**The Impact of 3-D Vision in our High Tech World**

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**3-D Vision**
- Optometry’s unique opportunity in early detection of visual problems
- Use of 3-D technology in entertainment and education
- Public visual health awareness

**Visual skills needed to see in 3-D?**
- You need two well-functioning eyes with clear vision in each
- You need to have mastered the task of focusing on objects near & far
- You need to develop the ability to coordinate eye movements
- You need to “fuse” the different images coming from each eye into one 3D perception

**Early detection**
- Amblyopia
- Refractive error
- Binocularity dysfunction
- Accommodative dysfunction
- Eye movement deficiency
- Visual developmental delays
- Declining school and sports performance

**Amblyopia Correction**
- Glasses or Contacts
- Patching
  - Traditional
  - Eye drops
- Vision therapy

**Early detection**
- Result is monocular vision

**LAZY EYE (Amblyopia)**
- One eye dominates the other and vision signals from the non-dominant eye are ignored
- People with amblyopia do not experience stereopsis
- Need diagnosis and treatment as early as possible

Before using 3-D viewing as a risk assessment tool, many children with conditions causing amblyopia went undetected and untreated.
Early detection

- Nearsightedness (myopia)
- Farsightedness (hyperopia)
- Astigmatism (image is blurred no matter where you look)

LACK OF BINOCULAR VISION

- Two eyes not properly aligned
- Strabismus (eye turn) is present
- Inputs from the two eyes not successfully combined in the brain and 3D stereoscopic perception will not occur

Correction of Refractive Error

- Glasses and/or Contact lenses
  - Myopia
  - Hyperopia
  - Astigmatism

Binocular Vision Correction

- Initial correction of amblyopia and/or refractive error
- Vision therapy

In office VT

Eye Coordination Difficulties

- Double vision
- Fatigue
- Avoidance of close work and reading

Eye Coordination Correction

- Vision therapy

Initial correction of amblyopia and/or refractive error

Vision therapy

Avoidance of close up work, such as reading

Quality of the 3D viewing experience compromised
Early detection

- Early detection of amblyopia, refractive error, binocularity, focusing and eye movement problems will also result in...
  - Earlier detection of...
    - Visual developmental delays
    - Learning related visual problems
    - Drop in school and/or sports performance

Correction of Accommodation

- Reading lenses
- Vision therapy

Understanding the 3-D Viewing Experience

- Is it uncomfortable watching 3-D?

3-Ds of Stereoscopic 3-D Viewing

- Dizziness/Nausea:
  - Exaggerates visual motion hypersensitivity (VMH) response, which can cause motion sickness and vergence-accommodation conflict
  - Feeling of dizziness or nausea during or after viewing 3D content

Causes of 3-D Viewing Challenges

- This conflicting sensory information can cause vision-induced motion sickness
3-Ds of Stereoscopic 3-D Viewing

- **Discomfort:**
  Eyes must converge in front of or behind the screen to view 3D images which can potentially create eyestrain and headaches.
  **Sitting at a greater distance from the screen can help relieve strain.**

- **Lack of Depth:**
  A viewer lacking binocular vision simply won’t see 3D. While this doesn’t pose any problem viewing the screen, it serves as a “vision screening” that something is abnormal with the viewer’s binocular vision.

Why don’t people go to the eye doctor?

- 60% of Americans above age 40 say there is NO immediate or perceived reason to go.
- 56% of Americans between ages 18-38 have symptoms related to binocular vision problems.
- Public awareness/education of the 3-D symptoms of 3-D viewing may potentially drive patients to our offices if they experience the symptoms.

Snellen Acuity Chart

- **Poor screening tool** (used for the past 150 yrs)
  - Only 27% sensitive
  - Misses most...
    - Hyperopia
    - Astigmatism
    - Imbalanced refractive error
    - Binocular problems
    - Focusing problems
    - Alignment issues
    - Eye movement problems

3-D Viewing

- **Superior screening tool**
  - 47-94% sensitivity
  - Detects most
    - Refractive error & Imbalances
    - Binocular, Convergence & Accommodative insufficiency
    - Eye Alignment & Movement difficulties

Children’s Vision EXAM Legislation

What 3 states currently have comprehensive children’s vision EXAM laws??

- 2000 KY
- 2007 MO
- 2008 IL
**Why is Seeing 3-D Important?**

- It helps develop efficient reading skills
- It increases participation in classrooms as more schools adopt 3D as teaching tool
- Increasingly utilized in a growing list of professions

**3-D Imagery**

Commonplace experience for every sector of our community

**Entertainment Industry**

- Movies
- HDTV
- Computers
- Gaming systems
- Mobile devices
- Eyewear

**How do 3-D Displays Work?**

**Evolution of 3-D viewing technologies**

1. **Anaglyph**
   - Most basic form of 3-D
   - Utilizes different colored images & filters in front of each eye

2. **Active Shutter**
3. **Passive Polarized**
4. **Glasses Free**
How 3-D Displays Work

- **Passive Polarization**
  - Utilizes images and lenses of opposite polarization in front of each eye
  - Method currently used in most 3-D movies
    - Achieved with special screen filters
    - Most economical

- **Active Shutter**
  - Alternate occlusion of the OD and OS images in sync with the alternating screen images being displayed
  - Sequential “shuttering” occurs at a very high rate of speed (120X/sec.) = Flicker Effect
  - Requires complex timing and expensive glasses
  - Used in most HDTV and home entertainment

3-D Movies

- Illusionary motion picture technology has its roots based in stereoscopic photography
- The film is generally shot using two perspectives which are not too different from each other
- Two sets of films appear as a single image with the help of special glasses

- Beauty and the Beast
- Titanic
- Men in Black III
- The Amazing Spider-Man
- Toy Story 2
- Finding Nemo
- The Amazing Spider-Man

3 C’s of 3-D Movie making

1. Comfortable
2. Consistent
3. Captivating

By Using:
- Coloring
- Lighting
- Shadowing

Rated the top 3D movie of all time
- AVATAR
- Uses 3D as an immersive world, creating an entirely believable and utterly enchanting planet to explore
3-D HDTV

- USA currently has 9 channels dedicated to 3-D
  - ESPN3D sports channel
  - 3net history/action/travel/kids/lifestyle/concerts
  - Xfinity3D movies and programs on-demand
  - 3D dedicated on-demand DirectTV channel

3-D HDTV

- 3D commercials used as compelling marketing tools
  - New cars
  - New food
  - New soda
  - New technology
  - New services

Consumers react more positively to the images they see in 3D.

3-D Computers

- 3D gaming
- Blu-ray movies

Future see-through 3-D computers

3-D Gaming Systems

- PS3
- Voyageur 3D Gaming System
- Nintendo 3DS
- Nvidia 3D Vision system

3-D Mobile Devices

- Glasses-free stereoscopic vision
  - Mobile phones
  - Mobile devices

3-D prescription glasses

- Marchon 3D
- Gunnar Optiks
AOA 2011 American Eye-Q survey

- 53% of parents with children 18 or younger believe 3D viewing is harmful to a child’s vision
- 29% feel very concerned that their child may damage their eyes due to prolonged use of computers or hand-held electronic devices

3-D in the High-Tech Classroom

- Teachers are incorporating 3D imaging, digital devices, and the latest computer applications into their daily curriculum
  - Learn faster
  - Concentrate better
  - Retain better

3-D in the Classroom

- Approximately 40% of children in special education classes have some sort of vision problem that is preventing them from moving into a regular classroom

3-D Classroom Research

- 46% increase in student engagement
- Between 17-25% increase in test scores
  - Increase motivation, attention, participation
  - Decrease behavior problems

3-D Beyond the Classroom

- Sports
- Driving
- Operation of complex machinery
- Performing many fine motor tasks

3-D videos help me learn easier, because I’m a visual learner...in 3D...it’s literally right in front of you.”
8th grade Student, MI

“It helped to see a 3-D view of things. It was easier for me to picture and understand the structure.”
5th Grade Student, CO
Future of 3-D imaging

- Science
- Technology
- Industry
- Military
- Medicine
  - Neurosurgery
  - Eye surgery
  - MRI

3-D Viewing

Tests on viewers watching 3D show an increased level of activity in certain parts of the brain, but a drop in heart-rate.

AOA and 3D@Home Consortium

- Group of more than 50 companies and organizations collaborating together to ensure that the quality of the 3D viewing experience is as high as possible
  - Entertainment companies
  - Consumer electronics and technology
  - 3-D display manufacturers
  - Public health
  - AOA

3-D Benefits – A Public Health Tool

American Optometric Association, along with other vision health professionals, has stated publicly that—
there is NO evidence that viewing or attempting to view 3D images will harm a child’s eyes

For an estimated 1 in 4 children, and millions of adults—
difficulties with 3D viewing can unmask undiagnosed deficiencies & lead to treatment

3-D as Secondary Prevention Tool

- Vision screening performed on ASYMPTOMATIC populations
  - Uncover vision problems BEFORE people have symptoms or even realize that they have a problem
  - 20% of those who view 3D content have “3D vision syndrome”
  - Children AND Adults

Optometry’s Role

- Ask ALL patients (young AND old) about 3-D visual complaints with movie, TV, games, etc.
  - Case history
  - VA’s
  - Refractive error
Optometry’s Role

- Binocularity testing
  - Distance and near stereo
  - Amps
  - NPC
  - CT
  - Vergences
  - Oculomotor assessment

Optometry’s Role

- Diagnose and treat early!!
  - Amblyopia
  - Refractive error
  - Binocularity
  - Alignment
  - Accommodation
  - Muscle imbalance

Vision Therapy

What is Vision Therapy?

An individualized and progressive treatment program consisting of visual procedures to improve the deficient visual skills.

Understanding the 3-D Viewing Experience

4-Ds of 3-D viewing

1. Dizziness
2. Discomfort
3. Lack of 3-D
4. See your DOCTOR of Optometry

Additional 3-D information

AOA.org/3D
3D Practice Kit from AOA
3Deyehealth.org
Vision3D.com

THANK YOU!!

Any questions??

It’s been a pleasure being here...have a blessed day!!