Letter to the Editor • What Do We Really Know About the Diagnosing and Treating of Infantile Esotropia (IE)?

Curtis R. Baxstrom, OD • Federal Way, Washington

It is great to have an article on an important topic like infantile esotropia. Thank you to the author for bringing this case to our attention and for sharing some critical information on infantile esotropia. However, after reading "Where Do Eyes Turn? An Exploration of Non-surgical Methods for the Treatment of Infantile Esotropia,"[1] I was perplexed with a quandary of questions regarding the content and where we as a profession stand in our advancement of appropriate care. This is a topic that we need to investigate thoroughly to truly understand infantile esotropia, how it develops, how to diagnose it, how to understand the ophthalmological surgical considerations, and how to effectively treat it optometrically using a model based on development and neurology. One might be surprised to find out that IE is actually the most common type of esotropia, making up 28-54%.[2]

The questions that need to be addressed:

1. What is the current model for the development of IE?
2. Is this actually a case of infantile esotropia?
3. What are the clinical criteria one should use to diagnose IE?
4. What are the surgical considerations and how successful is it?

Regarding the cause of IE, the author notes that, "More recent literature considers the cause to be a disruption in the cortical signals for ocular alignment, relating either to a weakened disparity signal or to a heightened motion bias." The reference for this is a chapter by Tychsen that was published in 1993.[3] I actually reviewed this chapter and presented it in 1994 at the 2nd International Congress of Behavioral Optometry in Sydney, Australia in a presentation titled, "Vestibulo-Optokinetic Interactions in the Development of Binocularity and Strabismus." The reference is now over 25 years old, and for a more current overview of IE, I would recommend a review of several articles written by Brodsky[4] and Tychsen.[5] At first glance, it would appear that they are at polar opposites, as Tychsen suggests it is more of a cortical problem, and Brodsky suggests it is a subcortical problem. I would suggest they are complimentary and overlapping and, in my opinion, support an optometric non-surgical approach to IE. Considering these and multiple other references, there appears to be a model developing that is developmental in origin. An abduction deficit presents that disrupts the initial cortical development that is in place at 3 months. This is when the infant is increasing their width of scan patterns that allows us to first observe the abduction deficit and cross-fixation pattern in IE. The IE becomes an established pattern of disrupted binocularity, and the abduction may spontaneously disappear. The abduction deficit has set the stage for decorrelation of the originally intact binocular cortical processing, leaving one with asymmetric monocular motion processing.[6] The temporal-to-nasal pathways are present at birth, whereas the nasal-to-temporal pathways are not. They normally would develop as cortical binocularity becomes more established with the emergence of symmetrical monocular motion processing and stereopsis. This normally occurs from 3-6 months of age.

The next concern is whether this case was actually IE. The patient was 8 months old and presented with a history of intermittent esotropia onset at 3 months. Dry retinoscopy was OD +2.50-2.00x90 and OS +2.00-1.50x90,

with possible amblyopia of the right eye based upon resistance to occlusion of the left eye. The patient was found to have an intermittent right esotropia. It should be noted that most infantile esotropes generally do not develop amblyopia because they freely alternate in a cross-fixation pattern.[7] No abduction deficit was noted. No testing was presented looking for monocular motion processing asymmetry, which can be tested using monocular OKN or pursuits as described in Tychsen's chapter.[3] The testing of infants should always include this when there is a possibility of strabismus, as well as to differentiate IE from other types of esotropia.[8] Over the past 20+ years, there has been a large amount of literature on the monocular pursuit, OKN, and VEP findings, suggesting the asymmetry is a hallmark of infantile esotropia. Without this information, it is difficult to clinically decide if you have a case of IE.

The patient next returned for a cycloplegic refraction; it was +2.50 DS, and the amblyopia was no longer noted. No dry findings were reported to compare with that day. Early accommodative esotropia cases can present before 6 months.[9] The amounts can be lower than +3.00 D, and thus it would be possible that this was a partially accommodative or accommodative case that was intermittent and established earlier than 6 months. The patient was now noted to have a 33 PD constant right esotropia. It is not noted if this was at far or near, and it should be noted that most IE cases demonstrate an alternating cross-fixation pattern. It is reported that the magnitude of strabismus did not change with the distance refraction, but nothing was mentioned regarding any near vs. far findings or the use of plus at near. Nothing was reported on the testing of monocular asymmetry of motion processing based upon pursuits or OKN. Since no additional plus was found, the patient was diagnosed with infantile esotropia. I'm not sure how the lack of more plus found during cycloplegia would eliminate a possible accommodative component to the esotropia. With no far vs. near findings or the documentation of monocular motion processing asymmetry, it is difficult to make a definitive diagnosis of IE. One might ask why all the astigmatism was found at the initial visit under dry conditions and why none was observed under cycloplegia. It could be that the astigmatism was an adaptation for the infant to shift in and out of space without having to accommodate. Accommodation comes on board as early as 1 month but is not adult-like until much later. Thus, it appears there may have been an accommodative component present that was interfering with the binocular development.

Regarding the evaluation of an infant who may present with IE, I would strongly recommend the following:[8]

1. Testing for abduction deficit. Note whether the infant can bury the temporal conjunctiva so it is not seen and is symmetric between the eyes. The challenge is that the abduction deficit is commonly seen early on but will commonly release after 4-6 months, sometimes not till 19+ months. It is underreported in the literature because it is generally ignored. In two studies they found 95.4% of infants with IE to have an abduction deficit early.[10,11] This appears to be a critical factor that will disrupt the established correlated binocular cells and promote the maldevelopment of monocular motion processing asymmetry and the loss of early stereopsis that is generally present.
2. Observe for a cross-fixation pattern. Because of the bilateral abduction deficit, this is a common finding that becomes established. It also allows equal access for both eyes to develop without amblyopia, much like an alternating exotrope.

3. Test for motion processing asymmetry by observing monocular OKN and/or pursuits. This appears to be the hallmark for infantile esotropia with an abduction deficit. If the child develops a partially accommodative esotropia or amblyopia, there may still be some asymmetry depending upon how early the esotropia is established.
4. Refrain from testing visual acuity with fix and follow[12] or resistance to occlusion[13] as they are both poor tests. I prefer using Cardiff Cards that can help determine asymmetric visual acuity between the two eyes quickly and efficiently. This can be done as an initial evaluation and to monitor for changes as they are recovering over time. I also have a set of Teller cards but use them for only the very young infants.
5. Perform far and near retinoscopy to determine how they respond to changes in their visual world both in regard to visual contact and as related to accommodation. A distance finding in isolation does not tell us anything regarding how they deal with near space. In the case of very young infants, one can perform retinoscopy at 12 inches and 20 inches. Their experience with visual space is not like an adult and is more related to what experiences they've had since birth (i.e., mother's face and breast). It is not uncommon to see them in visual contact with a good reflex and brightness at 12 inches and present with dimness at 20 inches.

Surgical Considerations

It is reported in the ELISSS study that better stereo was found at 6 years old in those that underwent early surgery at 6 and 24 months compared to those later between 32 and 60 months of age.[14] I would suggest that the findings are not that significant. It is reported that the early group had better stereopsis, but one should take into consideration the difference in arc seconds for the two groups. Early surgery gives you a better response on the Titmus fly, which is a 3552" target (13.5% early vs. 3.9% later), but not with the circles, which are 140"-200" targets (1.2% early vs. 1.3% later).

The question of early infantile esotropia surgery depends upon what you're looking for regarding outcomes. Von Noorden presented a study that looked at a reassessment of infantile esotropia for the XLIV Edward Jackson memorial lecture.[15] He broke the outcomes into four categories: optimal (subnormal binocular vision), desirable (microtropia), acceptable (residual small angle heterotropia), and non-acceptable (larger angle heterotropia). It was found that surgery prior to 2 years of age had the most optimal outcomes but also had the highest percentage of unacceptable outcomes. Surgery after 4 years of age had the best overall outcome of optimal, desirable, and acceptable. Thus, one must ask if you want the best overall outcomes, or do you take a chance on an unacceptable outcome and hope you achieve the optimal outcome?

You may also look at the Cochrane Database of Systematic Reviews.[16] The latest review for IE was done in 2013. It found that, "It has not been able through this review to resolve the controversies regarding type of surgery, non-surgical intervention, and age of intervention." So when someone tells your patient that research supports an earlier approach, the Cochrane Database of Systematic Reviews absolutely disagrees with this.

So where do we go from here? We need more optometrists to work with this population and type of strabismus. We need to continue to share our experiences and findings with this population. We are in a much better position to provide the most appropriate care for IE than any other provider. If you are interested in more information on

this topic, please see Digivision for a 2-hour lecture I presented at COVD in 2018. It can be found in the "48th Annual COVD Conference Videos-2018". I have no financial interest in this lecture or Digivision.

Thank you again to the author for the courage to begin further conversation within our profession on this very challenging topic. This is a type of strabismus that most do not discuss or write about. It includes many important topics, including the development of motion processing and stereopsis and most importantly, the optometric evaluation and management of infantile esotropia.

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