

EXOTROPIA IN A PEDIATRIC POPULATION LESS THAN SIX YEARS OF AGE

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Abstract

We conducted a retrospective record review of all pediatric patients less than age six who were examined at the University Optometric Center (UOC), State University of New York, State College of Optometry in New York City between January 1, 1992 to December 31, 2001. The inclusion criteria for this study were: presence of exotropia, onset of exotropia by age six, and initial examination within the specified ten-year period. Some 2,736 records were reviewed. Of these, 40 (1.46%) met the inclusion criteria.

Males constituted 58% (23/40) of the sample, while 42% (17/40) were females. Seventy-three percent (29/40) presented with alternating exotropia, and 27% (11/40) had unilateral deviations. Twenty-one patients were primary exotropes: ten of these (48%) were classified as divergence excess, eight as (38%) basic exotropes, and three (14%) as simulated divergence excess. Fourteen patients (35%) exhibited secondary exotropia. Nine (64%) of these had neurological abnormalities, two (14%) ocular disease, and three (21%) significant refractive error. Sixty percent of the 40 subjects presented with hyperopia. Forty-eight percent (19/40) of our patients experienced hypoxia at birth, while 50% (20/40) had developmental and/or speech delays.

In our sample, exotropia had a positive correlation with: an onset prior to age two, alternating deviation, hypoxia at birth, delayed developmental milestones, and neu-

rological involvement. No gender predilection was found.

Key Words

age of onset, basic exotropia, convergence insufficiency, divergence excess, exotropia, developmental delays, primary exodeviations, pediatric, pre/peri/post natal risk factors, simulated divergence excess

INTRODUCTION

The examination and diagnosis of strabismus in young pediatric patients can be one of the most challenging optometric encounters. Further, optimal management of these cases requires a knowledge of the condition's natural history in order to most effectively arrive at a prognosis and to provide appropriate clinical interventions. We believe this is particularly true of exotropias.

Primary exodeviations have been classified by their presenting patterns as: divergence excess, basic exo, convergence insufficiency, and simulated divergence excess. The divergence excess pattern has a greater exodeviation at distance than near by at least 15°. The basic exo pattern presents with essentially the same magnitude of deviation at both distance and near. The convergence insufficiency pattern has a greater deviation at near than distance by at least 15°. The simulated divergence pattern masquerades as a divergence excess pattern, but the occlusion and +3.00 tests expose it to be a basic exo pattern. The occlusion test disrupts fusion and the lingering effects of vergence, while the +3.00 diopter test alters accommodation and its accompanying accommodative convergence. Exodeviations can also be

classified as exophoria, intermittent exotropia or constant exotropia depending on the presence or absence of binocular alignment.¹

Secondary exodeviations can be consecutive, which manifest after strabismus surgery, or sensory, which manifest as a consequence of visual or neurological deficits.¹ In this paper we use the various exodeviations terms, but limit them to strabismus, i.e., not phorias.

Esodeviations occur far more frequently than exodeviations, with a prevalence ratio of approximately three to one.^{2,3}

Though true congenital exotropia (a constant large angle deviation presenting between two and four months of age) is rare, especially in the absence of mitigating factors,⁴⁻⁷ the presentation of an exotropia in a newborn is not uncommon. These deviations, or apparent deviations, are usually self-limiting and resolve with the maturation of the visual system and ocular anatomy.⁸⁻¹¹ Persistence of an intermittent or latent exodeviation beyond three months of age can give credence to the diagnosis of early onset exotropia. Age of onset of exodeviations in the pediatric population less than six years of age appears to cluster around birth to two years of age, with a limited incidence beyond five years of age.¹

PURPOSE

We sought to investigate and document trends regarding exotropia in the areas of demographics, exodeviation types, refractive error, pre/peri/postnatal trends in a pediatric sample less than six years of age. This is in the interest of providing information that will enhance the optometric management of pediatric patients who present with exotropia.

SUBJECTS

A retrospective record review was approved by the Internal Review Board (IRB) Committee of the University Optometric Center (UOC), State University of New York, State College of Optometry in New York City. The inclusion criteria of this study were: the patient had to exhibit an exotropia at some location in space, the exotropia had to manifest before six years of age, and the initial examination at UOC had to occur within the period from January 1, 1992 to December 31, 2001. We targeted a patient base of less than six years of age to eliminate the possibility of prolonged near point visual activity as an etiological factor of divergence excess.¹²⁻¹⁶

METHODS

A computer-generated search was used to identify all of the UOC's pediatric patients who met the above criteria. In order to assure a complete retrieval of all patients with exotropia, the initial computer query included a broader range of diagnostic codes. Exotropia, monocular and alternating exotropia, constant and intermittent exotropia, A/V/X pattern exotropia, and convergence insufficiency diagnostic codes were used for the search. Each record that met at least one of the diagnoses was reviewed for inclusion into the study. Qualifying records were retained for further review and study inclusion, while the remainder was excluded. Thus, a patient who was diagnosed with a convergence insufficiency (receded near point of convergence and exophoria on near cover test) but no true exotropia at near was excluded from the study.

As part of the routine eye examination performed at UOC, each patient's parent or guardian was asked to complete a patient questionnaire. (See Appendix A.) The questionnaire provided information about the child's ocular and medical history, and included questions regarding the following areas: chief complaint, ocular history, medical history and review of systems, pre/peri/postnatal histories, developmental milestones, pharmacological history, areas of special testing, and familial ocular and medical history. The examiner reviewed the completed questionnaire with the parent and child, and obtained additional history when needed. If an ocular misalignment was at issue, information regarding onset,

laterality, duration, constancy, frequency, magnitude, and progression was further investigated.

All patients received an optometric evaluation by a pediatric clinical faculty member. Although each doctor used a standard examination format, it was not possible to gather all test results on each patient. Some of the usual obstacles with pediatric patients were patient's age, testing capacity, and cooperation. In our retrospective review of the patient's record, we sought to obtain the following information on each patient:

1. age of the patient at their first examination at UOC
2. gender
3. medical and ocular histories
4. evaluation of strabismus
5. refractive status
6. visual acuity
7. pre/peri/post natal histories

For refractive status we used the following criteria: (+ and - refer to corrective lenses for each condition).

Hyperopia: $> +0.25$ diopter

Emmetropia: ± 0.25 diopter

Myopia: > -0.25 diopter

Anisometropia: $> +1.00$ diopter difference between the eyes or > -3.00 diopter difference between the eyes

High Hyperopia: $> +4.00$ diopters

High Myopia: > -6.00 diopters

Astigmatism: > 1.50 diopters

Based on the data, statistical analyses applying chi square and t-test functions were calculated to demonstrate patterns regarding exotropia in the specific areas of; demographics, exodeviation types, and refractive error. Linear regression analysis, Pearson's coefficient, analysis of variants (ANOVA), and a multiple regression analysis were applied to seek statistical significance regarding pre/peri/postnatal insults and exotropia. Fusion and management options were also analyzed, but not with a statistical application.

RESULTS

Demographics

During the 10-year period between January 1, 1992 and December 31, 2001, 2,736 patients under the age of 6 years had their initial examination at UOC. Forty patient records (1.46%) met the age of onset, time frame, and exotropia inclusion criteria. For the same criteria, we found the prevalence of esotropia at UOC to be

3.40% (93/2736). There was no statistically significant difference between genders; males constituted 58% (23/40) of the sample while 42% (17/40) were females. The average patient age was 27.1 months, with a range of age between two and 55 months.

Of the 40 patients, 19 (48%) reported the age at which exotropia was first observed. The average age of onset was 11.5 months, with the range being from birth to 36 months. Twelve of 19 (12/19) or 63% presented with an onset under age one, which is statistically significant to the 0.01 level. Sixteen percent (3/19) reported the onset between one year to under two years of age, while 21% (4/19) presented between two years and under three years of age. (See Figure 1.)

Strabismus evaluation

We classified the exotropia along the following parameters:

I. Primary Versus Secondary (We were unable to obtain information for this parameter for five of our sample)

Some 21 of our sample were primary exotropes. Ten of these (48%) were divergence excess, eight (38%) were basic exotropes, and three (14%) were simulated divergence excess. There were no convergence insufficiency exotropes. (See Figure 2.)

Fourteen of our sample were classified as secondary exotropes. Nine of these (64%) had neurological abnormalities, two (14%) had ocular disease and three (21%) had a significant refractive condition.

II. Alternating Versus Unilateral (Laterality)

Twenty-nine of our sample (73%) had an alternating strabismus. This has statistical significance at the 0.10 level. The remaining 11 (27%) were unilateral, with an even left versus right eye predilection; 15% and 13% respectively.

III. Constant Versus Intermittent (Temporal)

Nine subjects (22%) were constant exotropes, and the remaining 31 (78%) were intermittent. Five of the nine constant exotropes and six of the intermittent exotropes presented with neurological abnormalities or ocular pathology.

IV. Interplay between the Lateral and Temporal factors

In our sample, 25% were unilateral and intermittent, 2% were unilateral and

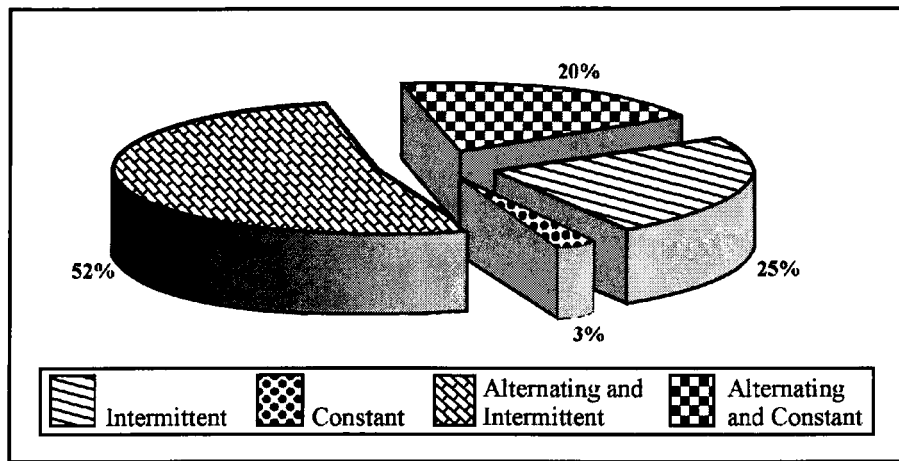


Figure 1. Age of Exotropia Onset

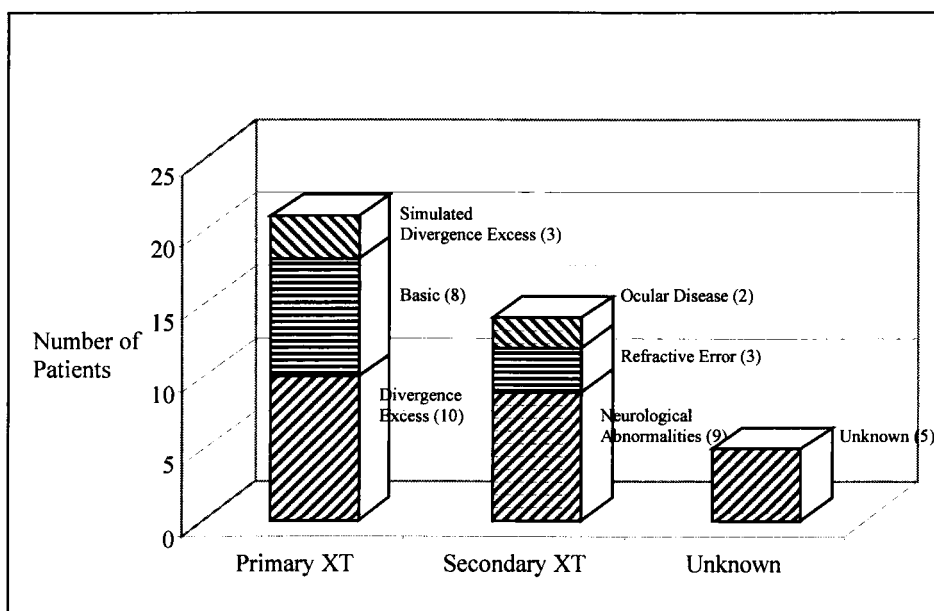


Figure 2. Primary vs. Secondary Exotropia

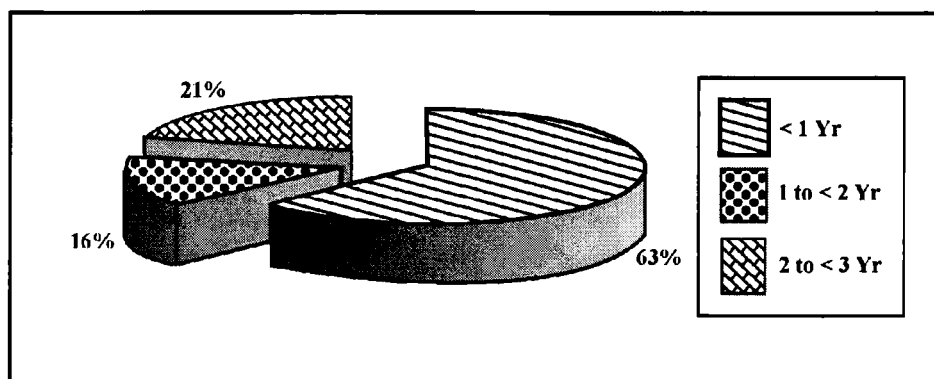


Figure 3. Unilateral vs. Bilateral Constancy

constant, 53% were alternating and intermittent, and 20% were alternating and constant. (See Figure 3.)

Refractive Status

Information was available for 39 of our subjects. Of these, 23 were hyperopes, six essential emmetropes, three anisometropes, two myopes, two high hyperopes, one astigmat, and one high myope.

Visual Acuity

We were unable to access sufficient reliable and comparable data on this aspect of the study. It should be kept in mind that the average age of our subjects was 27.1 months, and we confined the information obtained to the subject's initial examination at UOC. Our usual procedure with pediatric patients is to obtain as much information as possible on the first examination by means of conventional methods. In the younger child Preferential Viewing techniques are routinely used; however, these yield gradient acuities and have a range of acceptable normal visual acuities. In general the main issue is the equality of vision in the absence of pathology. Frequently, fixation patterns serve as a viable means of determining reduced visual acuity.

Factors Affecting Development

1. Pre-natal Insult

Two subjects were exposed to maternal drug abuse. Limited birth history was obtained from these two patients due to adoption. Both subjects manifested an intermittent divergence excess exotropia of which one was alternating and the other unilateral. Twenty-seven mothers of 40 patients (67%) reported an uneventful pregnancy, while 11 mothers (28%) reported complicated pregnancies.

2. Peri-natal Insult

Thirty-five percent of the mothers had a cesarean section. Vaginal delivery was reported for 58% of mothers and information was not given by 7% of mothers. The majority of births (75%) were unremarkable deliveries, while 18% presented with complications.

Birth history revealed 32 patients (80%) were full-term births, while five subjects (13%) were prematurely born. Adequate information was not provided by three patients (7%). Nineteen (48%) subjects were shown to have some degree of hypoxia at birth.

3. Post-natal Insult

Developmental delays were subdivided into two categories: specific versus

non-specific. Specific developmental delays were noted in nine (23%) of our patients. Non-specific developmental delays affected 53% of our patients. Fifty percent (20/40) of our subjects endured some delay in reaching developmental and/or speech milestones.

Based on linear regression analysis and Pearson's coefficient, pre/peri/postnatal insults were highly correlated with exotropia. However, both an analysis of variants (ANOVA) and a multiple regression analysis were inconclusive due to a cross-over of subjects within the group.

DISCUSSION

Demographics

The prevalence of exotropia in our study was 1.46%. This is in agreement with Chew et al, who used similar inclusion criteria and reported a prevalence of 1.2% in their sample of 39,277 children.¹⁷

However, our prevalence rate is somewhat higher than other studies. A possible explanation for this is our broader age range inclusion along with the fact that we included all types of exotropia and did not exclude patients with systemic health issues. Thus, Moore, who limited his subjects to healthy infant (congenital) exotropes reported a prevalence of 0.003%.¹⁸ Biglan et al also limited their sample to healthy infants under age one and reported a 0.12% prevalence rate of infantile exotropia.⁵ Friedman and co-workers detected exotropia in 0.3% of children ages one to two and half years in welfare clinics in Israel.²

Esotropia has been found to be more frequent than exotropia; the ratio often applied is 3:1 respectively.^{1-3,15} We had also accessed the number of esotropes in our initial computer search of 2,736 patients. The prevalence of esotropia was 3.40% (93/2,736) while the prevalence of exotropia was 1.46%. This resulted in a ratio of 2.33:1.

There was not a difference of statistical significance between females (42%) and males (58%) in our sample. Hunter et al, also did not find a gender discrimination.¹⁹ This gender balance conflicts, to some extent, with that of Krzystkova and Pajakowa,²⁰ Cass,²¹ and Gregersen,²² who reported that females had a higher predilection for intermittent exotropia compared to males.

Phase	Distance Cover Test	Near Cover Test
I	Exophoria	Orthophoria
II	Intermittent Exotropia	Ortho to exophoria
III	Exotropia	Exophoria to intermittent exotropia
IV	Exotropia	Exotropia

In our sample, the reported mean age of onset was 11.5 months, with a range from birth to 36 months. Since we could gain this information from about half of our subjects, our mean age is possibly skewed. Based on the data collected, 63% (12/19) presented with onset under one year of age, 16% (3/19) presented between one year to under two years of age, and 21% (4/19) presented between two years and under three years of age. This data is consistent with previous studies that indicate most exotropic deviations occur before two years of age (79% or 15/19 in our sample). Biglan et al report the mean onset at 7.8 months with a range from four to 12 months. Their sample was 12 patients under age one; the criteria excluded patients with neurological defects, prematurity, trauma, craniofacial syndromes and ocular disease.⁵

It is important to note that not all exotropic deviations noted in the first year of life have long-term implications. Transient neonatal exodeviations normally occur in the first few months of life and are consequent to developing ocular alignment and control. This type of exotropia usually resolves by three months of age, but can persist longer and then spontaneously regress.^{8,23} Neonatal exodeviations should be regularly monitored for regression versus progression, and management should be modified accordingly.

Strabismus Evaluation

The binocular evaluation of a young child with an exodeviation can be a challenge and change during the examination. Factors such as patient cooperation, alertness, fusional control, convergent accommodation, tonic convergence and viewing distance can influence test results.¹ Some authors view exodeviations as an evolving process of binocular decompensation that proceeds from an exophoria to an exotropia.²⁴ Calhoun conceptualized a phase pattern to this process, as is depicted in Table 1.²⁵ In other instances, the exodeviation is proposed to stabilize at some point in the process.²⁶ The pro-

longed occlusion and +3.00 tests are helpful in differentiating a true divergence excess from a basic exotropia, but these tests are often not feasible with very young patients. Thus, multiple evaluations over time can provide valuable insights about the pathogenesis of these deviations.¹

In this regard, Von Noorden tracked 51 intermittent exotropic patients for 3.5 years. Their ages ranged from 5-10 years.¹ He found signs of decompensation in 75% of the subjects (from exophoria to exotropia), while 9% were stable and 16% improved.¹ Cooper found that 85% of his divergence excess patients were intermittent at times, but felt that this pattern was not uniform.²⁷ Frequently, divergence excess is initially diagnosed in the young child, but with time the forces of convergence and accommodation lessen and the exodeviation is altered.²⁸

As noted earlier, several authors believe that intermittent exodeviations are more prevalent than constant exodeviations.^{1,15,29} Our data is in agreement with this finding; 31 subjects (78%) were intermittent and nine (22%) were constant exotropes. In addition, our data could be considered to substantiate the variability of primary exodeviations in that ten subjects had a diagnosis of divergences excess, eight were basic exotropes and three were simulated divergence excess. It should be noted that none of our sample presented with convergence insufficiency.

These findings could promote the concept of a progressive process from divergence excess to simulated divergence excess to basic exotropia. However, it is also possible that our subjects had all stabilized in terms of their particular exodeviation.

Refractive Status and Amblyopia

There has been considerable debate in the literature regarding refractive status and its relation to exotropia. According to Donders, uncorrected myopia may lead to under-stimulation of accommodative convergence, resulting in an

exo-posture.³⁰ A similar argument can be made with significant hyperopia (>+4.00DS). If this amount of hyperopia is left uncorrected, the visual system cannot overcome the accommodative demand to maintain clear vision. The lack of accommodative effort can result in an exodeviation.³¹

Jampolsky supported the view that anisometropia manifesting as unequal astigmatism or myopia in the two eyes created unequal retinal images, thereby inhibiting proper fusion and facilitating exotropia.³² O'Conner et al reported 40% of their exotropic patients were anisometric.³³ Smith et al studied 600 patients with intermittent exotropia of which 21% were diagnosed with anisometropia.³⁴ O'Connor and Smith et al defined anisometropia as at least a 1.00DS difference between the two eyes. Bremer et al stated anisometropia was a significant predictor for strabismus by age one year.³⁵ Other studies argue that refractive status does not play a significant role in the pathogenesis of exotropia and the presentation of refractive errors among exotropes is similar to that of the non-strabismic population.^{18, 20, 22, 29, 36, 37}

Sixty percent of our patients had a hyperopic refractive error, which could largely be due to the age of our sample (i.e. less than six years of age). This is not unusual since hyperopia is the most prevalent refractive error in this age category.³⁸⁻⁴¹ In consideration of the amblyogenic effect, we incorporated the American Optometric Association Practice Guidelines' definition of anisometropia: >1.00 DS hyperopia and >3.00 DS myopia.⁴² Our study found anisometropia in 8% of the patients. Essential emmetropia was defined as +/-0.25DS in our study and was present in 14% of our patients.

With strabismic deviations, correction of refractive error is critical for purposes of alignment, clear retinal image stimulus, and prevention of amblyopia. Amblyopia has been reported to occur in 5% (Griffin et al),³⁶ 7% (Dunlap),⁴³ 12% (Moore),⁴⁴ and 13% (Smith et al)³⁴ of concomitant exotropes. Smith et al retrospectively analyzed the visual acuity of 600 patients with intermittent exotropia and found functional amblyopia in 77 cases. Functional amblyopia was defined as two or more lines difference in correctable visual acuity between the two eyes. Smith et al

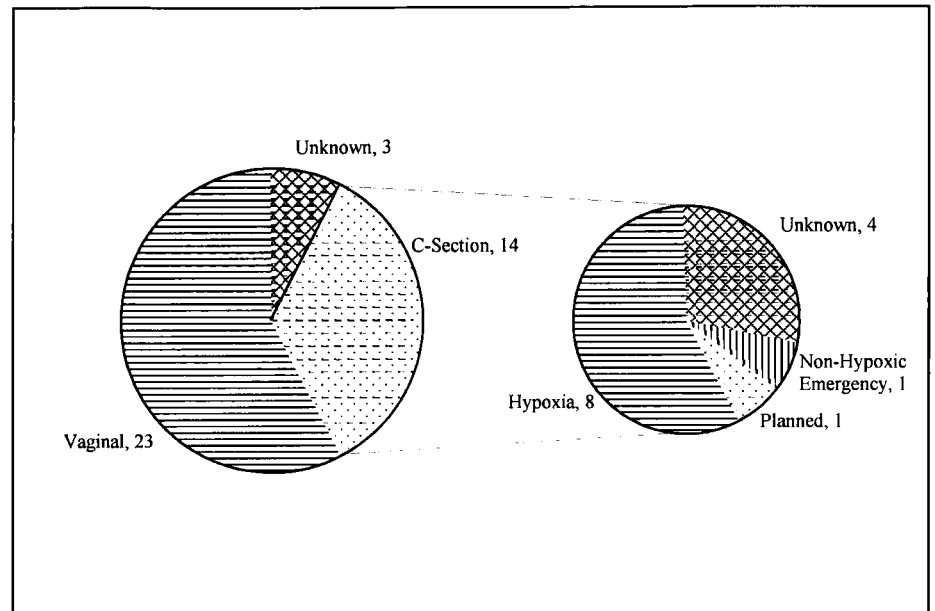


Figure 4. Birth History in Exotropic Patients. Reasons for Cesarean Section Delivery.

proposed that intermittent exotropia is composed of two components: a tropia and a phoria. When the eyes are phoric, bifixation takes place thereby preventing amblyopia. Amblyopia is thought to occur when the tropic phase increases in frequency and the individual starts to prefer one eye over the other for fixation.

Applying these fixation patterns as predictors of amblyopia to our study, the alternating exotropes would unlikely be amblyopes. This represents 73% of our sample. Further, 25% were intermittent, and it is probable that a percentage of these would not be amblyopic. Nevertheless, the Smith et al study strongly indicates the importance of monitoring the laterality of an exodeviation and monocular visual acuities at frequent intervals.

Developmental Factors

1. Pre-natal Insult

Maternal cigarette smoking during pregnancy has been correlated with both exotropia and esotropia. Chew et al observed that mothers who smoked two packs of cigarettes per day compared with those that did not smoke posed a greater risk for strabismus in their offspring.¹⁷ There was no explicit report regarding adjunctive maternal cigarette smoking in our study. However, two of our patient's mothers reported a history of drug abuse during pregnancy; both were adopted cases. One of the children was born with an addiction.

Eleven mothers (28%) reported complicated pregnancies, involving: drug addiction, lupus flare-up, vaginal bleeding, toxemia, unknown reason for hospitalization, gestational diabetes, preeclampsia and multiple gestation, cervical cerclage secondary to premature rupture of membranes (PROM), and cancer removal in the mother.

2. Peri-natal Insult

It is uncertain whether one particular factor during delivery could directly result in exotropia. Potential risk factors linked with exotropia include trauma during birth, toxemia during late pregnancy, prematurity, low birth weight, and respiratory problems during the neonatal age.^{17, 45-47} In our study, 35% of mothers had a cesarean section due to the following reasons: six were emergency procedures related to hypoxia issues, five were for unknown reasons, one was planned, one was due to gestational diabetes, and one was due to breech presentation. (See Figure 4.) Since 25% of all deliveries in the general population are cesareans, a cesarean, in and of itself, does not constitute an eventful delivery.^{48, 49} In our study, 18% of patient's mothers experienced complicated deliveries due to emergency cesareans, meconium swallowing, and nuchal cord compromises.

Prematurity is defined as <37 weeks of gestational.⁴⁸ The average premature gestational age in our sample was 30 weeks. Thirty-two patients (80%) were full-term births, five patients (13%) were prema-

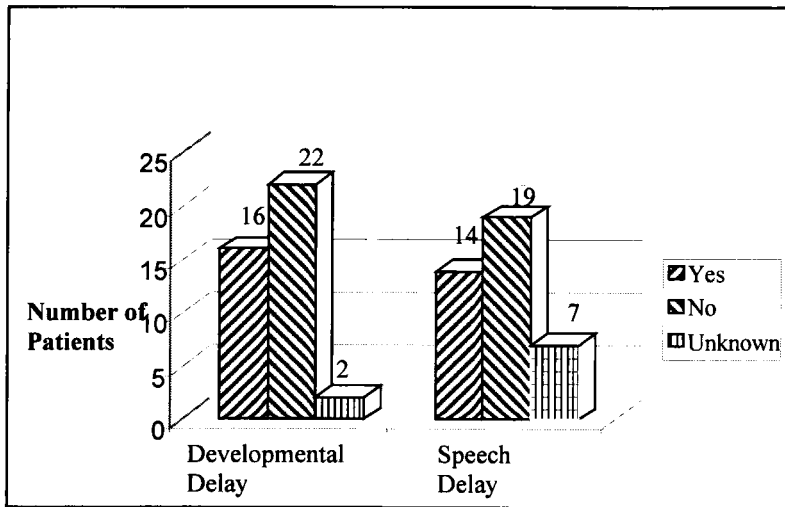


Figure 5. Prevalence of Developmental and Speech Delay in Exotropia

ture, and three (7%) were unknown. Prematurity has been shown to be a significant predictor of strabismus.^{50,51} Bremer et al studied 2,449 premature infants and noted that when strabismus was present at three months of age there was an eleven-fold chance that the child would maintain the deviation at one year.³⁵

Retinopathy of prematurity (ROP) and low birth weight each has an independent relationship with strabismus.³³ It is important to note that ROP patients can appear to present with a pseudo-exotropia secondary to a dragged or temporally-displaced macula. One can differentiate a true versus pseudo-exotropia based on ocular movement during unilateral cover testing. The latter will not show any movement with monocular occlusion. Low birth weight is defined as <2500 grams (5.5 pounds) and very low birth weight is defined as <1500 grams (3.3 pounds).^{48, 49} Although, there is a general correlation with prematurity and low birth weight, our sample was inconsistent with reporting birth weights. Therefore, a direct association cannot be discussed.

For the purposes of our study, we assumed that the child was full-term if history of prematurity was not elicited from the intake form or the case history. It is possible that our sample under-estimated the potential number of premature and low birth weight infants. This could have occurred if information was withheld, overlooked, or not known by the adult accompanying the child. For future prospective studies, specific duration of

pregnancy and birth weight information should be sought.

Nearly 50% of our patients endured some level of hypoxia at birth. Reasons for hypoxia included fetal distress, nuchal cord, low birth weight, prematurity of birth, gestational diabetes, multiple gestation, bradycardia, and preeclampsia. In healthy fetuses, a one to two minute nuchal cord event may not lead to hypoxia because of fetal oxygen reserve.⁴⁸ However, as seen by the reasons for hypoxia in our patient sample; such cases do not generally portray a healthy population.

3. Post-natal Insult

Congenital exotropia has been associated with neurological syndromes, developmental delays, ocular disease, and craniofacial abnormalities.^{6,19,52} Our study agrees with these findings. We did not have any patients with craniofacial abnormalities; thus no correlations could be made in that respect.

We subdivided developmental delays into two categories: specific versus non-specific. The former group had overt neurological abnormalities, while the latter included non-specific neurological delays or mental retardation. Specific developmental delays were noted in nine (23%) of our patients. In a number of our subjects, more than one insult was reported. Our subjects presented with the following specific conditions: five with a seizure component, two cerebral palsy, two Down's syndrome, one shaken baby syndrome, one Canavan's disease, one encephalocele, one stroke, and one unknown. One or more non-specific devel-

opmental delays were found in 21 (53%) of our patients, including one pervasive developmental delay, one autism, four hypotonic, sixteen not meeting developmental milestones and fourteen with speech delays. Developmental milestones entailed meeting age-norms for sitting, creeping, crawling, and walking. Fifty percent of our patients endured some delay in development and/or speech. (See Figure 5.)

Historically, there has been a high correlation between constant exodeviations and neurologically compromising and/or ocular disease conditions.^{6,52-54} Our study supports this claim, since 56% (5/9) of our constant exotropes presented with neurological or ocular pathology. A comparison with our intermittent exotropes revealed 19% had a history of neurological or ocular disease. In both groups, neurological involvement surpassed ocular associations. Ocular disease affected two of our patients (5%). The first patient was an alternate, constant exotropes diagnosed with macrocornea and possible infantile glaucoma; the second patient was a large-angle intermittent exotropes with several ocular complications including microcornea, microphthalmia, and ptosis. Patients with constant exotropia should be carefully examined for any secondary associations. Gallin states, "Any congenital or early onset exotropia (i.e. onset before 2 years of age) is presumed to have a structural lesion (retinoblastoma, cataract, intracerebral tumor) unless explicitly proven otherwise."⁵⁵ Congenital exotropia is considered a diagnosis of exclusion.

CONCLUSION

Our study concurred with previous findings in the literature regarding exotropia in the younger pediatric population in the following parameters; onset of deviation prior to age two, increased prevalence of intermittency, implications of occlusion and plus lenses in manifesting simulated divergence excess, and associated risk factors. Risk factors were divided into pre/peri/postnatal categories. Hypoxia at birth, delayed developmental milestones, and neurological involvement showed a significant correlation with exotropia in our patient population. These children should be closely monitored.

Strabismic evaluation for future prospective studies of exodeviations in the

pediatric population should include; comprehensive birth and developmental history, age of onset, distance and near magnitude, laterality, constancy, frequency, retinoscopy, stereoacuity, and ocular health assessment. Constant exotropia should be further investigated to determine if it is congenital or secondary in nature. It is important to realize the future potential consequences our exotropic patients may face including progression, amblyopia, vision therapy, and surgical intervention to optimize their developing visual systems.

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Appendix A.

Infant Vision Clinic Ocular and Medical History Questionnaire

Date: _____

Patient's Name _____ Date of Birth _____

The reason my child is being examined is _____ general check up _____ other, please explain:

When did symptoms start: _____

Last eye exam was on _____ Where: _____ Glasses: Y/N Age 1st Worn _____

Does your child have any of the following:	Explain	
Eye turns in/out	Y	N
Squints a lot	Y	N
Doesn't seem to focus	Y	N
Rubs eyes excessively	Y	N
Burn, itch, red, tear, discharge	Y	N
Poor tracking /eye movements	Y	N
Head tilt/Face turn	Y	N
Blurry vision	Y	N
Double vision	Y	N
Frequent headaches	Y	N
Eye pain	Y	N
Excess light sensitivity	Y	N
Any eye injury or surgery	Y	N
Any lazy eye/amblyopia	Y	N

Last medical exam was on _____ Doctor: _____ immunizations up to date : Y N
 current medications(dose & reason for taking) _____

Medical History/System Review	Explain	
Does your child have or has your child had		
Allergies/ allergies to medicines	Y	N
Surgery/hospitalizations	Y	N
Cardiovascular/heart problems	Y	N
High blood pressure, murmur, other		
Breathing problems	Y	N
Asthma, shortness of breath, other		
Gastrointestinal problems	Y	N
Food problems, diarrhea, vomiting, other		
Endocrine problems	Y	N
Diabetes, thyroid, growth, other		
Urinary problems	Y	N
Pain/discomfort, blood in urine, other		
Skin problems	Y	N
Unusual rashes, excess dryness, other		
Musculoskeletal problems	Y	N
Juvenile Rheumatoid Arthritis, other		
Neurological problems	Y	N
High fever, seizures, balance, other		
Psychiatric/Social problems	Y	N
Any behavior problems, other		
General growth/developmental: normal /delayed		

Chronic fever Y N _____
 Unexplained weight loss/gain Y N _____
 Ear/nose/throat problems Y N _____
 Hearing loss, frequent sore throats, sinus problems
 Blood diseases Y N _____
 Bleeding disorders, sickle cell, other
 Cancer, HIV virus, other medical Y N _____
 conditions not noted above? Specify: _____

1. How long was the pregnancy? _____ months
 2. Birth weight _____ lbs _____ oz.
 3. Any complications during pregnancy? Y N _____
 4. Any complications during delivery? Y N _____
 5. Apgar score _____ @ 1 min _____ @ 5 min
 6. Labor during delivery lasted _____ hours
 7. Labor/delivery was _____ natural _____ induced _____ Caesarian _____ Forceps/Suction used
 8. My child is: _____ natural _____ adopted _____ foster _____ other _____
 9. Mother's age at child's birth: _____
 10. Father's age at child's birth: _____

11. Immediately after birth my child was:
 _____ received oxygen _____ doing well, requiring no medical treatment
 _____ allergic _____ placed in incubator
 _____ running a fever _____ having Rh problems
 _____ having breathing/feeding problems _____ placed in neonatal ICU
 _____ other _____ jaundiced

12. Medication prescribed during first year of life: none _____ med: _____
 13. Age when child first: sat _____ crawled _____ crept _____ walked _____ talked _____
 14. In Daycare/Preschool? Y N Difficulties? _____

15. Has your child undergone any of the following testing/treatment?
 Educational Y N Neurological Y N Psychological Y N
 Occupational Y N Speech Y N Physical Y N

Family History

Does anyone in the family have:

Amblyopia/Lazy eye Y N
 Eye Turn / Strabismus Y N
 Myopia/Hyperopia as young child/infant Y N
 Color Vision defect Y N
 Glaucoma Y N
 Cataracts before age 40 Y N
 Blindness Y N
 Tear duct problems Y N
 Other eye problems/diseases Y N
 High blood pressure/heart problems Y N
 Diabetes Y N
 Neurological diseases Y N
 Birth defects Y N
 Genetic or familial disorders Y N
 Cancer Y N
 Other medical condition not listed above Y N

Explain

Who:

Date: _____ Signed: _____ Relation to patient: _____

Reviewed by _____, Intern _____, O.D. Date _____