Vision Skills & Autism Spectrum Disorder

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VISION AND AUTISM

- Objective evaluation of refraction
- Tracking eye movements/eye contact
- Binocular vision
- Visual spatial processing
- Central/peripheral processing
- Why stims?
- Intervention

IN THE BEGINNING

- Augmentative comm work
- TBI motion sensitivity BIT
- Giant steps Montreal/ St. Louis
- Eval with OT/PT/SPL
- 3 month documented
- Soaring Eagles DIR

Visual Processing

- Ability to interpret/sort out/remember make sense of sight input
- Affected by past experience/learning
- Sight evolves into vision through learned experiences
Sight input
Rarely the issue with typical DV but SPN
Differentiate detection/discrimination/recognition
Measure subj or Obj
Refraction significance/sensory/balance/curve
To get to wear!

Visual Input
- Clarity of sight necessary for appreciating visual instruction
- Bring DVD for fixation/puppets
- Sensory input more affected

Motor systems for eye movement
- Fine motor/oculomotor skills to scan
Extra ocular muscles for eye teaming for depth, triad, vergence location
Focus adjustment/clarity identification

TRACKING
Two primary components:
Mechanics & Navigation
- Mechanics refers to fine oculomotor control
- Navigation refers to visual processing/spatial orientation skills to direct spotlight of attention around page
- Poor scanning on page results in loss of place, skipping words or lines, misreading known words

oculomotor
- Fix and track toys
- Flicker/colored lights across midline
- Track patterns (ants)
- Field of choices
- Aug comm fields
- Ball track
- OKN
- GSM

Physical screening
Gross motor versus fine oculomotor
Head/body versus eye
Sit forward deal with posture and gravity
Proprioception support
Thrusting/jaw/blink/under/overshoot/stuck
Sustain visual attention
Peripheral fixations visual attention colors
Peripheral fixations from nose
OKN
Tracking limits
- Head is heavy
- Can’t run and scan with head
- Can’t scan with eyes
- Restricted awareness
- Visual vestibular integration

Eye movement in ASD
- Reduced voluntary pursuits
- Reduced non-cognitive fixations
- Reduced scanning accuracy when tunneling
- Eye gaze detection/significance of

Reading related symptoms of poor tracking
- Loss of place
- Skipping words
- Skipping lines
- Word substitutions
- Misreading known words
- Using finger
- Tracking with head
- Tracking with rulers and windows
- Comprehension better when read to

Demand increases with grade/ DD

Saccades therapy
- Sacc big to small
- Pursuits small to big
- Monoc to binoc
- Predictive to non-predictive
- Low density to high density
- DD head from eyes
- Support against gravity/ less support
- Low cognition to higher cognition
- Biofeedback lights
- Ultimately integration & automaticity/flow*

Diadic and Triadic
- Reciprocal gaze
- Shared gaze
- Pointing
- Lights for therapy
EYE CONTACT

• Challenge of simult perception
• Binoc vision challenge
• Watch mouth for language
• Do not get info from facial expressions
• Do not relate attention and eye contact

Accommodation/blur

• Near point of focus clarity
• Focus facility (flexibility)
• Flipper lens/near far chart
• CP/age/pupil/light/distance
• Meds
• Reading glasses

EYE TEAMING

• Affects depth perception
• Ability to sustain visual attention
• Convergence Insufficiency (ADD)
• Squinting to avoid double vision
• Adjust head posture for eye muscle imbalance

incidence

• General Pop 3-5% incid of strab
• Children 6m -18yrs 25% incid BV disorder
• Children with CP 43% incid strab
• Children with Downes 38% incid strab
• Autism Spectrum Disorder: 21% incid

BINOCULAR VISION

• Stim versus binoc vision problem
• Check straight ahead/chair on wheels/rotate/or chase!
• Reflections and cover test
• Pulls strings at near
• Reaches for 3D
strabismus
- Can be in/out/up/down
- constant/intermittent
- Alternating/unilateral
- Near/far

adaptation
- Easier to constant, versus intermittent
- Large versus small turn
- Effect on sensory motor matching

observe
- Posture
- Horiz head turn
- Vertical head tilt
- Blocks with nose
- Head on arm
- Effect of posture & muscle tone on alignment
- Flexion v extension
- Blinking/winking/closing eye/squinting/clumsy
Brain glue

- Ability of brain to integrate images
- Why some kids depth perception more affected than others?

Convergence insufficiency

- Screen with push ups
- Frontal headaches
- Add
- NIH studies

Visual Spatial Skills

- Visual spatial skills allow a person to develop an awareness of both internal and external space coordinates that are used to organize and interact with the world around them. Awareness about the location of objects in external space as well as orientation of one's self is based upon the understanding of these directional concepts. Linguistic symbols rely on proper orientation relative to a reference point for identification.

Visual spatial skills are HUGE!

- Independent survival!
- All aspects of learning & movement
- From where body p relative to each other
- Where you are in the room
- Where surr objects are rel to each other & to you
- Letter, # & word orientation
- Self versus surround movement
- ADL’s/parietal lobe damage/neglect
- Staying in my spot, reading, looking B&F
- Social skills (body space)
Are we there yet?

- Concepts of distance, time, quantity also affected by sophistication of visual spatial skills
- How many steps to? Inch/mile is so long
- How long is your TV show
- Create familiar/concrete reference units
- NVLD poor visual spatial concepts

SPATIAL ORIENTATION

b d p q

Dyslexia

Test informal

- Dominance
- Angels –x mid
- Labeling
- chair
- Arrow
- bd
- questions

Test Formal

- Piaget age 5-11
- LAD 1-12th grade
- Jordan age 5-12.11
- SASP age 4 to adult
- Visual spatial midline
Treatment
Developmental experiences important to develop internal visual spatial reference mechanisms

- Mental map of body
- Bilaterality
- Laterality
- Directionality
- Distance/ time

3d to 2d
- Child has to establish these concepts well enough in real space to be able to project them onto abstract/one dimensional space on the page
- Advanced scanning relies on fundamental spatial cues for efficiency rather than strategies related only to context
- Higher grades greater demand on effic to get through sheer volume

VISUAL MOTOR

- Fine Motor Dexterity
- Visual Processing
  - Integration

QUESTIONS

- How does your child negotiate stairs?
  - Holds on rail/alternates feet/draggs heels down each stair/does not look as she/he steps, feels edge of stair with back of heel, steps 1:1, rather than alternating?
  - Is there a difference going up versus going down?
  - Does your child enjoy car travel or get sick from car travel?

QUESTIONS (cont.)

- Does your child step carefully around and appear very aware of all objects, or does he stumble over or ignore the objects?
- Will TV or computers hold your child’s attention for at least 20 minutes? Is he show specific?
- Does he enjoy looking at books?
QUESTIONS (cont.)

- Does your child engage in repetitive self “stim” behavior – if so, see solution behaviors list.
- Will your child look at objects directly when reaching for them, or will he use his peripheral (side) vision?
- Does he appear to do a lot of things using peripheral vision?
- Does he appear to not notice objects in front of him?

- Do you ever see an eye turn or drift out of alignment?
- How confidently does your child step off/over objects?
- How well does he manage changes in surface terrain like sudden changes in height or slope?
- Does your child show fear of heights or does he like being high up?
- Will your child look down when walking?

Visual Spatial Attention Switching

- Global Vs Focal processing
- Global/ambient/primitive/reflexive
- Responsible for orientation
- Where am I?
- Focal/central/recognition/identification
- What is it?

Sensory story

- Begins as primarily ambient baby
- Introduction of more focal attention
- Focal spotlight ambient background on curve of attention distribution
- Figure ground/focal ambient balance in constant flux due to in/extrinsic factors

Central/Peripheral

- Focal/central
- Sensitive to detail
- Stationary/slow move
- Sequential process
- ID & recog cognit
- Slower processing
- Later to develop
- Linked to higher Cort
- what is it?

- Global/periph
- Tuned to larger form
- To move/change/fast/flick
- Simult process
- Subcortical aware
- Fast processing
- First to develop
- Linked to triad/reflex
- Where am I?

VISUAL SPATIAL ATTENTION

- Stationary spotlight attention muted periphery cognition
- Movement changes the dominance
  Integrate ambient with triad

Relative dominance change called:

VISUAL SPATIAL ATTENTION SWITCHING
Global Overload

- Simultaneous processing overload results in tunnel vision response.
- Process the world in a sequential focal segmented response.
- Poor eye movements due to lack of spatial cues.
- Clumsy due to tunneling of vision and unaware of surroundings for orientation in ADL and sports.

Field flux

Focal sequential processing (tunnel)

Ambient simult fragmented (Donna W)
Ambient seq fragmented (pseudofocal)
Polarized

Solution behaviors

- Squinting
- Using peripheral vision
- Lines up objects/looks at with side vision
- Toys lined up on the floor
- Runs back and forth looking at edges with side vision
- Drops things repeatedly in side vision
- Light/fan gazing
- Watches rolling credits/fast forward
- Looks through fingers
- Flicker toy OCD
- Plays with door opening
- Drags hand against wall
- Perspective looking
- Framing

Why?

- Using pathway that is dominant to regulate himself and occupy his attention in a way that puts him in control of the sensory input. He is reducing the world to a level he can manage it.
VSAS
• Goal to create more typical balance between central/peripheral vision.
• The larger the visual space that can be processed and integrated effectively, the more likely an appropriate response will be seen.

Intervention
• Specific to child's style
• Sight-glasses
• Binoc Dysf- prism/therapy
• Oculomotor-therapy
• Analytical systems profile
• Sensory system

Intervention Visual Spatial Attention
Designed to promote ability to process without becoming overwhelmed and to switch between focal and global bias as appropriate.

Create largest useful field of view

Intervention
• Activities and interventions are designed to bias attention towards primarily focal/global switching or simultaneous processing.
• Many physical activities require by their very nature specific mode of processing.
• By observing the child carry out the activity you can see the effectiveness of their processing.
• Interventions such as lenses, filters, occluders also bias spatial attention.

Activities
• Nature of activity promotes processing
• Movement and balance promote ambient function
• Identification and recognition/stationary promote focal
• Activities which require changing balance of both
• Some kids have to start focal to focal *

Intervention
• Lighting
• Dark periphery/BG spotlight attention desk
• Spotlight reach/step on path
• Use UV light for figures/teach letters
• Stepping stone paths use flu
• Disco light habituate periphery while sustain focal attention, direct/indirect/intensity & speed
• Flicker toys for fix and track
OCCLUDERS

• Binasals/bitemps/opaque/wrap around
• Bias attention center v periphery
• Degrade focal with blur or graded filter
• Peak hats
• Desk top occluder wall side shield

*Cannot filter covertly so filter overtly*

color

• Filters increase peripheral awareness and arousal yellow/orange
• Filters result in improved focal visual attention /blue

lenses

• Plus to expand awareness
• Minus emphasis on figure
• Yoked as dysruptive/change perspective
• Change vis/vest relationships
• Create better match between internal construct of space and external spatial surround
• Obs performance change carefully movement,visual spatial judg/posture/gait /affect/eye movements/balance/VNAS

yokes

• Alter visual space/create match between internal/external space with lenses which alter visual spatial perception in front/back plane or side to side plane, create visual spatial matches for integrated learning.

Response to stim

• Redirect and substitute
• Use cognitive drive
• Sensory diet
• Remove objects with high stim value

Questions?

• Will he ever regress? Learned behavior
• What must we do if we see him stim?
• Can we do therapy if he won’t wear glasses?
• Is he too young?
• How can my other therapists help?
Vision and Learning
Educational Seminar Series

THE VISUAL CONNECTION

OPTOMETRIC RESOURCES FOR INFORMATION OR REFERAL

College of Optometrists in Vision Development www.covd.org
Optometric Extension Program Foundation, Inc. www.oep.org
Parents Active for Vision Education (PAVE) www.pave-eye.com

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2C OR NOT 2C WITH ASD

Dr. Neil Margolis (Developmental Optometrist)

Key words:

Developmental Optometrist: A vision care provider who is qualified beyond routine eye care to evaluate the functional visual skills, such as tracking, eye teaming, visual spatial processing, visual analysis skills and the visual sensory system. The developmental optometrist is also qualified to provide recommendations for appropriate accommodations to compensate for vision skill weaknesses and to prescribe lenses and or therapy to develop visual skills.

Vision therapy: Is individualized therapy designed to facilitate the development of vision skills utilizing lenses, equipment and appropriate developmental learning activities.

Eighteen years ago, I was asked to evaluate a young boy who had been diagnosed on the autism spectrum. What immediately caught my attention was that he was squinting his eyes and repeatedly winking one eye. He was squinting so badly that you could hardly see his eyes. I asked his mother about his squinting and she replied that her other doctors had told her that it was just a “stim”, behavior and that it would go away with time.

After evaluating this boy, who was non-verbal, I was able to determine that he was actually seeing double vision. Squinting his eyes and closing his eye was his way of solving the problem of double vision. Using special prism glasses, I was able to get rid of his double vision and his squinting stopped, his face opened up. He was more visually attentive.

This served as a valuable lesson for I learned that non-verbal children are “telling” us through their behaviors what their problems are. For him, squinting was a solution to his problem. For me, it was a place to look for the cause. Subsequently, after working with other professionals at a school for children with autism, I developed a protocol for the evaluation and treatment of vision skill problems. The following is an outline of the evaluation protocol.

When I first meet a child typically I will put on a video, dim the lights and encourage him to roam the room exploring and becoming used to my presence and my voice while I talk to the parent. Often, I will sit on a low seat or even on the floor to make myself less intimidating.

While talking to the parent about the child’s school placement, other therapies and observations relative to the child’s visual behavior I get the chance to watch the child moving around.

Once he has habituated to his surroundings I will have him look across the room at a DVD or to a mechanical puppet while I measure his refraction objectively using a retinal light reflection technique. I also have a camera which screens for high refraction problems while taking a picture from four feet. This allows me to determine, in an objective manner, without getting too close, whether the child requires glasses.

This in itself can be a solution to a problem of visual inattention. Parents are taught appropriate techniques to help children with tactile sensitivity adapt to new glasses.
Eye teaming, which relates to depth perception and near point (table top) visual attention, is similarly evaluated using toys and activities to attract the child’s attention while eye alignment is studied. The symmetry of light reflections relative to the pupils is judged. Observation of eye movements in response to blocking the child’s view with my hand in an intermittent manner reveals whether their eyes are aligned in a typical manner. Having the child reach and pull on a stretchy elastic string held close to his face allows me to determine how well he can team his eyes at near. This also allows me to notice whether he is reaching and looking away or integrating his visual and motor systems in a typical manner when reaching.

Poor eye teaming causes squinting, blinking, head tilting, poor depth perception and can limit visual attention on the page or interfere with eye contact.

Tracking skills are evaluated by observing the child track a flicker light or iPhone picture, or by observing him looking back and forth between changing lights. For more advanced children, I like to see how well they can scan number patterns that depend on accurate tracking to keep their place.

Poor tracking interferes with scanning ones surrounding when moving around. This affects awareness and ability to safely negotiate ones surrounding. Good tracking is required to scan all the options on a communication device or scanning to keep ones place when reading on the page.

Now that sight, binocular vision and tracking have been evaluated I need to learn about their visual processing skills and visual sensory system.

To learn about the child’s ability to visually analyze or process visual information, I enjoy sitting on the floor with them and watching them solve developmental puzzles. Noticing whether they choose the round shapes to insert in the round templates or attempt to fit a square in a round shape. Noting if they orient the puzzle shape using their vision before they insert it in the template or whether they turn it around and around until it fits (non-visual). If they can complete basic form puzzles there are more complex puzzle designs which provides further insight into their visual analytic skills. For more advanced children there are abstract tests which use designs and patterns on the page to access how well the child can notice differences, manage visual clutter or remember what they have seen. These are important requirements for academic learning. Watching the child copy designs using stick layouts or using motor free tests also allows me to determine if copying is being affected primarily because of vision or motor skills.

Visual processing defines the ability to learn and remember from visual presentations. To organize and categorize visual information. Developmental delays in visual processing interferes with the learning and identification of letters and words. Developmental delays in visual processing need to be considered when designing the visual display of communication devices. In the more advanced child visual processing skills determine the child’s ability to notice copying errors and to read the words he knows accurately when reading them in sentences.

Children who appear clumsy or cannot orient themselves spatially in their surroundings often have poorly developed visual spatial judgment references. Watching how the child physically responds to activities requiring him to judge distance, to cross his midline or to separate his body sides, to reference against himself, gives me insight as to whether the fundamental “mental map” of his body is sufficiently developed. These foundational references are necessary to allow him to advance to more sophisticated spatial judgments on the page. Watching how the child rotates his puzzle pieces and organize spatial layouts on the page, are further applications of visual
Spatial judgment skills.

Spacing on the page when copying or reversals when writing are related to developmental delays in visual spatial processing. Children who are good at reading (hyperlexic) but appear clumsy when they move around may have poor visual spatial skills.

Children who appear to look with their side vision, or carry out repetitive movement activities in their side vision often have an imbalance between their central and peripheral vision. Watching the child respond to flicker lights, to spin toys, to moving patterns or lines gives insight into this balance. Watching their posture, gait, orientation and awareness as they move through the hallway while wearing special prism lenses that change their peripheral vision gives further information on central/peripheral vision balance. The peripheral vision system is most sensitive to movement, changes in lighting and edges. It helps a person orient themselves to their surroundings.

When the peripheral vision system is overly dominant it will also cause the child to be hyper-vigilant and overly distracted by his surroundings. It will also become an effective pathway for the child to regulate himself when he is anxious, bored or dis-regulated. When a child is completely overwhelmed by the visual sensory input he may respond by tunneling his vision which results in clumsiness, unawareness of his surroundings and poor scanning.

After observing the child’s response to all these probes, I can determine whether his visual skills are responsible for behavioral, attentional, educational, “visual stim behaviors” or performance concerns. If vision skills represent a significant barrier to progress, a vision therapy intervention program can be designed to develop the skills. A report can be written to request accommodations in the classroom and for integration of therapy activities with other professionals.

In the classroom cardboard walls on the table, glasses with tinted sides or wearing a visor can help channel visual attention towards the teacher. Use of spacing, line guides, different color lines, covering visual clutter and multisensory teaching helps to compensate for visual processing problems.

Vision therapy activities can be designed to target tracking or eye teaming problems using game like activities which separate head and eye movement control, or use polarized lenses to ensure both eyes are teaming. Visual analytical experiences are created which require selections initially using blocks, puzzles and shape sorters and which proceed over time (in a developmental hierarchy) to visual processing of designs and letter shapes on the page.

Visual spatial references are developed by engaging the child in physical activities which develop body image in space awareness and which require judgments of distance or time or orientation with respect to themselves. Activities which develop the awareness of the child’s own physical parameters are designed. Copying object layout designs on the table with geometric pieces, judging right and left sides on the page, or judging how to space words on the page to fit them all in, are more sophisticated applications of visual spatial judgment skills.

Peripheral/Central vision attention is developed by engaging the child in activities that require movement and balance (peripheral vision bias) while also attending to visual detail for identification (central vision bias). By changing the nature of the activity as well as using different lighting or peripheral vision lenses the ability to process and manage more visual information simultaneously is developed in a progressive manner.

The vision evaluation should serve to profile the child’s visual skills and to match weaker skills to
performance concerns. The experienced evaluator should be able to recommend therapies or compensations to address the performance concerns. Furthermore the evaluation should also serve to highlight the child’s relative visual strengths and how best to take advantage of them.

When vision is well developed and regulated it serves as a primary sensory pathway for attention and learning. If not, it interferes with learning and attention. It is incumbent on the developmental optometrist, through his testing and observation, to understand whether vision is helping or interfering with performance and development, and to “speak for the child”.

Any questions are welcomed at neilvision@aol.com, or call (847)255-1040.

About the author: Dr. Neil Margolis is a Developmental Optometrist practicing in Arlington Heights, Illinois. He has specialized his practice over the last 25 years towards the evaluation, differential diagnosis and treatment of tracking, binocular vision and visual processing skills to the extent they affect academic learning and visual attention. In many cases this includes working with children who are non verbal, have developmental delays or have multiple neurological diagnoses. He is a Fellow of both the College of Vision Development as well as the American Academy of Optometry. He is currently on the Advisory Board of Soaring Eagle and Giant Steps schools, both of which are dedicated to the education of children on the autism spectrum.