Refractive Screening of Turkish Term Infants with a Handheld Autorefractometer

Miadında Doğan Türk Bebeklerde Refraktif Kusurların Taşınabilir Otorefraktometre ile Taranması

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ABSTRACT

Objective: It is important to detect the visual problems at its earliest period, in order to improve the quality of life of newborns. This study aimed to determine the refractive status of healthy term Turkish babies and to investigate whether there is a correlation between refractive status and birth weight.

Material and Methods: Two hundred and three healthy full-term babies at an age of postnatal 8 weeks were included in the study. In order to evaluate refractive status, handheld autorefractometer device was used in all subjects. The types of refractive errors were analyzed both in right and left eyes separately. Measurements taken under cycloplegic condition were analyzed for spherical equivalent, astigmatism and anisometropia.

Results: Hypermetropia was found as the most common refractive error among the participants (65% in right eyes, 62% in left eyes). With the rule astigmatism is found to be the most common astigmatic pattern in both eyes (75% in right eyes, 70% in left eyes). Anisometropia incidence was found to be 8%. No correlation between refractive status and birth weight was detected (p=0.105 r=-0.280).

Conclusion: Our outcomes provide a cross-sectional refractive data of a group of term Turkish infants and show that the hypermetropia is the most common refractive error. We did not detect a correlation between refractive error and birth weight, birth height, and gestational age. Therefore, all infants regardless of the gestational age and other parameters should be screened for refractive errors.

Key Words: Astigmatism, Birth Weight, Gestational age, Hypermetropia, Refractive error

ÖZ

Amaç: Yenidoğan bebeklerin yaşam kalitelerini artırmak için mümkün olan en erken dönemde görsel problemleri tespit etmek önemlidir. Bu çalışmada sağlıklı term Türk bebeklerde kırma kusurlarının varlığının ve miktarının belirlenmesi ve refraktif durum ile doğum ağırlığı arasında bir korelasyon olup olmadığının araştırılması hedeflenmiştir.

Gereç ve Yöntemler: Çalışmamıza Ocak 2018-Ağustos 2018 tarihleri arasında göz hastalıkları bölümüne rutin göz taraması için başvuran, postnatal yaşı 8 hafta olan, miadında doğmuş iki yüz üç sağlıklı bebek dahil edildi. Kırma kusuru varlığını ve miktarını değerlendirmek için tüm olgularda el otorefraktometre cihazı kullanıldı. Kırma kusurları hem sağ, hem de sol gözde ayrı ayrı analiz edildi. Sikloplejik koşullar altında yapılan ölçümler, sferik eşdeğer, astigmatizma ve anizometropi açısından analiz edildi.

Bulgular: Çalışma grubumuzdaki bebeklerde en sık kırma kusuru olarak hipermetropi saptandı (sağ gözlerde % 65, sol gözlerde % 62). Kurala uygun astigmatizma her iki göz için de en sık olarak rastlanan astigmatik paterndi (sağ gözlerde % 75, sol gözlerde % 70). Anizometri insidansı % 8 olarak bulundu. Kırma kusuru miktarı ile doğum ağırlığı arasında korelasyon saptanmadı (p = 0.105 r = -0.280).

Sonuç: Hipermetropi ve kurala uygun astigmatizma term doğan sağlıklı Türk bebeklerde en sık görülen kırma kusuru tipleri olup, bu bebeklerde kırma kusuru miktarı ile doğum ağırlığı arasında bir ilişki saptanmadı. Sonuç olarak, term bebeklerde tüm doğum parametrelerinden bağımsız olarak refraktif tarama yapılması refraktif hataların erken tespit ve takibi açısından önemlidir.

Anahtar Sözcükler: Astigmatizma, Doğum Ağırlığı, Gebelik yaşı, Hipermetropi, Kırma Kusuru

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Received / Geliş tarihi : 09.10.2019
Accepted / Kabul tarihi : 09.01.2020
Online published : 10.03.2020
Elektronik yayın tarihi
DOI: 10.12956/tchd.631370

INTRODUCTION

Refractive errors present at birth are associated with gestational age (1). Simple hypermetropia is the most common optical condition in term infants which reduces rapidly during the first year of life with the process of emmetropisation (1). Emmetropisation is completed in 82% of full term infants by 12 months of age (2).

Portable autorefractors are practical and useful tools for detecting refractive errors in infants, young children and preschoolers, both during screening and research. Nevertheless, measurements with these autorefractors without cycloplegia, especially in children, can be highly variable in terms of the reliability of refractive measurements (3-5).

Our purpose in this study was to investigate the refractive condition of healthy term Turkish infants under cycloplegic conditions using a handheld autorefractor device and to evaluate whether there is a correlation between the refractive status and the birth weight or gestational age.

METHODS

This is a retrospective cohort study. A total of two hundred and three healthy term babies at an age of postnatal 8 weeks (37-42 week of gestation, the mean gestation age was 39,1 weeks) who were presenting for routine eye examination in TOBB ETU Medical School Hospital, Ankara, Turkey from January 2018 to August 2018 were included in the study. Before making the measurements, written informed consent was obtained from the parents of the newborns. Ethical approval was obtained from the institutional research and ethics committee. This study was conducted in accordance with the Helsinki Declaration Principles and ethical approval was obtained from our Institution's Clinical Research Ethics Committee with the decision number 118/34 dated 20/03/2019.

Welch Allyn (software version 2.16 and 2.20; Welch Allyn Medical Products, Skaneateles Falls, NY) handheld autorefractometer device was used in all subjects. This handheld autorefractor has a working distance of 35 cm and based on a Shack-Hartmann wavefront analyzer. There is a fixation stimulus consisting of eight flashing green LEDs that surround a small, red central light in the shape of a circle. The device shows refractive status as sphere, cylinder and axis after taking 5-8 measurements.

Each baby received an ocular examination including cover and motility tests. Anterior segment examination was performed by hand-held biomicroscopy (SL-17; Kowa Ltd., Tokyo, Japan) and detailed posterior segment examination was performed by direct ophthalmoscopy in cycloplegic condition in order to rule out any congenital anomalies. Babies with ocular anomalies (nystagmus, strabismus, single or double ptosis) and whose parents had genetic eye diseases were excluded from the study.

Refractive errors were measured using hand-held refractometer 45-60 min after instillation of 1% cyclopentolate (Siklopleji n®, Abdi Ibrahim, Istanbul,Turkey) that was diluted by half. Astigmatism was defined as the within the rule astigmatism when the maximum refractive power was between 30 degrees (60 to 120 degrees) of the vertical meridian, and as against the rule astigmatism when the maximum refractive power was between 30 degrees (30 to 150 degrees) of horizontal meridian. Refractive error was recorded in the form of spherical equivalent (SE), where the SE = sphere + cylinder/2. Anisometropia was documented when there is more than 2.0 diopter difference of spherical equivalents between the two eyes. The mean values of mean spherical equivalent, astigmatism and anisometropia were analyzed.

Statistical Analysis

In order to define quantitative variables, mean ± standard deviation (SD) values were used. In addition, frequency and percentage values were used for nominal data. Shapiro Wilk's test was used to check normality assumption. Correlations were analyzed with Spearman's correlation analysis test. Statistical analyzes were performed using SPSS version 16.0 software and statistical significance was set at $p < 0.05$.

RESULT

The mean gestational age was 39.1 weeks (range: 37 - 42 weeks). The mean birth height was 50.2 ± 1H.1 cm and the mean birth weight was 3235 ± 389 g (min-max, 2840 - 4380 g) and the mean head circumference was 34.2 ±1.2 cm.

The types of refractive errors were recorded both in right and left eyes separately and the results are summarized in Table I. Hypermetropia was found as the most common refractive error among the subjects. Subject-wise distribution of refractive errors in right and left eyes were also shown in Figure 1. The design of astigmatism (with the rule, against the rule and without astigmatism) for both eyes were shown in Table II. 'With the rule astigmatism' is found to be the most common astigmatic pattern in both eyes. Percentage of eyes falling into different astigmatic magnitude groups (<1, 1-2, 2-3, 3-4) in right and left eyes were also shown (Figure 2). Fifty six percent of right eyes and 54% of left eyes had astigmatism magnitude less than 1 diopter (D). Five percent of right eyes and 4% of left eyes had astigmatism magnitude between 3D and 4D. Anisometropia

Table I: Refractive errors of the right and left eyes.

Refractive Errors	Right Eyes Number (Percentage)	Left Eyes Number (Percentage)
Hypermetropia	131 (65%)	126 (62%)
Myopia	57 (28%)	64 (32%)
Emmetropia	15 (7%)	13 (6%)

Table II: The pattern of astigmatism for right and left eyes.

Pattern of astigmatism	Right eye	Left eye
Within the Rule Astigmatism	153 (75%)	142 (70%)
Against the Rule Astigmatism	30 (15%)	31 (15%)
No Astigmatism	20 (10%)	30 (15%)

incidence was found to be 8% among the whole group. No significant correlation was observed between the refractive status and the birth weight (p=0.105 r=-0.280) (Figure 3).

DISCUSSION

Ametropia refers to a group of visual disorders caused by refractive errors of the eye and is associated with an increased risk of amblyopia and strabismus (6). In order to prevent ametropia related visual impairment, it is important to recognize the baseline values of refractive error at birth and the corresponding refractive changes during the developmental stages. We aimed to investigate the refractive status of healthy term Turkish infants at an age of postnatal 8 weeks to provide a population based refractive data. It is well-known that healthy term newborns are known to be hyperopic at birth (7). In concordance, hypermetropia was found to be the most common refractive state in term babies in our study (65% in right eyes and 62% in left eyes). Similarly, Varghese et al. showed that hypermetropia is the main refractive error in infants and that the higher the degree of prematurity, the lower the hypermetropia. In addition, myopia is commonly observed in infants under 28 weeks of gestation (8).

In our study, myopia higher than -2.75 D was not observed in any infants. This means that in term babies even if myopia is present it is not of a significant degree so that chances of emmetropisation can be achieved as the child grows.

The commonest type of astigmatism was 'with the rule astigmatism' (75% in right eyes and 70% in left eyes). Similar with our findings, in a study conducted by Cook et al. (9) found that the prevalence of within the rule astigmatism was 59% and against the rule astigmatism was 10.2% in term babies.

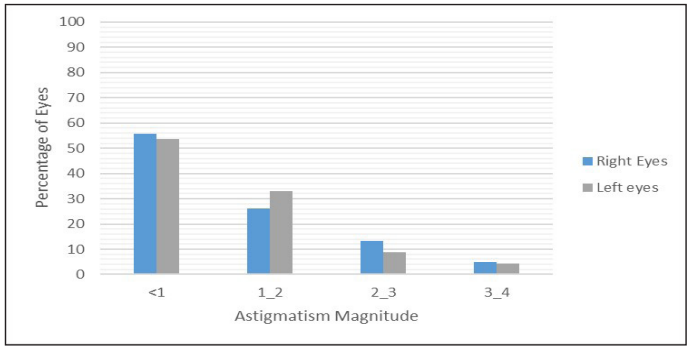

Figure 1: Percentage of eyes falling into different astigmatic magnitude groups in right and left eyes.

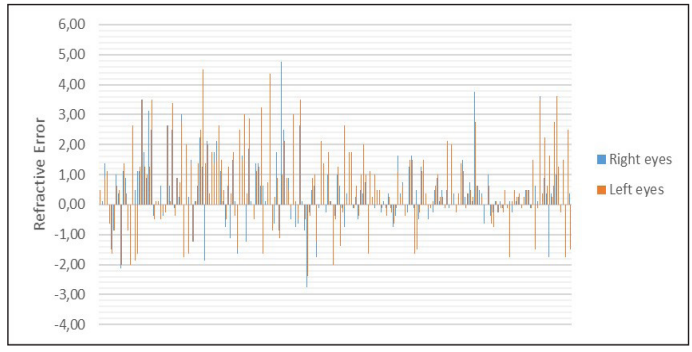

Figure 2. Distribution of refractive status in right and left eyes for each subject.

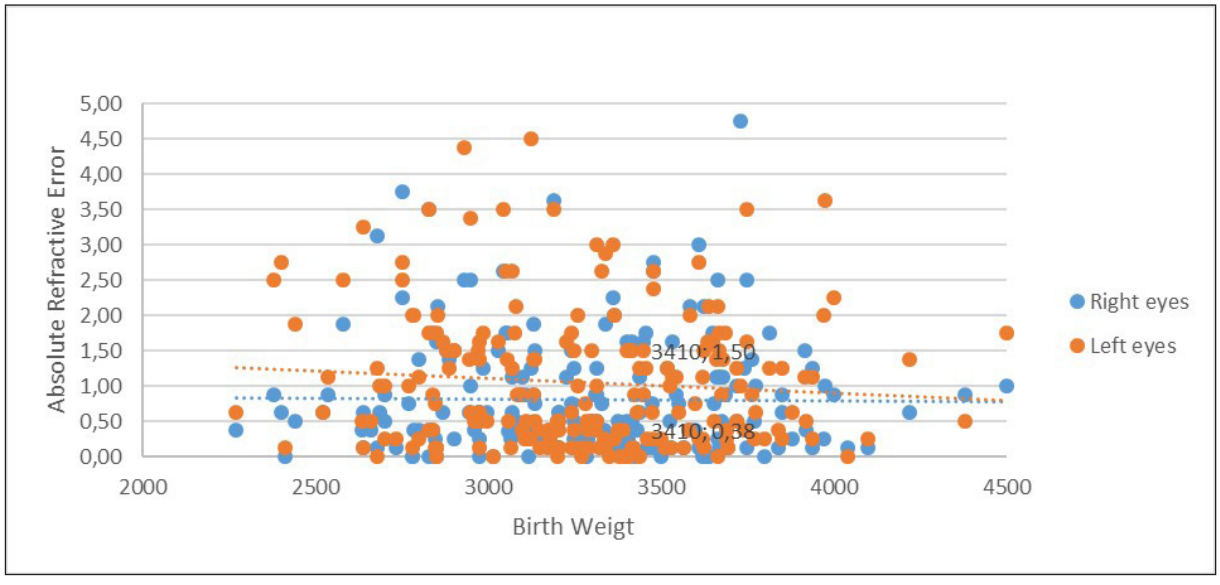

Figure 3: Distribution of refractive status according to the birth weight in right and left eyes.

The incidence of anisometropia was found to be 8% in this study population. It is known that anisometropia is a common problem in preterm babies rather than term babies. It was previously shown that in very low birth weight babies the incidence was found to be 29.2%, in low birth weight it is 19.2% and in normal weight babies 6.0% (8).

In this study, it was investigated whether there is a relationship between refractive errors and birth weight, birth height and gestational age. No correlation is shown in any of these parameters. Similarly, in a previous study, no correlation of astigmatism with birth weight, length or head circumference has been shown (8).

Previously it has been shown that birth weight is more correlated with refractive error in preterm babies compared to gestational age (9,10). Similarly, Varghese at al. (8) found that refractive error correlates better with birth weight more than it did to gestational age in preterm babies. Therefore, it is estimated that the effect of these two parameters on refractive status ceases once the infant reaches its term period.

It was previously shown that children who were hyperopic in infancy were 13 times more likely to become strabismic, and 6 times more likely to show measurable acuity deficits by 4 years, compared with controls (1). Early detection of hyperopia is important to prevent future visual disturbances (11). Hypermetropia was found to be the most common refractive state in term babies in our study population. Yet, the most important limitation of the current study is the lack of follow-up examinations of the babies to evaluate the refractive changes as babies grow. However, this study is important as it provides a cross-sectional refractive data of a group of term Turkish infants. A further study with larger sample size and longitudinal follow-up would be valuable to determine the tails of normal distribution and to evaluate developmental refractive changes of Turkish children.

CONCLUSION

Our outcomes provide a cross-sectional refractive data of a group of term Turkish infants and show that the hypermetropia is the most common refractive error. We did not detect a correlation between refractive error, birth weight, birth height, and gestational age. Therefore, all infants regardless of the gestational age and other parameters should be screened for refractive errors.

Compliance with Ethical Standards:

Conflict of Interest: On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

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