular accommodative facility with plus and minus</td>
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What visual disorders do optometrists encounter most due to increased near point demands on our population?

**Binocular Vision and Accommodative Disorders**

Accommodative Insufficiency

Convergence Insufficiency

Convergence Excess
Case Examples
8 year old male

<table>
<thead>
<tr>
<th>Initial Findings</th>
</tr>
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</table>
| **Case History** | Complain of distance blur (minimal)  
Tremendously close working distance  
No HA, no asthenopia |
| **Visual Acuity sc** | Distance | Near |
|                  | 20/20 OD, OS | 20/20 OD, OS |
| **Cover Test sc** | ortho | ortho |
| **Retinoscopy** | +0.75 sph  
+0.75 sph | 20/20  
20/20 |
| **Near Prism Bar Vergences cc** | Base In  
x/12/6 | Base Out  
x/18/16 |
8 year old male

<table>
<thead>
<tr>
<th>Accommodative Testing</th>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minus Lens Amplitude</td>
<td>7.75D</td>
<td>7.75D</td>
</tr>
<tr>
<td>(age expected = 10.5D)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRA/PRA</td>
<td>+2.50/-2.50</td>
<td></td>
</tr>
<tr>
<td>Binocular Accommodative Facility</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Can clear both +/-2D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(notes increased difficulty with minus)</td>
<td></td>
</tr>
</tbody>
</table>
Assessment / Plan

- Mild Accommodative Insufficiency
- Hyperopia
  - Rx given for near and school work (+1.00 D OU)
  - Continue to work on appropriate working distance
  - Consider need for therapy in future
### 6 year old male

#### Initial Findings

| Case History                                                                 | No visual complaints, Kindergarten  
|                                                                             | Good school performance  
|                                                                             | Last exam July 2015  
|                                                                             | Good VA, all findings wnl  
| Visual Acuity sc                                                            | Distance  
|                                                                             | Near  
| 20/40 +2 OD, OS                                                            | 20/30 - OD, OS  
| Cover Test sc                                                               | ortho  
|                                                                             | ortho  
| Retinoscopy                                                                  | +1.50 sph  
|                                                                             | 20/80  
|                                                                             | +1.50 sph  
|                                                                             | 20/80  
|                                                                             | No amount of plus improves DVA, NVA not better with plus  
|                                                                             | Poor plus acceptance at near  
|                                                                             | Nothing improves distance VA (Even tried minus!!)  
| Near Prism Bar Vergences cc                                                 | Base In  
|                                                                             | x/18/16  
|                                                                             | Base Out  
|                                                                             | 45 No break  

# 6 year old male

## Accommodative Testing

<table>
<thead>
<tr>
<th></th>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minus Lens Amplitude (age expected = 11.5D)</td>
<td>5.50D</td>
<td>7.50D</td>
</tr>
<tr>
<td>NRA/PRA</td>
<td>Very poor plus acceptance/-2.50</td>
<td></td>
</tr>
<tr>
<td>Binocular Accommodative Facility</td>
<td>Cannot clear either +/- 2D</td>
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</tr>
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</table>

## Oculomotor Testing

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Gross Saccades / Pursuits</td>
<td>Below Average</td>
</tr>
<tr>
<td>King Devick</td>
<td>Unable to complete 3rd card</td>
</tr>
</tbody>
</table>

## Revisit Case History

> While doing VA... I need glasses I see like that at school HA every night, especially after school. "I get HA on school days not weekend" Fatigues easily I get blurry at "rest time" at school Can be distracted easily
Assessment / Plan

- Accommodative Insufficiency
- Hyperopia
  - Begin Vision therapy to treat accommodative and oculomotor disorder
  - Attempt to work patient into plus acceptance
    - Rx given for near and school work (+1.00 D OU)
What visual disorders do optometrists encounter most due to increased near point demands on our population?

**Binocular Vision and Accommodative Disorders**

**Accommodative Insufficiency**
Accommodative Insufficiency

What are they going to say?
## Accommodative Insufficiency

### Symptoms

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Accommodative Insufficiency

What are you going to see?
## Accommodative Insufficiency

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Low A/R Cylinder – Birnbaum Theory

Onset of myopia often preceded by low A/R cyl (Hirsch 1964)

A/R cyl is an early adaptation
Lag of accommodation is present during near work
(Accommodation is localized beyond the plane of regard)

A/R cyl produces vertically oriented blur circles which permit resolution of the vertically oriented characters of our language

A/R cyl permits one to accommodate less while maintaining adequate visual resolution at near point with a minimum loss of distance visual acuity
Low A/R Cylinder – Birnbaum Theory

As Near point stress persists or visual efficiency is unsatisfactory

↓

Myopia development may occur

We often see low A/R cyl reduce or disappear with plus lens treatment or vision therapy
Accommodative Insufficiency

What are you going to do?
Accommodative Insufficiency
Treatment Options

- **Added Lenses**
  - Refractive error as necessary
  - Optimize spectacle and/or contact lens Rx

- **Plus lenses**
  - need reflected in clinical signs

- **Orthoptics / Vision Therapy**
  - generally requires 12-24 office visits
    - dependent upon age, motivation, compliance
Accommodative Insufficiency Treatment

Treatment of Accommodative Dysfunction in Children: results from a Randomized Clinical Trial Optometry and Vision Science, Vol. 88, No.11, November 2011, Scheiman, M., Cotter S, et.al.

- 211 children ages 9-17 with symptomatic CI
  - 74% had accommodative dysfunction
  - 29% had decreased amplitude of accommodation when compared to age norms
  - 19% had decreased accommodative facility
  - 26% both

Conclusion:
Vision therapy/orthoptics was effective for improving decreased accommodative amplitude and accommodative facility
Case Report
Case: 10 year old Hispanic Female

- **Chief Complaint:**
  - Frontal HA daily w/ new Rx
  - Either eye turns out: left more often
  - Intermittent diplopia and blur at near (words move on page)
  - Symptoms worse at end of day
  - Normal ocular and systemic health

- **Current Rx:**
  - OD -1.75 sph
  - OS -1.50 sph
Case: 10 year old Hispanic Female
### Initial Findings

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<tr>
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<th>Near</th>
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<tr>
<td><strong>Visual Acuity cc</strong></td>
<td><strong>20/20 OD, OS</strong></td>
<td><strong>20/20 OD, OS</strong></td>
</tr>
<tr>
<td><strong>Retinoscopy = Subjective</strong></td>
<td><strong>-1.75 sph</strong></td>
<td><strong>20/20</strong></td>
</tr>
<tr>
<td></td>
<td><strong>-1.50 sph</strong></td>
<td><strong>20/20</strong></td>
</tr>
<tr>
<td><strong>Cover Test cc</strong></td>
<td><strong>18Δ IAXT</strong></td>
<td><strong>40Δ IAXT</strong> (very high frequency)</td>
</tr>
<tr>
<td><strong>Near Prism Bar Vergences cc</strong></td>
<td><strong>Base In</strong></td>
<td><strong>Base Out</strong></td>
</tr>
<tr>
<td></td>
<td><strong>x/14/8</strong></td>
<td><strong>x/1/23/16</strong></td>
</tr>
<tr>
<td></td>
<td><strong>x/12/7</strong></td>
<td></td>
</tr>
<tr>
<td><strong>NPC</strong></td>
<td><strong>20cm/no recovery</strong></td>
<td><strong>5cm/8cm</strong></td>
</tr>
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</table>
10 year old female

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<td><strong>Distance</strong></td>
</tr>
<tr>
<td>Worth 4 Dot</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Minus lens Amps</td>
</tr>
<tr>
<td>norm = 9-10 D</td>
</tr>
<tr>
<td>Stereopsis</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>
Worth 4 - dot - Sensory Fusion
Worth 4 dot

- 4 dots = *stable fusion* with no suppression

- Diplopia (5 dots) - Unstable Fusion
  - *decreased sensory-fusion*
    - cannot integrate 2 images
  - *insufficient motor fusional vergence*
    - add prism to ↓ vergence demand
Diplopia
Addition of $8\Delta BI$ near
### What did we see?

**Convergence Insufficiency**

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Assessment / Plan

- **Assessment**
  - Myopia OU
  - Convergence insufficiency

- **Plan**
  - Rx given: -1.50 sph OU
  - +1.75 add OU due to very low amps., HA, and discomfort w/ minus Rx
  - 4Δ BI OD, OS to aid fusion (8Δ BI total)

  Referred for Vision therapy / orthoptic training
Intermittent Strabismus

- **Treatment Tips**

  - **Prism Rx**
    - Ideal for patients who demonstrate an exo deviation at near as well as distance
    - Can be used in conjunction with orthoptic program to ease convergence demand
    - Ideal for patients unable to commit to an orthoptic program

  - **Orthoptic Training**
    - Treatment option for convergence insufficiency patients
    - Lack of success typically coincident with lack of compliance therefore not an ideal option if patient not committed and/or motivated for orthoptic treatment
Treatment of Strabismus with Relieving Prism

- Proper patient selection
  - Proper diagnostic criteria
    - Normal sensory skills
      - Must eliminate sensory problems before Rxing relieving prisms
    - Motor skills are high
      - May need orthoptics or surgery to improve motor skills before Rxing relieving prism
  - (+) Fusion ability
    - evaluate sensory fusion
    - evaluate motor fusion
  - Intermittent deviations or deviations with the capability of motor fusion skills
To Summarize:

Patients MUST have the ability to FUSE in order to successfully use prism as a treatment option.
**Prism Rx given with weekly active orthoptic therapy**

↓

Orthoptic therapy increases convergence (BO) amplitudes

↓

The goal is to decrease in the amount of prism reliance over time

↓

A decreased magnitude of prism correction helps to increase fusional effort & slow vergence adaptation
Relieving Prism

- Reduces, does not eliminate motor fusion demand

- Rx the minimal amount of prism that will achieve comfortable binocular vision
  - Too small a prism Rx will not allow BV to be attained or maintained

- Current Rx of 45 y.o. patient with a 30Δ IXT Convergence Insufficiency diagnoses:
  - +1.75 -0.75 x 080 1Δ BI
  - +1.75 -0.75 x 085 1Δ BI
  - +2.50 Add

- Rx enough prism to stabilize Sensorimotor Fusion
  - Decrease over time as motor fusion increases or size of deviation ↓
### Relieving Prism

- **Expected Residual deviations**
  - Esotropia = 4 - 6 Δ
  - Exotropia = 10 - 15 Δ
  - Vertical deviations = 2 - 4 Δ
• Obtained prism Rx after 6 weeks of VT - some relief immediately
• Gradually improved fusion/reduced diplopia in the next 6 weeks of VT
• Now reports NO diplopia except when tired (can recover fusion)
• Cover Test shows exophoria at all distances
• NPC to nose
• Minus lens amps: 10 D OD/OS
What visual disorders do optometrists encounter most due to increased near point demands on our population?

**Binocular Vision and Accommodative Disorders**

**Convergence Insufficiency**
Convergence Insufficiency

What are they going to say?
## Convergence Insufficiency

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Convergence Insufficiency

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Convergence Insufficiency

What are you going to do?
Convergence Insufficiency Treatment Options

- **Lenses**
  - Refractive Error as necessary
  - Optimize spectacle and/or contact lens Rx

- **Added Lenses**
  - Prism

- **Orthoptics / Vision Therapy**
  - generally requires 12-24 office visits
  - dependent upon age, motivation, compliance
Vision therapy / orthoptics was the only treatment that produced clinically significant improvements in the near point of convergence and positive fusional vergence. Half the patients (58%) were still symptomatic at the end of treatment, although their symptoms were significantly reduced. All three groups demonstrated statistically significant changes in symptoms with 42% in office based vision therapy/orthoptics, 31% in office based placebo vision therapy/orthoptics, and 20% in home based pencil push ups.

A randomized clinical trial of vision therapy/orthoptics versus pencil push-ups for the treatment of convergence insufficiency in young adults

Convergence Insufficiency Studies

Base in prism reading glasses were found to be no more effective in alleviating symptoms, improving the near point of convergence, or improving positive fusional vergence at near than placebo reading glasses for treatment of children aged 9 to < 18

Randomized clinical trial of the effectiveness of base in prism reading glasses versus placebo reading glasses for symptomatic convergence insufficiency in children

Convergence Insufficiency Studies

12 weeks of office based vergence and accommodative therapy results in a significantly greater improvement in symptoms and clinical measures of near point of convergence and positive fusional vergence and a greater percentage of patients reaching the predetermined criteria of success compared with home based pencil push ups, home based vergence and accommodative therapy, and office based placebo treatment.

Randomized clinical trial of treatments for symptomatic convergence insufficiency in children
Arch Ophthalmol. 2008 Oct;126 (10):1336-49 (CITT group)
Case Report
10 year old female

- **Case History**
  - c/o distance blur without Rx OD, OS
  - Lost Rx several months ago
  - 1\textsuperscript{st} Rx at 7 years old
  - c/o difficulty with near work when wearing Rx
  - (+) Asthenopia and headaches cc
    - Worsens at end of day
    - Extreme fatigue with near work
    - Not present without Rx

- **Medical history**
  - Heart defect
    - entering hospital next day for surgical procedure with extended stay
  - NKMA
### Initial Findings

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<tr>
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<td>20/300 OD, OS</td>
<td>20/20</td>
<td>OD, OS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cover Test sc</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>----</td>
<td>12Δ X'</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Retinoscopy = Subjective</th>
<th>-4.25 -0.75 x 090</th>
<th>20/20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-4.50 sph</td>
<td>20/20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cover Test cc</th>
<th>ortho</th>
<th>18Δ IAET</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Near Prism Bar Vergences cc</th>
<th>Base In</th>
<th>Base Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>x/8/4</td>
<td>x/25/20</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cover Test with +2.00D</th>
<th>----</th>
<th>4Δ E'</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Near Prism Bar Vergences with +2.00D</th>
<th>Base In</th>
<th>Base Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>x/12/10</td>
<td>x/20/16</td>
<td></td>
</tr>
<tr>
<td>x/12/7</td>
<td>x/23/16</td>
<td></td>
</tr>
</tbody>
</table>
AC/A ratio

AC/A ratio = 12 X' ↔ 18 E' = 30 / 4 = 7.5/1
### Accommodative Testing

<table>
<thead>
<tr>
<th></th>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minus Lens Amplitude</strong></td>
<td>5.50D</td>
<td>5.0D</td>
</tr>
<tr>
<td><em>(age expected = 10.5D)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NRA/PRA</strong></td>
<td>+2.25/-1.25</td>
<td></td>
</tr>
<tr>
<td><strong>Binocular Accommodative Facility</strong></td>
<td>2.0 cpm <em>(difficulty with minus)</em></td>
<td></td>
</tr>
<tr>
<td><strong>Monocular Accommodative Facility</strong></td>
<td>4.0 cpm <em>(difficulty with minus)</em></td>
<td></td>
</tr>
<tr>
<td><strong>MEM</strong></td>
<td>+0.50 D</td>
<td></td>
</tr>
<tr>
<td><em>all meridians</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10 year old Female

- **Assessment**
  - Myopia OU
  - Convergence Excess
  - Accommodative Insufficiency

- **Plan**
  - Rx given
    - OD \(-4.00 -0.75 \times 090\)
    - OS \(-4.50\) sphere
    - +2.00 Add
With +2.00 D Add

\[ \text{AC/A ratio} = 12 \, \Delta \, X' \leftrightarrow 18 \, E' = \frac{30}{4} = 7.5/1 \]
What visual disorders do optometrists encounter most due to increased near point demands on our population?

**Binocular Vision and Accommodative Disorders**

*Convergence Excess*
Convergence Excess

What are they going to say?
## Convergence Excess

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthenopia and headaches</td>
<td>Significant esophoria at near</td>
</tr>
<tr>
<td>Intermittent blur</td>
<td>Reduced negative fusional vergence at near</td>
</tr>
<tr>
<td>Intermittent diplopia</td>
<td>High AC/A ratio</td>
</tr>
<tr>
<td>Symptoms worse at end of day</td>
<td>Low PRA</td>
</tr>
<tr>
<td>Burning and tearing</td>
<td>High MEM</td>
</tr>
<tr>
<td>Inability to sustain and concentrate</td>
<td>Fails binocular accommodative facility testing with -2.00</td>
</tr>
<tr>
<td>Sleepiness when reading</td>
<td></td>
</tr>
<tr>
<td>Decreased reading comprehension over time</td>
<td></td>
</tr>
</tbody>
</table>
What are you going to see?
## Convergence Excess

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Sleepiness when reading</td>
<td></td>
</tr>
<tr>
<td>Decreased reading comprehension over time</td>
<td></td>
</tr>
</tbody>
</table>
Convergence Excess

What are you going to do?
Convergence Excess Treatment Options

- **Lenses**
  - Refractive Error as necessary
  - Optimize spectacle and/or contact lens Rx

- **Added Lenses**
  - Plus lenses
    - Lowest amount of plus to eliminate symptoms and normalize exam data
  - Prism
    - Rarely needed 2° high AC/A ratio

- **Orthoptics / Vision Therapy**
  - Generally requires 12-24 office visits
  - Dependent upon age, motivation, compliance
Vision Therapy for Convergence Excess

Journal of American Optometric Association, 1997 Feb;68(2)81-6
Gallaway M, Schieman M

Record review of 83 patients with CE

Vision therapy was successful in enhancing negative fusional vergence and eliminating symptoms in the vast majority of patients with convergence excess and should be considered an effective treatment for this condition

84% of patients reported a total elimination of initial symptoms
Convergence Excess Treatment Options

- **Lenses**
  - Refractive Error as necessary

- **Added Lenses**
  - **Plus lenses**
    - Lowest amount of plus to eliminate symptoms and normalize exam data
  - **Prism**
    - Rarely needed 2° high AC/A ratio

- **Orthoptics / Vision Therapy**
What visual disorders do optometrists encounter most due to increased near point demands on our population?

Binocular Vision and Accommodative Disorders

Accommodative Excess
Case Report
Case History
- c/o near blur (minimal distance blur)
- (+) headaches and (+) asthenopia at end of day
- Gets tired easily when reading
- Intermittent near blur, print comes in and out
- (-) diplopia
- Sleeps or stops reading to relieve symptoms
- Medical hx -
  - unremarkable
  - NKMA
8 year old female

<table>
<thead>
<tr>
<th>Initial Findings</th>
<th>Distance</th>
<th>Near</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Visual Acuity sc</strong></td>
<td>20/20 OD, 20/20 OS</td>
<td>20/25 OD, 20/30 OS</td>
</tr>
<tr>
<td><strong>Cover Test sc</strong></td>
<td>3 $\Delta X'$</td>
<td>6 $\Delta X'$</td>
</tr>
<tr>
<td><strong>Retinoscopy</strong></td>
<td>+0.50 -0.50 $\times$ 090</td>
<td>20/25</td>
</tr>
<tr>
<td>Variable reflex</td>
<td>+0.50 -0.50 $\times$ 090</td>
<td>20/20</td>
</tr>
<tr>
<td>W/M ↔ A/M</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Near Prism Bar Vergences sc</strong></td>
<td>Base In $x/10/8$</td>
<td>Base Out $x/14/6$</td>
</tr>
<tr>
<td></td>
<td>$x/12/7$</td>
<td>$x/23/16$</td>
</tr>
</tbody>
</table>
8 year old female

<table>
<thead>
<tr>
<th>Accommodative Testing</th>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minus Lens Amplitude (age expected = 10.0D)</td>
<td>9.50D</td>
<td>9.75D</td>
</tr>
<tr>
<td>NRA/PRA</td>
<td>+1.25/-2.50</td>
<td></td>
</tr>
<tr>
<td>Binocular Accommodative Facility</td>
<td>Unable to clear plus lenses</td>
<td></td>
</tr>
<tr>
<td>Monocular Accommodative Facility</td>
<td>Unable to clear plus lenses</td>
<td></td>
</tr>
<tr>
<td>MEM</td>
<td>+0.50 D all meridians</td>
<td></td>
</tr>
</tbody>
</table>
8 year old Female

- **Assessment**
  - Accommodative Excess

- **Plan**
  - Treatment Options
Accommodative Excess Treatment Options

- **Added Lenses**
  - uncorrected refractive error
  - Plus lenses not helpful
    - reflected in clinical signs

- **Orthoptics / Vision Therapy**
  - *generally requires 12-24 office visits******
    - dependent upon age, motivation, compliance
<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Blurred vision at near</em></td>
<td>Normal accommodative amplitudes</td>
</tr>
<tr>
<td><em>Discomfort and strain associated with near tasks</em></td>
<td>Low NRA</td>
</tr>
<tr>
<td><em>Fatigue associated with nearpoint tasks</em></td>
<td>Low MEM</td>
</tr>
<tr>
<td></td>
<td>BAR - Fails (+)</td>
</tr>
<tr>
<td><em>Intermittent blurred distance vision, worse after reading</em></td>
<td>Fails monocular accommodative facility with plus</td>
</tr>
<tr>
<td><em>Difficulty with attention and concentration with reading</em></td>
<td>Variable acuity findings</td>
</tr>
<tr>
<td></td>
<td>Variable retinoscopy and subjective findings</td>
</tr>
<tr>
<td></td>
<td>Low degree of A/R astigmatism</td>
</tr>
</tbody>
</table>
8 year old Female

- **Assessment**
  - Accommodative Excess

- **Plan**
  - No Rx
  - Orthoptic treatment initiated
  - Completed in 12 weeks
  - Symptoms relieved
Device Advice

Visual
20-20-20 Rule
Visual Rules to help prevent eyestrain for children (and adults)

- 20-20-20 Rule

- Choose a comfortable supportive chair so that the child’s feet are on the ground

- Suggest that they limit leisure screen time to 2 hours/day (this includes TV watching, playing video games, and using mobile devices)

- Take notice if children are squinting, rubbing eyes

- Remind children to blink more regularly

- Check for glare and reflections on the screen

- Adjust lighting

- Remember that kids do not have awareness of the time they spend on many media devices
Visual Rules to help prevent eyestrain for children (and adults)

- **Pre-school and Kindergarten aged children**
  - Limit tech time to 2 hours or less daily
  - Increase font size

- **Elementary school children**
  - Cell phones for quick tasks only
  - Hold device at Harmon’s distance slightly below eye level
  - Take frequent breaks

- **Middle school and high school students**
  - Place the screen 20-28 inches from your child’s eyes. Align the top of the screen at eye level
  - Use small devices (phones) for quick tasks (texting) do not use to read articles and documents
  - Build in breaks every hour
Harmon Distance Review

- Use the “Harmon Distance” when reading, writing and doing other close work. The distance between the eyes and the task is the distance between the elbow and the middle knuckle. (Dr. Darrell Boyd Harmon’s “Harmon Distance.”)
Posture-Rite Lap Desk
Lap Gear Smart Media Desk Exec Lap Desk
7 things you’re doing at your desk that will give you eye strain

Don’t wear glasses with an old prescription. For maximum comfort, ask your eye doctor about custom computer eyeglasses.

Eye strain can be caused by excessive lighting. Overhead lighting should be no brighter than your screen.

Avoid "turtling" – sitting with your back rounded, chin jutting forward and head tilted back – to get closer to your screen. If you can’t see your screen clearly with good posture, visit an eye doctor.

Old monitors and low-resolution screens are hard on the eyes. Upgrade to a high-resolution flat panel display for less eye fatigue.

Sitting too close to the screen can cause eye fatigue and blurred vision.

Having your mouse too far away will make you lean closer to your screen, increasing focusing strain.

Are you sitting in a bad chair? Your back should be supported so you can sit upright and at a comfortable viewing distance from your screen.
Other Quick Tips:

**Get an eye exam:**
Your eye doctor can identify vision problems and prescribe special computer glasses for greater viewing comfort.

**Avoid "computer stare":**
It’s easy to forget to blink when looking at a computer screen. Remember to blink often and fully to keep your eyes moist and comfortable.

**The “20x4” (20-20-20-20) rule:**
Keep your eyes at least 20 inches from your screen and take a 20-second break every 20 minutes to look at something at least 20 feet away.
Optometric Practitioner Tips

- Determine optimal refractive errors
  - Smaller refractive errors may have more of an impact on patients with digital eyestrain
  - Monitor uncorrected hyperopia
  - Monitor uncorrected astigmatism

The effects of induced oblique astigmatism on symptoms and reading performance while viewing a computer screen


The presence of induced astigmatism produced a significant increase in post task symptoms...the correction of small astigmatic refractive errors may be important in optimizing patient comfort during computer operation
Optometric Practitioner Tips

- Rule out accommodative and binocular vision disorders

- Consider lens options that best suit patients need
  - "prism isn't poison"
  - Bifocal
  - PAL
  - Consider need for multiple spectacle Rxs

- Educate parents on ALL treatment options
Device Advice
Parent Education
E-reading has the potential to significantly change the nature of reading for children and families, but its impact is still unknown.

Twenty to twenty-nine percent of young children (age 8 or under) live in a home with an e-reader (Common Sense Media, 2013; Wartella, Rideout, Lauricella, & Connell, 2013; Rideout, 2014), and forty to fifty-five percent have a tablet device at home (Wartella, Rideout, Lauricella, & Connell, 2013; Rideout, 2014). Many young children have read books electronically (Common Sense Media, 2013; Wartella, Rideout, Lauricella, & Connell, 2013). Among older children, nearly half (46%) have read an e-book (Scholastic, 2013). But children still spend much more time with print than e-books (:29 vs. :05, according to the Cooney Center's 2014 study). There are so many different types of ebooks and variations in how they may be used that it's not yet possible to know how this trend ultimately will affect children's reading.
The Three C’s of media use:

- **Consumption** - to take in or use media passively without contributing
- **Creation** - To produce and distribute something in a way that requires active engagement, acquired skills, and complex problem solving
- **Communication** - to use media to connect with another person

“After reading these sections no parent will be able to say they don’t have reason to limit their child’s media consumption and communication between 1-2 hours per day”
Advice to Parents who complain to their optometrist and ask about limiting media consumption and communication

- Common Sense
- Flexibility
- Awareness
- Develop a plan/rules
  - Communicate these rules to your children
  - Enforce your rules
- Develop some alternatives to media use
Advice to Parents who complain to their optometrist and ask about limiting media consumption and communication

- **Media Tracking**
  - Media consumption extends far beyond TV
  - Cell phones and tablets allow children to play games and watch videos ANYWHERE

  “Start by making a list of your media devices and your children’s. Track your children’s media use by device. You will be surprised how quickly it adds up”
Media Creation

- Play through technology is the way children learn to use technology.

“The goal for parents is to use media CREATION to both inspire and prepare children for 21st-century skills.”

- All combined research revealed that children are able to naturally regulate themselves when it come to media creation.
NOT Creation
<table>
<thead>
<tr>
<th>Media Creation</th>
<th>Media Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blogging</td>
<td>Texting</td>
</tr>
<tr>
<td>Power point presentation</td>
<td>Surfing the web</td>
</tr>
<tr>
<td>Making videos</td>
<td>Social media</td>
</tr>
<tr>
<td>Creating animation</td>
<td></td>
</tr>
<tr>
<td>Learning touch typing</td>
<td></td>
</tr>
<tr>
<td>Learning apps</td>
<td></td>
</tr>
<tr>
<td>(reading and math, etc.)</td>
<td></td>
</tr>
</tbody>
</table>
Device advice

- New England Journal of medicine 2008 - \( \frac{1}{4} \) preschoolers are obese
  - 1/3 of children overweight in kindergarten were obese in 8\(^{th}\) grade
- Too much screen time is part of the obesity epidemic
- Media has positive and negative forces

Children need a moderate diet of food as well as a moderate media diet
Family challenges

- "Swap Out"
  - Swap out 30 minutes of media consumption or communication for a non-media activity (sports, board games, face to face conversation etc.)

- Cell phone STOP station
  - Leave phones in this area
  - Determine times that they can be used

- Media Time Out
  - Pick a block of extended time with no media use

- Reading Challenge
  - Determine a 24 hour age appropriate reading goal for every member of the family

- Keep media out of children’s bedrooms
Technology Advice to Help Prevent Eyestrain:

Our #1 Rule! Every 20 minutes, take a 20 second break and look 20 feet away.

- Choose a comfortable, supportive chair so that the child’s feet are on the ground
- Limit leisure screen time to 2 hours/day. Media extends far beyond TV. Cell phones are tablets allow children to play games and watch videos anywhere.
  - Track Your Media: Start by making a list of you and your children’s media devices. Track their media use by device. You will be surprised how quickly it adds up.
- Take notice if children are squinting or rubbing their eyes
- Remind children to blink more regularly
- Check for glare and reflections on the screen
- Adjust lighting
- **Remember that kids do not have awareness of the time they spend on many media devices**
<table>
<thead>
<tr>
<th>Pre-School/Kindergarten</th>
<th>Elementary</th>
<th>Middle/High School</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2 hours or fewer</td>
<td>-Cell phones- quick tasks only!</td>
<td>-Place screen 20-28 in from child's eyes</td>
</tr>
<tr>
<td>-Increase font size</td>
<td>-Take frequent breaks</td>
<td>-Align top of screen at eye level</td>
</tr>
<tr>
<td></td>
<td>-Hold device equivalent distance to child's forearm</td>
<td>-Use phones for texting, not reading articles or documents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Breaks every hour</td>
</tr>
</tbody>
</table>

Advice to Parents:

- Develop a plan/rules, communicate these rules and enforce them!
- Develop some alternatives to media use
  - "Swap Out"- Swap out 30 minutes of media consumption for a non-media activity (sports, board games, face to face conversation, etc.)
  - Cell phone STOP station- leave phones in this area, determine times that they can be used
  - Media Time Out- Pick a block of extended time with no media use
  - Reading Challenge- Determine a 24 hour age appropriate reading goal for every member of the family
  - Keep media out of children's bedrooms
Some final thoughts.....

THE LEARNING HABIT

A Groundbreaking Approach to Homework and Parenting That Helps Our Children Succeed in School and Life

Stephanie Donaldson-Pressman • Rebecca Jackson • Dr. Robert M. Pressman
The omnipresent power of the cell phone

I can’t think of another single device that changed the family dynamics of our home, and the relationship I’ve enjoyed with my son, as much as the smartphone. Our cell phone rules and experiences have been fluid. They started with the basics: passwords (we have always required them), parental controls (installed on his phone), and time limits. They have changed over the years, as we—as a family—have changed.

I’m much more careful about my own cell phone use since my son got his. I try harder to be fully present when I’m with him, because that’s the behavior I want to encourage. I leave my phone at home, just to show that I can, and I feel better when I do. (Sometimes, I just take the pictures in my mind.)

Here are a few things I’ve learned along the way:

- I made my child wait until he was 14 to get a smartphone. I wish I had waited longer.
- That phone will become the most important thing in your child’s life. Be prepared for it.
- Your child will walk around staring at their phone. They will seem distracted and irritated when they can’t look at it.
- Your child now has another way of communicating with their friends, people they like, people they don’t like, and you. Be prepared for a breakdown in verbal communication with you.
- When given a choice, they will send you a text rather than call. Have rules about calling—it’s important that they don’t forget how!
- “Quality time” with your child will never be the same. If they own a phone, they are multitasking. It’s a new and strange feeling to constantly share your child, even when they are with you.

- The way they experience the world will forever be changed. The first time you catch them staring into their phone at a concert while videotaping it, you’ll understand. Stress the importance of being fully present at their lives.
- As hard as you try, you can’t place digital limits on communication—Snapchat and Twitter messages are just a few sites that allow children to get around parental texting limits. You’ll have to monitor this, and it will make you feel uncomfortable to do that. You’ll get over it and so will your kids, but your relationship with them will never be quite the same.
- You can control how your child uses their phone—in your presence—with clear rules. Don’t give up that power.
- You can control where and when your child can use their cell phone in your house, by establishing clear rules. Don’t give up that power.
- Your child will wake up exhausted if you let them take a cell phone into their room at night . . . so don’t.
- Your child’s grades will start to decrease if they don’t turn the cell phone off during homework time.
- Explain to your child that digital footprints last forever.* Talk to them about respecting their body and those of other people. Have a clear plan about what will happen if your child uses the phone for sexting, bullying, taking or receiving naked pictures, and posting destructive content online. Make sure they know the plan, make sure you follow through the second it happens . . . for sure: Something, at some point, will happen.

* Except when they don’t— Wickr and other apps claim that they delete messages after a specified length of time.
Lecture Goals

- Discuss digital media use and its effect on vision
- Discuss how we diagnose these issues
- Discuss how we treat these issues
- Develop “Device Advice”
  - How do we respond to the questions our parents and patients ask
Thank you!!

Valerie M. Kattouf O.D., F.A.A.O., F.C.O.V.D
Associate Professor, Illinois College of Optometry
312-949-7279
vkattouf@ico.edu