The Child on the Autism Spectrum
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What is Autism?
- Autism is a complex and common developmental disorder that includes problems with social interaction and communication, and ranges from mild to disabling in severity
- What is the incidence of autism?

Incidence
- Pre 2010 – 1 in 1500 with autism
- CDC 2012 – 1 in 150 children in the US has autism or an autism spectrum disorder, such as Asperger’s syndrome
- CDC 2013 – 1 in 88
- Latest – 1 in 68
- Incidence - variable
- Cause - multifactorial

Optometric Publications
- Appreciable numbers of infants exhibit visual problems that escape detection
- The absence of eye contact, unresponsiveness to facial gestures, and/or difficulty in sharing joint visual attention are signs of abnormal or atypical visual development

Testing protocols leading to early intervention
- Start with a careful history
- Does anyone in the family have issues?
- Place particular emphasis on eye movement and control - includes interest in parent, staff and doctor AND objects in the room as you test
- Carefully evaluate looking behavior
- Carefully evaluate refraction

Look Early - Look Often
Especially in the presence of difficulty
Testing protocols leading to early intervention

- Retinoscopy is a significant resource for determining how the child is really looking – look also at pupil size and change in this process
- Binocular function - if binocular function is present, the chances improve for having a foundation for "looking"
- Pupillary reflexes – speed and quantity of movement
- Blink reflexes – link with fixation

Communication Pearls

- The best way to induce anxiety in children with autism is to prompt them to look at you
- When children on the spectrum are trying to listen to what you are saying, prompting them to look at your eyes will make them anxious and interfere with them being able to listen to you.
  “I can see you or I can hear you. Which do you want?”

Communication Pearls

- There are three primary reasons for this:
  - Many children have auditory processing problems. Research has shown that people on the spectrum often look at your mouth. This would make sense if they need to look at your mouth to better understand what you are saying.
  - Some children use peripheral vision to view things. For them, direct vision is too intense and overwhelming, so they look with their peripheral vision. When they are “looking” at you, they will appear to be looking away from you because they cannot maintain eye contact.
  - Many adults on the spectrum have indicated that they become overwhelmed by the intensity of looking directly into your eyes. It feels very intimidating, very scary.

Communication Pearls

- Therefore - forcing a child to look at you is not increasing their understanding, but often inhibiting it. It totally overwhelms and distracts them.

Communication Pearls

- Like most all of us, looking at someone is much easier when we do it under our own volition. It is intimidating when someone prompts us to look at them.
  - Same goes for all communication. We have found that children with ASD will look at you more frequently when indirectly invited to, not told to.
Communication Pearls

- Use the following tips during examination and you find the child looking at you more often:
  - When talking to the child, position yourself so you are in front of him and at eye level.
  - When your face is in his field of vision, it will get his attention better. This does not mean “In their face” which would intimidate them. Just in their field of vision so it makes it easier for them to reference you.

- Use less words and more nonverbal language when communicating. Use more animated facial expressions, and exaggerated gestures to communicate. This invites the child to reference your face to obtain the information needed.

- Use words to augment your nonverbal language; while conveying most of information nonverbally. I animate my facial expressions which draws their attention.

- When the child stops referencing you, try pausing briefly until his attention returns. Often the break in the interaction invites the child to check back with you to repair the breakdown.

- For many young children their eyes follow their hands. If they feel safe with my touch, bring their hands up to the sides of your face which automatically brings a soft gaze. Do this in moments of sharing positive emotion so the child references the positive gaze. This helps encode positive associations with gazing at your face.

- The worst time to demand eye contact is when you are angry and scolding. Very intimidating and encoding strong negative associations with looking.

- Invite facial referencing,
  - Do not demand eye contact
  - Definitely do not grab and turn their face to you.
  - Facial referencing is glancing at the face for information or to share a positive moment, not necessarily eye contact.
Communication Pearls

› If the child is relaxed and feels safe with you, he will be more likely to reference your face. If you demand it he will be scared to look at you. Relating is about feeling safe and accepted, not instructed.

So What to do?
And how does this involve optometry?

› Routine young child exams with more careful attention to specifics we address with every patient
  ◦ History
  ◦ Ocular Motility – special attention here
  ◦ Binocular Function
  ◦ Refraction
  ◦ Visual Acuity
  ◦ Eye Health – especially pupil responses

So What to Do?

› If a child has does not develop appropriate eye tracking ability, there is a greater chance that they will not develop appropriate binocular function and refractive testing will show fluctuations
› Don’t assume this is just a child who has not developed an ability to “pay attention.”
› Paying attention is VERY important from the earliest of ages

Early Indicators of Risk related to Vision

› Pupillary Reflex
› Blink Reflex
› Gaze Following
› Attention
› Oculomotor Function
› Choice of fixation object
› These are all tests optometrists do every day in practice

Pupil Response
Seeing what a child is interested in can give clues to what they're able to recognize -- different shapes or sounds, for example.

A researcher might show a child two images side by side and see which one they look at for longer. Measuring the size of a baby's pupils could do the same without needing a comparison.

Perspectives on Psychological Science – Jan 2012

Abnormal Pupillary Reflex

...have shown that children and young adults with autism have prolonged latency and less constriction of their pupils in reaction to light.

Pupillary Reflex Differences Distinguish Autism From Typical Development
Daniel M. Keller, PhD

Pupil Size

Pupil size related to accommodation
If pupil does not decrease, it can be assumed that the child is not really looking

Blink Reflex

Moreover, typical toddlers inhibited their blinking earlier than toddlers with ASD, indicating active anticipation of the unfolding of those events.

These findings indicate that measures of blink inhibition .... are useful quantifiers of atypical processing of social affective signals in toddlers with ASD.

Inhibition of eye blinking reveals subjective perceptions of stimulus salience Sarah Shultz, Ami Klin, and Warren Jones, Edited by Riitta Hari, Aalto University School of Science and Technology, Espoo, Finland, and approved November 1, 2011
www.pnas.org/cgi/doi/10.1073/pnas.1109384108
Blink

- When we are looking more intently at something, blink rate decreases or stops
- Watch blink rate

Gaze Development

- Conclusions: Infrequent self-initiated socially directed gaze may be an early marker of later social and communication delays.
  - Social and non-social visual attention patterns and associative learning in infants at risk for autism
  - A.N. Bhat, J.C. Galloway, R.J. Landa

Atypical Response to Direct Gaze

- Conclusion: This study suggests that a broader autism phenotype, which includes an atypical response to direct gaze, is manifest early in infancy.
  - Neural Correlates of Eye Gaze Processing in the Infant Broader Autism Phenotype
    BIOL PSYCHIATRY 2009;65:31–38

Gaze Behavior

- These findings suggest that although gaze behavior at 6 months may not provide early markers for autism as initially conceived, gaze to the mouth in particular may be useful in predicting individual differences in language development.
  - Gaze behavior and affect at 6 months: predicting clinical outcomes and language development in typically developing infants and infants at risk for autism
    Gregory S. Young, Noah Merrin, Sally J. Buggers and Sally Oudenhoff
    Developmental Science 12:5 (2009), pp 798-814

Gaze Behavior

- Eye contact is crucial in achieving social communication. Deviant patterns of eye contact behavior are found in individuals with autism, who suffer from severe social and communicative deficits. ...
  - The results revealed that children with autism were no better at detecting direct gaze than at detecting averted gaze, which is unlike normal children.
Gaze Behavior

- This suggests that whereas typically developing children have the ability to detect direct gaze, children with autism do not. This might result in altered eye-contact behavior, which hampers subsequent development of social and communicative skills.


Self-directed Gaze

- Conclusions:
  - Low-risk group were more likely to have normal social gazing
  - Infrequent self-initiated socially directed gaze may be an early marker of later social and communication delays


Gaze Following

- Active gaze following by 12 months
  - 335 words known by 18 months
  - Babies without Active gaze following or other patterns
  - 195 words known by 18 months


Gaze Development

- If the baby can follow your gaze and know what you are looking at, they will have better language skills by 18 months of age
  - These are not just “simple” findings that we see at 12 months or 18 months or two years. These findings can be the start of a cascade of developmental and behavioral issues that could last a lifetime
  - See where they are looking!

Attention

- ...oculomotor abnormalities might play a causal role in functions known to be impaired in autism, such as imitation and joint attention
  - Infrequent self-initiated socially directed gaze may be an early marker of later social and communication delays.

  - Kennedy Krieger Institute
Attention

Using head-mounted eye tracking to record gaze data from both parents and infants, Yu and Smith find that infants extend their sustained attention to an object when a mature social partner also shows visual attention to that object, suggesting a pathway through which social interactions may influence the development of sustained attention.

Oculomotor Function

Eye Movements

Abstract: Although atypical eye gaze is commonly observed in autism, little is known about underlying oculomotor abnormalities. Oculomotor abnormalities might play a causal role in functions known to be impaired in autism, such as imitation and joint attention.

Eye Tracking

This study used eye-tracking to examine how 20-month-old toddlers with 1) autism spectrum disorder ... 2) typical development ..., and 3) non-autistic developmental delays ... monitored the activities occurring in a context of an adult-child play interaction.

Toddlers with ASD, in comparison to control groups, showed less attention to the activities of others and focused more on background objects (e.g., toys).

Eye Movements

Oculomotor abnormalities may play a role as a sensorimotor defect at the root of impairments in later developing functional systems, ultimately resulting in socio-communicative deficits.

Eye Tracking

In addition, while all groups spent the same time overall looking at people, toddlers with ASD looked less at people's heads and more at their bodies.

In ASD, these patterns were associated with cognitive deficits and greater autism severity.
These results suggest that the monitoring of the social activities of others is disrupted early in the developmental progression of autism, limiting future avenues for observational learning.


Most authorities now believe that subtle signs of ASD are present under 12 months of age, and eye tracking technology has been used experimentally to detect gaze patterns at progressively younger ages.


Fixation times on mouths and objects but not on eyes are strong predictors of degree of social competence.

Visual Fixation Patterns During Viewing of Naturalistic Social Situations as Predictors of Social Competence in Individuals With Autism

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This effect was not present in response to nonfusal stimuli.

Disengagement from Faces

These results suggest that toddlers with ASD are not captivated by faces to the same extent as toddlers without ASD and that this effect is not driven by a generalized impairment in disengagement of attention.

Eye Contact

- This might result in altered eye-contact behavior, which hampers subsequent development of social and communicative skills.

Looking to the Eyes

- Looking at the eyes of others is important in early social development and in social adaptation throughout one's life span.

**References**


- Looking at the eyes of others is important in early social development and in social adaptation throughout one's life span.

**Looking to the Eyes**

- Our results indicate that in 2-year-old children with autism, this behavior is **already derailed**, suggesting critical consequences for development but also offering a potential biomarker for quantifying syndrome manifestation at this early age.

**Summary**

- Caregivers whose eyes wander during playtime -- due to distractions such as smartphones or other technology, for example -- may raise children with shorter attention spans, according to a new study.

**So What to Do?**

- If you suspect something is amiss, do you:
  - Diagnose autism?
  - Refer as fast as we can?
  - Start looking earlier?
  - Initiate activities to stimulate looking whether diagnosed with autism or not?

- Depends on:
  - The perceived severity
  - What the family suspects
  - Whether the findings change in a month

**Management**

- Not necessary to make an immediate diagnosis of autism
- Work with community resources
- Emphasize the concerns you have to parents and the need for follow-up – with you
- OK to monitor without alarming parent - Not necessary to begin intervention until it is determined that specific prescribed eye movement activities do not change the looking behaviors
Management

- First, change the culture
- Activities for parents
  - Get babies down on their tummy – tummy time. They won’t always like it but it is necessary
  - Look at your baby especially when feeding, changing, and at other times when the baby is awake and alert – don’t leave eye contact to chance
    - This is NOT effective tummy time

Call to Action

- If you suspect something is amiss:
  - Initiate activities to stimulate looking patterns whether diagnosed with autism or not
  - Look early – look often – remember 1 in 68
  - Work with community resources – develop a resource list
  - Monitor without alarming parent - Not necessary to begin intervention until it is determined that specific prescribed eye movement activities do not change the looking behaviors
  - Short leash for follow-up

Communication with parents and other professionals

- Have a short time frame for follow-up
- Have list of resources handy
- Work as a liaison between parent and key resource personnel
- The key is to initiate activities and monitor frequently
- Encourage parents to be engaged with the baby from birth or as early as possible
- Make visual activities a part of daily activities

Communication with parents and other professionals

- Continue to follow on a frequent basis - yourself or in concert with a pediatric OD
- If symptoms persist, begin consultation with other professionals who can provide services
- Don’t simply refer and assume things are settled
- With the significant difficulty in oculomotor control, optometry must be involved

Call to Action

- Activities for parents
  - Get babies down on their tummy – tummy time. They won’t always like it but it is necessary
  - Look at your baby especially when feeding, changing, play time and at other times when the baby is awake and alert – don’t leave eye contact to chance
Develop a list of local resources

- Start with national websites
- Determine if there are local resources and formulate a list
- Don’t panic – the goal is to find services for the baby/child
- Although traumatic for both the parents and you, it is not life and death – become a trusted resource for the parents even if you are not involved in the treatment

Resources

- General Information on Autism
  - Autism Information Center, CDC
  - Autism Research, CDC
  - CDC Campaign: Learn the Signs. Act Early
  - Autism Spectrum Disorders, National Institute of Mental Health, NIH
  - Autism Society of America
  - Autism Speaks
    - www.autismspeaks.org
    - 212-252-8584

- Kennedy Krieger Institute:
  - Center for Autism
    - www.kennedykrieger.org
    - 800-873-3377

- Example of local resource
  - Florida State University
  - Center for Autism & Related Disabilities
    - www.autism.fsu.edu
    - 800-769-7926

- Specific Information on Autism and Genomics
  - Autism Genome Project Consortium
  - Autism Speaks: The Autism Genome Project
  - Family Health History
    - Office of Public Health Genomics

Contact Information

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