ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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Refractive Status in Children with Unilateral Congenital Nasolacrimal Duct Obstruction

Doğumsal Tek Taraflı Gözyaşı Kanal Tıkanıklığı Olan Olgularda Refraktif Durum

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ABSTRACT Objective: To investigate the refractive status and frequency of amblyopia risk factors in children who underwent probing for unilateral nasolacrimal duct obstruction (NLDO). **Material and Methods:** This descriptive cross-sectional study included 65 consecutive children with unilateral congenital NLDO who were still symptomatic at one year examination and necessiated nasolacrimal duct probing. A complete ophthalmic evaluation including cycloplegic refraction was performed. The spherical, cylindrical and spherical equivalent retinoscopy measurements of both eyes were noted. The risk factors for amblyopia and differences between refractive values of both eyes were evaluated. **Results:** The mean age at presentation was 20.4±9.2 months (range, 12 to 48 months). The left eye was involved in 30 (46.2 %) patients. Thirty-five subjects (54 %) were female. Nine children had amblyopia risk factors (13.8%). There was no statistically significant difference regarding cylindrical refractive error, spherical refractive error and spherical equivalent (p=0.9, p=0.9 and p=0.5 respectively) between two eyes. **Conclusion:** In the current study, no statistically significant difference was found between refractive values of both eyes. One tenth of children in our study group were found to be under risk of amblyopia mostly due to high astigmatism. Further studies about the effect of blurred vision on visual development of both eyes and binocular vision may provide more information about the refractive status in this group of patients.

Keywords: Amblyopia; anisometropia; child; nasolacrimal duct

ÖZET Amaç: Doğumsal tek taraflı gözyaşı kanal tıkanıklığı nedeni ile sondalama uygulanan hastalarda refraktif durumun ve ambliyopi risk faktörlerinin sıklığının araştırılması. **Gereç ve Yöntemler:** Tanımlayıcı kesitsel çalışmaya, doğumsal tek taraflı gözyaşı kanal tıkanıklığı olan, bir yaşta yapılan kontrollerde semptomlarda düzelme olmayan ve sondalama gerektiren ardışık 65 çocuk dahil edildi. Hastaların sikloplejin ile yapılan refraksiyon muayenesini de içeren detaylı oftalmolojik muayeneleri yapıldı. Her iki göze ait retinoskopi ölçüm değerleri, sferik, silendirik ve sferik eşdeğer olmak üzere not edildi. İki göz arasındaki refraktif değerlerin farkları ve ambliyopi risk faktörleri değerlendirildi. **Bulgular:** Hastaların başvuru sırasında yaş ortalamaları 20.4±9.2 aydı.(yaş aralığı, 12 ile 48 ay). Otuz hastada (46.2 %) sol gözde gözyaşı kanal tıkanıklığı mevcuttu. Otuz beş çocuk (% 54) kızdı. Dokuz çocukta (%13.8) ambliyopi risk faktörü bulunmaktaydı. Tutulan göz ile diğer göz karşılaştırıldığında silendirik, sferik ve sferik eşdeğer refraksiyon kusurları arasında istatistiksel olarak fark olmadığı görüldü. (sırasıyla; p=0.9, p=0.9 and p=0.5). **Sonuç:** Çalışmamızda, iki gözün refraktif degerleri arasında istatistiksel olarak fark saptanmadı. Hastaların onda birinde, çoğu yüksek dioptrideki astigmatizmaya bağlı olmak üzere, ambliyopi riski olduğu saptandı. Gelecekte, hastalığın sebep olduğu bulanık görmenin görme gelişimine etkisini araştıran çalışmalar, bu hasta grubunda gelişmesi beklenen refraksiyon kusuru konusuna ışık tutacaktır.

Anahtar Kelimeler: Ambliyopi; anizometropi; çocuk; nazolakrimal kanal

Congenital nasolacrimal duct obstruction (NLDO) is generally caused by obstruction at the level of Hasner membrane and symptomatic in 5-6% of infants.[1] Nasolacrimal probing is an effective treatment for congenital nasolacrimal duct obstruction in unresponsive cases to Criggler massage.[2,3]

NLDO is generally regarded as a benign disease as far as visual maturation is affected. Spontaneous resolution occurs in most of the cases in the first year of life.[4] However the remaining cases have symptoms after one year of age.[4]

Continual existence of the abundant tear meniscus overlying the cornea in the course of sensitive duration of visual development may have a role in causing anisometropia and amblyopia.[5] Numerous retrospective studies indicated a high frequency of

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anisometropia and amblyopia in patients with congenital NLDO.[6,7] Persistant tearing in unilateral NLDO may cause blurring of vision and cause deprivation amblyopia during the critical period of visual maturation. Correspondingly children with unilateral NLDO are likely to have disorders of binocular function.

Anisometropia is a well known cause of amblyopia.[8] Similarity in the refractive state of both eyes are necessary for development of stereoacuity.[9] Amblyopic children have insufficient fine motor skills which need rapid and carefull movements.[9]

In the current study, we investigated the refractive status and frequency of amblyopia risk factors of children who experienced probing for unilateral NLDO.

MATERIAL AND METHODS

This descriptive cross-sectional study consisted of consecutive children with unilateral congenital NLDO. Inclusion criteria were beginning of unilateral epiphora and/or discharge from birth which who was still symptomatic after Criggler massage until one year of age and necessiated probing. Exclusion criteria included any other extra- or intraocular abnormalities which may alter refractive status such as blepharoptosis, strabismus, microphthalmia and cataract.

The current study was confirmed by Baskent University Institutional Review Board (Project No: KA 18/48) and supported by Baskent University Research Fund. The study was accomplished complying with the principles of the Declaration of Helsinki. Informed consent form had been obtained from all parents of the patients who underwent probing. Probing was performed only if the child was at least one year of age or older. The younger children were managed by Criggler's massage.

Cyclopentolate 1% drops were instilled twice in each eye, 5 minute apart and 60 minutes before the ophthalmological examination under anesthesia. A complete ophthalmic evaluation including cycloplegic refraction was performed. The spherical, cylindrical and spherical equivalent retinoscopy measurements were noted. Afterwards, nasolacrimal duct probing was performed. The risk factors for amblyopia and differences between refractive values of both eyes were evaluated.

The risk factors for amblyopia were determined referring American Association for Pediatric Ophthalmology and Strabismus (AAPOS) guidelines.[10] The referral criteria were as follows: In children aged 12-30 months, astigmatism of 2.0 D, hyperopia of 4.5 D, myopia of 3.5 D, and anisometropia of 2.5 D; in children aged 31-48 months, astigmatism of 2.0 D, hyperopia of 4.0 D, anisometropia of 2.0 D, and myopia of 3.0 D; and children older than 48 months, astigmatism of 1.50 D, hyperopia of 3.50 D, anisometropia of 1.5 D, and myopia of 1.5 D. A media opacity more than 1 mm and any form of manifest strabismus of more than 8 prism dioptri were accepted as nonrefractive risk factors.

Statistical analysis was carried out by the statistical package SPSS (Version 17.0, SPSS Inc., Chicago, IL, USA). The continuous variables were not normal, they were defined as the median (interquarter range). Repeated measures data were analyzed with Wilcoxon Test. Correlations among measures were tested by Spearman's rank correlation test. Correlation coefficients were considered as either excellent relationship $r \geq 0.91$; good $0.90 \geq r \geq 0.71$; fair $0.70 \geq r \geq 0.51$; weak $0.50 \geq r \geq 0.31$; little or none r£0.3 (ref). Values of $p<0.05$ were interpreted statistically significant.

RESULTS

Sixty-five children were included in the study. The mean age at presentation was 20.4±9.2 months (range, 12 to 48 months). The left eye was involved in 30 (46.2 %) patients. Thirty-five subjects (54 %) were female. Referring to spherical equivalent refractive error, hyperopia was the most detected refractive error in affected and non-affected eyes with no statistically significant difference between two eyes (p=0.9). There was no statistically significant difference regarding cylindrical refractive error, spherical refractive error and spherical equivalent (p=0.9, p=0.9 and p=0.5 respectively) between two eyes. None of the children had strabismus, ptosis or any media opacity. Nine children had amblyopia risk factors (13.8%). Refraction of 9 children are given in

TABLE 1: Refraction of 9 children with ambliogenic risk factors according to referral criteria of AAPOS guidelines.[10]

		Right eye			Left eye			
NLDO/P eye	Age (Month)	Spheric	Cyl	Axe	Spheric	Cyl	Axe	Ambliogenic risk factor
OS	27	+2.00	-2.00	180	+1.75	-2.00	170	Bilateral astigmatism
OD	16	+8.00	-1.75	180	+8.00	-1.75	180	Bilateral hyperopia
OD	46	0	+1.00	90	-1.00	+2.00	90	Bilateral astigmatism
OD	14	+3.50	-1.75	180	+3.75	-2.25	180	Bilateral astigmatism
OS	18	+3.25	-2.00	120	+5.00	-2.00	180	Bilateral astigmatism, hyperopia
OS	18	+5.00	-1.00	90	+4.00	-1.00	180	Bilateral hyperopia
OD	36	-3.50	-0.50	100	-2.50	-	-	Bilateral myopia
OD	24	-	+2.50	180	-	+1.00	20	Bilateral astigmatism
OS	12	+4.00	+2.00	90	+4.00	+2.00	90	Bilateral astigmatism

AAPOS: American Association for Pediatric Ophthalmology and Strabismus, NLDO/P: Nasolacrimal duct obstruction/probing, Cyl: Cylindrical, OD:Right eye, OS:Left eye.

Table 1. The mean age of children who have amblyopiagenic risk factors was 23.4 (±11.2) months. Six out of nine children had astigmatism as a risk factor for amblyopia. The rate of anisometropia more than 1.0 D was 9.2%.

DISCUSSION

Congenital NLDO is a prevalent childhood disease that generally recovers in a spontaneous manner in first year of life; though its impact on refractive status and connection with amblyopia has been contentious.[5-7]

Children with unilateral NLDO have been considered to have a high risk of amblyopia by causing anisometropia.[6,7] Anisometropia is a well known factor for amblyopia.[8] Numerous studies reported that amblyogenic effect is more significant when the interocular difference exceeds one diopter.[11,12]

In the current study, the rate of anisometropia more than 1.0 D was 9.2%. According to referral criteria of AAPOS, any patient did not have anisometropia. The difference between refractive errors of both eyes was not statistically significant. Our finding was consistent with the study of Ellis et al.[5] It is speculated that due to individual physiologic differences, milder degrees of anisometropia may cause amblyopia.[5,13,14] Hence defining a cut off value for anisometropia is uneasy.

Ellis et al. investigated the association between NLDO and anisometropia, however did not verify that the distruption by tear film in NLDO was intercepted with emmetropization.[5] The prevalence of anisometropia range was reported to be 1.4 and 3.4% and anisometropic amblyopia between 0.64 and 1.25% in normal population.[15-17] Pietrowsky et al., reported higher rates of anisometropia (9.8%) and anisometropic amblyopia (5.2%) in children who had NLDO than reported for general population.[18] They showed that 87.5% of children with hyperopic anisometropia caused amblyopia in the eye with NLDO. In the same study 90% of the children with hyperopic anisometropia without amblyopia developed more severe hyperopia ipsilateral to NLDO. In the current study, hyperopia was prevalant in the eyes with NLDO, though there was no statistically significant difference between two eyes (p=0.9). According to revised referral criteria of AAPOS, only 13.8% of our patients had risk factors for amblyopia.[10] The results of the current study showed that unilateral NLDO did not have a negative effect on visual maturation and do not cause anisometropia.

In primates two sensitive periods have been shown in neurological development for binocular vision. The first period begins from birth and extends to 8 weeks. The second stage begins from 8 weeks and continues to 12-18 months.[19] Emmetropization is provided by clear focusing of the images on retina. Unilateral NLDO causes persistent watering and blurred vision which is considered leading to increased incidence of anisometropia.

Environmental factors were demonstrated to activate visually-elicited signals that arise from retina, moves through the choroid and starts scleral remodeling.[20] The children with disrupted vision during in-

fancy were shown to have deprivation-induced myopia.[21] Correspondingly, in the current study a myopic shift was expected in the eyes with NLDO, however no statistically significant difference was found between two eyes. On the other hand, the effect of excess tear in front of the cornea may cause a positive lens effect which was supposed to seize the eye growth causing relative hyperopia.[22] An interesting finding of the current study was that ambliogenic risk factor was mostly astigmatism. Amblyopia is generally evident in hypermetropes in normal population.[23] The mechanism about development of eye and refractive status is complicated and challenging. Future studies are necessary to clarify the possible effects on eye growth and its outcomes on refraction.

In the present study, risk factors for ambliopia were determined in 9 children (13.8%). Ramkumar et al. reported the prevalence of amblyopia risk factor as 20% in children with the diagnosis of NLDO.[24] The ratio of ambliopia risk factors in the present study was interestingly lower than the reported ratio for normal population.[25] However the absence of an age-matched control group consisting healthy age-matched children was a limitation for the current study.

The difference between the refractive errors of two eyes was not significant. Anisometropia was not the risk factor for ambliopia in our study group. The amblyogenic risk factors were high refractive errors in both eyes. Presumably the blurred vision in one eye may affect the visual development of both eyes and binocular vision.

One study established that increasing age in patients with unilateral congenital NLDO was connected to a higher frequency and severity of anisometropia.[26] The authors reported that each month of age was related to a difference of 0.007 D in spherical refractive value. The mean age of the patients in our study was 20.4±9.2. It is possible that the effect of blurred vision in the eye with NLDO may be more apperent by time.

With regard to the results of the study, unilateral NLDO does not affect visual maturation. However visual maturation is critical at this period of childhood. A cautious ophthalmological examination, prompt diagnosis, adequate management and follow up examinations at proper intervals may provide favorable vision.

STUDY LIMITATIONS

Limitations of the present study were its retrospective design, limited study population and short follow up time.

CONCLUSION

Although unilateral NLDO does not seem to be a cause of amblyopia, a detailed ophthalmological examination should be performed at childhood. Future studies with larger study groups may provide more information about the children with unilateral NLDO.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Aysel Pelit;* ***Design:*** *Nedime Şahinoğlu Keşkek;* ***Control/Supervision:*** *Handan Canan;* ***Data Collection and/or Processing:*** *Nedime Şahinoğlu Keşkek;* ***Analysis and/or Interpretation:*** *Aysel Pelit, Nedime Şahinoğlu Keşkek;* ***Literature Review:*** *Aysel Pelit, Handan Canan;* ***Writing the Article:*** *Nedime Şahinoğlu Keşkek;* ***Critical Review:*** *Aysel Pelit;* ***References and Fundings:*** *Aysel Pelit;* ***Materials:*** *Nedime Şahinoğlu Keşkek, Handan Canan.*

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