Clinical Case
- 17 year old recently completed vision therapy for Convergence Insufficiency still noting decreased reading speed and comprehension.
- All visual efficiency data within normal limits.
- No vertical or horizontal deviation.
- Parent and patient interested in Visual Information Processing Assessment.

Clinical Case
- Results of VIP assessment indicate deficiencies in figure-ground and visual processing speed.
- Underwent course of vision therapy and improved in further testing which translated to improved ability in school.

What is Visual Information Processing?
- It involves higher brain functions Non-motor visual perception and cognition and their integration with motor, auditory, language, and attention systems (from the AOA CPG 20).
- It is different than visual efficiency, which relates to visual acuity, accommodation, vergence, stereo-acuity, refractive errors, EOM function, etc.

Vision and Learning
- We are NOT talking about Learning Disabilities.
- The Individuals with Disabilities Education Act (IDEA) includes a definition of "specific learning disability" —as follows:
  - (i) General. Specific learning disability means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations, including conditions such as perceptual disorders, brain injury, behavioral/attentional dysfunctions, and developmental aphasia.
- A child with a learning disability may have trouble processing visual information in addition to their learning disability.
- Children without a learning disability can also have trouble visually processing information.
How is vision and learning linked?

- Visual efficiency problems can be a barrier to a child reaching their full educational potential.
- Amblyopia
- Strabismus
- Accommodative Dysfunction
- Ocular health
- Any efficiency problem need to be diagnosed and treated prior to testing for processing difficulties.

What is the cause of these complaints?

- Visual efficiency problems
- ADHD
- Learning Disability
- Dyslexia
- Visual Information Processing deficits

Our job is to figure out if vision is a cause and at what level.

Optometric management alone will not be able to "fix" all of these problems.

What can poor visual processing affect in school?

- Reading
- Spelling
- Math
- Hand writing

What complaints can kids have?

- Similar complaints that we get on a daily basis:
  - Trouble reading for long periods of time
  - Looses place while reading
  - Slow reader
  - Lack of comprehension
  - Not doing well in school
  - Not reaching potential
  - Teacher noticing problems

- Slightly different complaints as well:
  - Reverses letters and words
  - Unable to tell words apart
  - Poor spelling skills
  - Does better with auditory presented information than written
  - More able to answer better orally

What to do before we focus on VIP

- A comprehensive eye exam
- History
- Visual Acuity
- Stereo
- Accommodation
- Vergence
- Cover test
- Binocular vision
- Scotopic sensitivity
-NFL
- Retinoscopy
- Refraction determination
- Ocular health

Extra Information

- Two methods for assessing saccades and pursuits
- ISCO-Oculomotor Test
- http://www.isco.com/biomedical/motor-control-software/isco-integrated-eye-control-software
- ISCO roleing system
What to do before we focus on VIP

- If you perform VIP testing without first properly diagnosing visual efficiency deficits the testing may be invalid or misleading.
- If a child is diagnosed with a visual efficiency problem, (refractive error, CI, amblyopia, etc.) treat that first then proceed to VIP testing.

How is vision and learning linked?

- With Visual Information Processing there are four broad categories that are linked to learning.
  - Visual Analysis Skills
  - Visual-Motor Integration Skills
  - Visual Spatial Skills
  - Visual Attention

Visual Analysis Skills

- These are skills in which visual information is encoded, recognized and/or manipulated.
- Poor visual analysis skills impact the child’s ability to recognize words, ability to work at a comparable speed as classmates, incomplete work, poor spelling.
- These skills incorporate:
  - Form perception
  - Visualization
  - Visual-memory

Visual Analysis Skills: Form Perception

- Visual discrimination
  - Recognize familiar faces, toys, objects. Recognize letters and numbers and eventually words.
- Visual figure ground
  - Ability to attend to a specific feature in the visual array and ignore the rest. The ability to shift focus.
- Visual closure
  - Awareness of closure is the visual ability that allows determination of a shape or figure that is implied without the necessity of all the detail being present.
  - Form constancy
  - Recognition that form is the same in various environments, positions, sizes.

Position in Space (DTVP)

- Form constancy
- Figure ground (DTVP)

Visual closure (DTVP)

- Form constancy

Form Constancy

- Form constancy

Visual analysis skills: Visualization

- Ability to “picture” people, ideas, and objects even when the objects are not physically present.
- Developmentally first able to picture objects making certain sounds or forming by taste or touch.
- Ability to picture what words say (visual-verbal matching foundation for reading comprehension and spelling).
Visual analysis skills: Visual memory
- Ability to recall visually presented material
- Three levels:
  - Sensory information store (mediated memory): held less than one second
  - Short-term memory: immediate memory. Information retained for several seconds after being encoded or attended to
  - Long-term memory: permanent recode of objects, events, mental knowledge. No active rehearsal necessary (limited storage capacity)

Visual Motor Skills: Visual Motor Integration
- Ability to coordinate visual information processing skills with motor skills
- Optometry evaluates ability to integrate form-perception skills with the fine motor system in order to reproduce complex visual patterns

Copying (DTVP)

Visual-spatial skills
- Ability to understand directional concepts that organize external visual space
- Understand concepts of up/down, front/back, right/left related to one's body and to objects in space

Visual-spatial skills: Laterality/directionality
- Specific developmental sequence of knowledge of right/left using verbal labels
- Laterality – Awareness of right and left sides of body
- Directionality – Ability to use directions to understand and organize external visual space

Visual attention
- Selection of visual input
- Alertness
- Ready state needed for active learning
- Selective attention
- Choose relevant visual info while ignoring less relevant info
- Visual vigilance
- Maintaining conscious mental effort to persist at visual task
- Divided attention
- Ability to respond to two simultaneous tasks (one automatic while visually monitoring another task)

How is vision and learning linked?
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So now what do we do?
- Now we find tests that will measure each area and provide reliable information on the skill levels of our patients
- Many different tests can be performed but one commonality is that they are standardized
Standardized tests
- Provide "standard" instructions and directions - tester needs to read directly from test material
- Provide objective measurement of patient's ability
- Scoring is based upon normative data and the method of scoring is "standardized" as it is a set of scores and parameters which can be compared to other children the patient's age, year and month

Standard Battery of Tests for IUSO
This is built upon the fact that the patient had a comprehensive eye examination within the last year
- Detailed history/discussion with parent and patient
- Abbreviated sensory motor exam
- VIP testing
- Scoring - Parent Conference & Report - Therapy

Parent Discussion
- Information needed in addition to typical history
- Ask about:
  - Apparent deficiencies in school
  - Apparent strengths in school
  - Psycho-education testing
  - Teacher reports
  - Review of work, (care tell parents to bring in samples of school work for the assessment)
  - Parent, goals and patient's goals
  - Talk to both parent and child

Sensory Motor Examination
- Abbreviated sensory motor exam
  - Accommodation
  - Vergence
  - Cover test, especially vertical
  - Sensory fusion

Designing Core Battery of Tests
- Will need tests to evaluate each major area of visual processing
- Will need tests that are age appropriate
- Will need ancillary tests that are dependent upon individual patient needs

Core Battery of Test for IUSO
- Developmental Test of Visual Perception-2 (DTVP-2)
- DTVP Adult and Adolescent version for older kids
- Woodcock Johnson-III (WCJ-III) subtests
- Learning Efficiency Test-II (LET-II) or TVPS Memory subtests
- Developmental Eye Movement Test
- Visagraph
- WOLD
- Children's Color Trails test - newer test to the core battery

Ancillary Tests
- Standing Angels in the snow
- Jordan Left Right reversal test
- Raget test of right/left concepts
- Matching familiar Figures Test
- TVPS Memory Subtest
- The Dyslexia Screener

Developmental Test of Visual Perception-2 (DTVP-2)
- Visual analysis skills:
  - Visual analysis skills (motor reduced)
  - Visual-motor integration skills
- Two versions:
  - 60-subtest version (ages 4-11-11 subtests)
  - 30-subtest version (ages 3-10 and up 6 subtests)

DTVP-2
- Motor-reduced subtests:
  - Position in space
  - Figure ground
  - Visual closure
  - Form constancy
  - Visual-motor integration subtests:
  - Spatial orientation
  - Coloring
  - Spacial relations
  - Visual-motor speed
Learning Efficiency Test-II (LET-II)
- The test is a quick and reliable measure of the immediate, short-term, and long-term recall of visual and auditory memory.

Visual memory: Subject shown string of letters to remember, then given distracter tasks and asked to recall letters.

Auditory memory: Subject told string of letters to remember.

Woodcock-Johnson-3 (WJ-3)
- Battery of 40 subtests used for psychoeducational testing.
- 4 subtests used:
  - Visual matching (WJ-3)
  - Visual matching (reading speed)
  - Visual matching (reading fluency)
  - Visual matching (reading accuracy)
- 3 subtests used for reading achievement screeners:
  - Letter-word identification
  - Word attack
  - Reading fluency

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Visual processing speed WJ-3
- Automatic information processing that is fast and effortless.

- Visual matching: Subject circles 2 of 6 matching single digit numbers on a line. Progresses to double and triple digit numbers.

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Visual matching (WJ-3)
- Identification of grade level necessary to set Visagraph to appropriate level. Remember the Visagraph tests eye movements, not reading ability.

- 3 subtests of WJ-3 battery used:
  - Letter-word identification
  - Word attack
  - Reading fluency

- Dyslexia screeners may be utilized:
  - DEM (Decoding-Encoding Screener for Dyslexia)
  - DDT (Dyslexia Determination Screener)

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Word Attack WJ-3
- Measures phonemic awareness

- Subject required to “read” nonsense words by relying on unknown phonemic patterns

- Example: mibgus, nat

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Reading fluency WJ-3
- Targets how efficiently one can read simple sentences within a specified time.

- Subject required to respond to yes/no decision making after reading each simple sentence.

- Example: March is the month after June.

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DEM (Developmental Eye Movements)
- Reading single digit numbers presented in both vertical columns and horizontal format.

- Used traditionally to quantify presence of ocular motor dysfunction. Recent study indicates that DEM results do not correlate directly with EM parameters and should not be referred to as an EM test.

- DEM results do correlate with aspects of reading performance and may serve a diagnostic role.

- Ayres, Abel, Fricke, & McBrien, 2009

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Developmental Eye Movement (DEM)

- Tests A, B, and C:
  - Tests A and B (vertical)
    - Subject reads 40 numbers arranged in vertical columns.
    - Tests for rapid automatic naming (RAN-ability to name visual stimuli quickly).
    - Presence of deficits in both RAN and phonologic processing have an additive negative influence on reading performance above and beyond that of a single deficit (Wolf & Bowers, 1999).
  - Test C (horizontal)
    - Subject reads 80 numbers presented in 16 horizontal rows of 5 numbers each.

Adjusted time is calculated with using number of errors.
This subtest may be more closely related to the visual processing and cognitive demands required for reading.

Another test that may be used is King Devick

WOLD Sentence Copy

Four men and a jolly boy came out of the black and pink house quickly to see the bright violet sun, but the sun was hidden behind a cloud.

Children’s Color Trails Test

This test measures visual attention, sequencing and visual processing speed.

Core Battery of Test for IUSO

- Developmental Test of Visual Perception-2 (DTVP-2)
- Woodcock-Johnson-III (WCJ-III) subtests
- Learning Efficiency Test-II (LET-II) or TVPS Memory subtests
- Developmental Eye Movement Test
- Visagraph
- WOLD

Now what do I do with this information

- One can be educated and made aware of this “extension” of optometry.
- One can make referrals to those doctors who have the necessary tests and skills in designing assessments and therapy and co-manage their patients.
- One can purchase tests to use in the office to properly assess this “extension” of optometry.

References

- Scheiman, MS., Rouse, MW. Optometric Management of Learning-Related Vision Problems, 2nd edition [can be ordered through the Optometric Extension Foundation at http://www.oepf.org/]
- Taub, MB., Bartuccio, M., Maino, DM. Visual Diagnosis and Care of the Patient with Special Needs.

Sites for tests

- Children’s Color Trails Test – newer test to the core battery
- DTVP-2
  - http://portal.wpspublish.com/portal/page?_pageid=53,69628&_dad=portal&_schema=PORTAL
- DEM
  - http://www.bernell.com/
- WOLD
  - http://www.bernell.com/
Please complete your session evaluation using [EyeMAP online at][1] http://eyemap.cistems.net

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