THE DOUBLE VISION DILEMMA

Solving The Binocular Vision Pandemic

Tod R Davis, OD, FCOVD
Developmental Optometrist
WELCOME !!
THANK YOU FOR BEING HERE

15 % or more of the population cannot view 3-D
AGENDA

W hat is VISION? Basic information from medicine, neuroscience, and optometry.

H ow VISION develops and clinical significance

T he impact of VISION deficits on our *families*, society.

Dedication to A M Skeffington, OD FAAO

First Director of Education, AOA

Developed model of vision as dual spatial information processing system (anticipated “Magno / Parvocellular”)

Established OEP 1928. Largest CE provider in US excluding optometry schools. Large growth recently.
What is Vision?

Let’s Ask The Experts ......
What is Vision?

VISION IS MORE THAN “20/20”

“20/20” clarity at 20 feet

BUT most classroom learning occurs at about 20 inches.
What is Vision?

"Sight is what our eyes see. Vision is what our mind understands what we see."

Ricki G. Robinson, MD, MPH, Clinical Professor of Pediatrics, USC
What is Vision?

“Vision is the primary medium of thought.”

Rudolph Arnheim, PhD
Psychology of Art, Harvard University

Visual Thinking, p. 18
What is Vision?

“It is a terrible thing to see and have no VISION”

Helen Keller
1880 - 1968
What Is Vision?

Vision Is Our **Dominant** Sense

“The brain receives about 3 million bits of information every moment, & 2 million of these process vision”.

V. S. Ramachandran MD, PhD
What Is Vision?

“Vision is the key to a child’s whole development...”

Vision: It’s Development in Infant and Child

By Arnold Gesell, M.D.
What Is Vision?

“When we open our eyes each morning, it is upon a world we have spent a lifetime learning to see.”

An Anthropologist on Mars,

Oliver Sachs, MD
Vision Development

“Acquiring a functional visual system is a developmental process.”

Autism Solutions

Ricki G. Robinson, MD, MPH,
Clinical Professor of Pediatrics USC (CA)
Vision Development

Developmental Vision Clinical Model

We regard developmental immaturity (delay) as the basis of most vision problems. (non-pathological)
Vision Development

Developmental Vision Clinical Model

Evaluating and treating the visual system based on predictable developmental sequences.
Vision Development

Developmental Sequence

From Primitive Reflexes

To Gross Motor Skills

To Oculomotor Skills
Vision Development

Full development of fine motor including oculomotor control occurs after and depends on coordinated gross motor skills.

And

Full development of gross motor skills depends on earlier primitive reflex integration.
Binocular vision is a fine motor control system similar to eye-hand and speech.

Speech problems strongly associated with oculomotor control problems.

Parallels Between Auditory & Visual Processing

Leonard J. Press, OD
Vision Development

Later voluntary movement (Gross & Fine Motor) depends on involuntary movements of PRIMITIVE (EARLY) REFLEXES.

PRIMITIVE REFLEXES develop in utero, are directed from the brain stem, and are integrated from 6 months to 3 years.
Vision Development

The Origin Of Intelligence In The Child, Piaget (1953)

Highlighted importance of primitive reflexes in both motor and cognitive development.
Children with specific reading difficulties have problems that extend beyond...underlying language-related deficits. We investigated the role of persistent primary reflexes in disrupting...reading skills.
Vision Development

Prevalence Of Persistent Primary (Primitive) Reflexes And Motor Problems In Children With Reading Difficulties.

Dyslexia 10/4:316-338
Vision Development

“The first ABC a child learns is the *ABC of the body*, the foundation on which *cognitive learning* is built and the *mode through which it is expressed.*”

*ABC, Goddard Blythe, page 4*
The most striking finding ..the group of clumsy children diagnosed solely on the basis of motor difficulties, were significantly less sensitive...on all three tasks of visual sensitivity.

These results support the existence of generalised visual anomalies associated with impairments of cerebellar function.
Vision Development

Developmental Sequence

*From* MOUTH

to HANDS

to OCULO-MOTOR CONTROL
Vision Development

Cognitive And Motor Development

Is Underpinned By

Visual Processing & Fine Manual Control

In Typically Developing Children 4–11 Yrs

Deborah Ely Budding, Ph.D.
American Board of Pediatric Neuropsychology
©2011 The British Psychological Society 31 MAR 2011
Vision Development

CHILD’S DRAWINGS PREDICT LATER INTELLIGENCE

7,752 pairs of twins drew a picture of a child, scored by the number of body features (Draw-A-Child test).

There exists a moderately strong link between higher drawing scores and later intelligence test results.
Vision Development

“Vision is the brain’s way of touching the world”

Merleau-Ponty, 1964

Concepts of reach, grasp, and release.
Vision Development

“If I can't picture it, I can't understand it.”
Vision Development

Developmental Sequence

From NEAR SPACE to FAR SPACE

And The Effects Of Crowding
Vision Development
Developmental Sequence

Body position or “orientation” to judging distances.

“Depth perception”
Vision Development
Developmental Sequence

Relating An Object To
Surrounding Objects

“Spatial Relationships”
Or “3-D”
What is this?
What Causes Vision Problems?

BIRTH HISTORY:

Pregnancy and/or birth complications
Prematurity (<36 wks)
Birth weight (< 5 lbs)
Adoption
What Causes Vision Problems?

**MEDICAL HISTORY:**

- **Trauma,** especially head injuries
- **Genetic problems**
- **Serious illnesses** including *persistent* ear infections
What Causes vision problems?

DEVELOPMENTAL HISTORY:

- **P**oor crawling / creeping
- **L**ate or early walking
- **D**ifficulty learning to run or ride a bike
What Causes Vision Problems?

Stress from *Long-term near work*, including computers and devices.

*Poor nutrition* including Vitamin D deficiencies
Kids Haven’t Changed; Kindergarten Has

New data support a return to “balance”
in kindergarten

Harvard Education Letter. Vol 26, # 5
September/October 2010
Impact of Vision Problems
“life-altering”
Impact of Vision Problems
“life-altering”

3-D Movies
15% of population can’t view 3-D

www.3deyehealth.org
AOA site on 3-D
Impact of Vision Problems

“life-altering”

“25% of all school children in the U.S. have a vision problem significant enough to affect learning.”

Vision and Learning,
American Foundation for Vision Awareness.
June 1, 2002,

Bureau of the Census,
Washington, DC.
Impact of vision problems “life-altering”

Learning-Related Vision Problems
Education and Evaluation

National PTA resolution
June 1999
Impact of Vision Problems
“life-altering”

"Problems related to vision are among the most overlooked explanations for ADHD symptoms. “

Richard Saul, MD
Impact of Vision Problems “life-altering”

Developmental Dyslexia And Vision
JOURNAL OF CLINICAL OPHTHALMOLOGY
14 May 2013

“Dyslexia...represents a significant public health problem. Its etiology is unknown.

Numerous scientific studies have documented the presence of eye movement anomalies and deficits of visual perception...in dyslexics.”
Impact of Vision Problems “life-altering”

“Visual treatments can enhance..reading development for people with severe eye movement control problems. The appropriate specialist.... is a developmental optometrist.”

The Dyslexic Advantage, Pg 180
Brock Eide, MD
Impact of vision problems "life-altering"

Mental Illness In Young Adults Who Had Strabismus As Children

Children with exotropia strabismus, 3.1 times chance of mental health problems as adults.

Journal of Pediatrics
2008 Nov. 122 (5): 1033-1038
Oculomotor abnormalities may play a role...at the root of impairments in later developing functional systems, ultimately resulting in socio-communicative deficits.

Eye Movement and Abnormalities in Autism?
Laurie A. Brenner Æ Katherine C. Turner Æ Ralph-Axel Müller
Convergence Insufficiency

Inability to converge both eyes accurately and sustain for near work.
Convergence Insufficiency

CITT  Convergence Insufficiency Treatment Trial

Massive research effort > 10 years

6.1 million funded by NEI

Multicenter; Mayo, Bascom Palmer, and 6 Optometry colleges.

Masked, placebo-controlled, randomized clinical trial of eligible children 9 to 18 years of age.

Archives Ophthalmology VOL 123, 1/2005
Convergence Insufficiency

INCIDENCE

About 8% of population, or 1 in 12

Affects over 21 million in US alone

More common than glaucoma in children
Glaucoma in children 1 in 43,575

More common than amblyopia in children
Amblyopia in children 1 in 50
Research found that children with CI reported the following symptoms “fairly often” or “always” while reading or doing close work.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss Of Place</td>
<td>50%</td>
</tr>
<tr>
<td>Loss Of Concentration</td>
<td>45%</td>
</tr>
<tr>
<td>Words Blurring</td>
<td>36%</td>
</tr>
<tr>
<td>Double Vision</td>
<td>32%</td>
</tr>
<tr>
<td>Headache</td>
<td>32%</td>
</tr>
<tr>
<td>Eyes Feel Sore</td>
<td>21%</td>
</tr>
</tbody>
</table>
Symptoms/Signs of CI

Performance-related symptoms such as *loss of place, loss of concentration* occur more often than eye-related symptoms such as *headache, sore eyes*. 
Symptoms/Signs of CI

Second most common symptom was loss of concentration, almost 50% reported this symptom fairly often or always.

Strong connection with ADHD-like symptoms.
Symptoms/Signs of CI

The Relationship between Convergence Insufficiency (CI) and ADHD

3-fold incidence of ADHD with presence of convergence insufficiency

David B. Granet, MD FACS FAAO FAAP, Cintia F. Gomi, MD, Ricardo Ventura, MD, and Andrea Miller-Scholte, CO Ratner Children’s Eye Center, Department of Ophthalmology, University of California, San Diego, CA, USA
Symptoms/Signs of CI

Skips lines
Uses finger past 2\textsuperscript{nd} grade.
Symptoms/Signs of CI

King-Devick Test
Evaluating Saccadic Eye Movements
Symptoms/Signs of CI

DOUBLE VISION
Words appear to run together, move.
Symptoms/Signs of CI

DOUBLE VISION

This is a demonstration of what it is like to see print the way someone with double vision would see it.
Symptoms/Signs of CI

Not Autistic or Hyperactive. Just Seeing Double at Times

LAURA NOVAK
New York Times
September 11, 2007
Symptoms/Signs of CI

Headaches, especially after near work.
Symptoms/Signs of CI

*Kids' eye problems often emerge in homework battle*

Lauran Neergaard

*The Associated Press Medical Writer*
Diagnosing CI

Even though

CI affects many people of all ages

Impact on lives is extensive

Extensive research demonstrates that treatment is effective and permanent

Can cause behaviors that appear to be ADD/ADHD, reading and learning problems

Routinely missed in vision exams
Diagnosing CI

Why missed in routine exams??

CI patients usually have 20/20.
CI patients rarely complain about their eyes to their parents or eye doctor.
Most CI patients have “quality of life” symptoms which are overlooked in routine exams.
Diagnosing CI

To minimize chair time:

1. 15–item checklist CI Symptom Survey CISS for all school-age children prior to your exam.

2. Measure Near Point Of Convergence (NPC) by you or tech. Time: 1-2 minutes

3. Assess vergence facililty with a 3 BI / 12 BO prism flipper by you or tech. Time: 1-2 minutes
Diagnosing CI

Convergence Insufficiency Symptom Survey (CISS)

Validity and reliability of the revised convergence insufficiency symptom survey in children.

Diagnosing CI

Convergence Insufficiency Symptom Survey (CISS)

Parent or adult patient reports frequency of symptoms, then totals score.

Children (< age 21)

  total score = 16 or higher suggestive of CI

Adults  total score = 21 or higher suggestive of CI
Diagnosing CI

Vergence Facility
Diagnosing CI

Vergence Facility

3 Base In / 12 Base Out prism flippers
(Call Bernell, approx. $25.00)

Hold a 20/30 test card at 14 to 16 inches

15 cycles per minute (one cycle is BI then BO),
letters always clear and single.

When CI present, BO more difficult:
blur, double vision, and/or facial stress.
Diagnosing CI

Near Point Of Convergence

Present a penlight or transilluminator as a target at the patient’s midline, slightly below eye level, about 1 ½ feet away.

Aim light at patient’s forehead, not directly into patient’s eyes.
Diagnosing CI

Near Point Of Convergence

“I am going to slowly move the penlight towards your face and tell me when you see two lights.”

While slowly moving the penlight inward, note when one eye turns out, the convergence break point.

The patient may not see 2 if suppression present, or has poor observation skills.
Diagnosing CI

Near Point Of Convergence

The penlight is now moved slowly away from the nose until convergence re-establishes, the *convergence recovery point*. The patient may report seeing one light again.
Diagnosing CI

Nearpoint of Convergence: Test Procedure, Target Selection, and Normative Data

MITCHELL SCHEIMAN, OD, FAAO, MICHAEL GALLAWAY, OD, FAAO, KELLY A. FRANTZ, OD, FAAO, ROBERT J. PETERS, OD, FAAO, STANLEY HATCH, OD, FAAO, MADALYN CUFF, OD, and G. LYNN MITCHELL, MAS, FAAO

Optom Vis Sci 2003;80:214–225

Results

A clinical cutoff value of 5 cm (2”) for NPC break and 7 cm (3 inches) for NPC recovery with either an accommodative target or a penlight with red and green glasses.
Diagnosing CI

Near Point Of Convergence

Now hold a red lens over one of the patient’s eyes, or have them put on red/green glasses.

Repeat the procedure, break/recovery points with the filter will be more receded compared to no filter if the patient’s convergence is susceptible to fatigue.
Diagnosing CI
Near Point Of Convergence

When break/recovery points are receded, and you suspect double vision, do not ask the child directly if they see double, they could tell you what they think you want to hear.

Ask “how do you make words look OK again when they look funny or smeared?”

If the child sees double while reading, they will clearly state how they clear words by rubbing eyes, changing position of book, etc.
Communicating With Patients & Parents

**Important to communicate the child’s emotional struggle!**

**S**how the double vision demo if child has diplopia. Explain to the parent, “Can you imagine how hard it is to sit through school seeing like this?”

**A**llow the parent to feel the problem using 12 BO prism in front of parent’s eye while looking at print, may need to rotate prism slightly to produce discomfort.

**D**iscuss vision therapy referral.
Vision Therapy Referrals

“Finding a colleague in your area who specializes in (VT) is another important element .... Depending on your diagnosis, you will often need .. subspecialty care....for patients with binocular dysfunction. The majority of that care comes from ... dedicated binocular vision specialists.”

James Thimmons OD,
OPTOMETRY TIMES 12/2010
Vision Therapy Referrals

“When one looks at the services optometrists are uniquely qualified to render, …it only makes sense to direct our patients…to those in the profession who have demonstrated the desire to help. In the case of vision therapy, there are evidence-based protocols to support referrals.”

Paul B. Freeman, O.D.
Editor, Optometry; Journal of AOA
7/2011
Managing Vision Problems
By Developmental Optometrists

SPECIALIZED GLASSES

May include bifocals, prisms

More effective than colored overlays
Managing Vision Problems
By Developmental Optometrists

Optometric Vision Therapy

In-office procedures to effectively treat vision problems.
Managing Vision Problems
By Developmental Optometrists

It is treatment of the visual brain using proven neuroscience techniques such as feedback & visual awareness.
Where’s The Research?

CITT RESULTS

In-office VT plus home treatment: 75% reported fewer and less severe symptoms related to near work

Home-based “vision activities” including pencil push-ups or computer-based programs:

no more effective than a placebo

Prism reading glasses alone:

no more effective than placebo

Subsequent research shows patients long-term success, thus defining the cure for CI with office VT.
A successful or improved outcome after CI treatment was associated with reduced frequency of adverse academic behaviors and parental concern associated with reading and school work as reported by parents.
Where’s The Research?

Behavioral and Emotional Problems Associated With CI in Children: An Open Trial Abstract

Objective: This study investigated behavioral and emotional characteristics of children with convergence insufficiency (CI), before and after treatment with office-based vergence accommodative therapy (OBVAT).

Conclusion: In an open trial, attention and internalizing problems improved significantly following treatment for CI.

Journal of Attention Disorders
Online publication Nov 22, 2013
"Patients with CI usually exhibit an exophoria at near and normal alignment at distance; however, they can also be orthophoric and occasionally even esophoric."

CONCLUSIONS: Symptoms of dry eye were more frequent than binocular anomalies symptoms in post LASIK patients. However clinical procedures revealed that the percentage of patients with binocular (primarily CI) and accommodative anomalies was higher than that of patients with dry eye. Accommodative insufficiency (13.9%) and convergence insufficiency (11.1%) were the most prevalent anomalies.
Where’s The Research?

Study Results Indicate Testing Dry Eye Patients For Binocular Vision Disorders

Association For Research In Vision and Ophthalmology
Erin M. Rueff, OD, et al, OSU School of Optometry

“The researchers found the subjects’ scores on the OCULAR SURFACE DISEASE INDEX (OSDI) and the CONVERGENCE INSUFFICIENCY SYMPTOM SURVEY (CISS) to be positively correlated”

“The results suggest that clinically we should be testing our dry eye patients for binocular vision disorders as well”
What Is Vision Therapy?

From 2-D to 3-D Sight: How A Scientist Learned to See

Review of FIXING MY GAZE
Scientific American
August 4, 2009

Result of a primary care optometrist referral to a VT OD
What is vision therapy?

"Barry benefited from orthoptics — a hidden corner of restorative medicine.

With contrived ocular exercises, specially trained optometrists treat patients whose eyes are cosmetically aligned but imperfectly foveated.”

New England Journal of Medicine
Review of FIXING MY GAZE
July 2, 2009
What is vision therapy?

“Several visual scientists have now demonstrated the reversibility of infantile loss of vision & stereopsis, but blindness to these findings and under appreciation of the solutions offered by orthoptics still persist.”

New England Journal Of Medicine
Review of FIXING MY GAZE
July 2, 2009
What Is Vision Therapy?

"Related to vision therapy is the relatively unknown field of behavioral optometry, which for almost one hundred years has understood that vision is a group of skills that can be trained. The field relies on neuroplasticity."
What Is Vision Therapy?

The neurobiologist Dr. Susan Barry spent 50 years with 2-D vision...

With neuroplasticity-based training from her behavioral optometrist, Barry reawakened her visual cortex and finally experienced 3-D, as she described in Fixing My Gaze.”
What Is Vision Therapy?

Older Children Can Benefit From Treatment For Childhood's Most Common Eye Disorder

Results from a nationwide clinical trial... Many children *ages 7 through 17 with amblyopia (lazy eye)* may benefit from treatments that are more commonly used on younger children.

National Eye Institute  April 11, 2005
What Is Vision Therapy?

“..poor visual-perceptual processing is one of the many characteristics of autism... Indeed, children with challenges in visual-spatial thinking are lost in space. **Optometrists can help both in diagnosis of ASD..as well as in treatment.***

Ricki G. Robinson, MD, MPH,
Clinical Professor of Pediatrics, USC
What Is Vision Therapy?

“The conclusions, particularly the failure to recommend optometric vision therapy for children likely to benefit, are based on the exclusion of the most relevant data…”

Joseph Manley, MD
Medical-legal Expert Witness

Commenting on
ACADEMY OF PEDIATRICS
Report On Learning Disabilities, Dyslexia & Vision
March 1, 2011
What Is Vision Therapy?

“They fail to acknowledge abundant published and anecdotal evidence supporting vision therapy.
This...includes controlled trials, case reports, and consensus of experts – the same kinds of data that underpin the daily practice of medical professionals.”

Joseph Manley, MD
What Is Vision Therapy?

The Number of Placebo Controlled, Double Blind, Prospective, and Randomized Strabismus Surgery Outcome Clinical Trials: None!

Dominick M. Maino, OD, MEd, FAAO, FCOVD-A
Editor, Optom Vis Dev 2011;42(3):134-136.
THANK YOU FOR YOUR UNDIVIDED ATTENTION
Tod R Davis, OD, FCOVD
Developmental Optometrist
www.virginiavisiontherapycenters.com
Springfield, Gainesville, Winchester, Fredericksburg

QUESTIONS?