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# Refractive error status in cases of ROP

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**Aim:** To find out the refractive status in cases of ROP (stage 2) at one year of age.

**Materials and methods:** 88 eyes of ROP (stage 2) were included in this study, however, 80 eyes participated; these patients were initially examined during their neonatal period and were assessed for refractive error status at one year of age. Refraction was done under cycloplegia. These patients were having weight less than 1250 g at the time of birth.

**Results:** We found that 31.25% of the eyes were myopic, 48.75% were emmetropic and 20% were hypermetropic.

**Conclusion:** At one year of age patients of ROP stage 2 have a significant amount of refractive error, and myopia is more common than hypermetropia.

**Key words:** retinopathy of prematurity, myopia, emmetropia, hypermetropia

## INTRODUCTION

Retinopathy of prematurity is a vascular disease found in premature infants with retina which is incompletely vascularised. The sequels range from no effect on vision to total bilateral irreversible blindness. Refractive errors are part and parcel of lives of babies. While babies carried to term are hypermetropic in most cases, premature babies are usually found to be myopic or emmetropic (1). The risk of myopia increases in the presence of ROP. Moreover, eyes demonstrating ROP continue to exhibit signs of myopia. The status of ROP has been shown to be related to the degree and frequency of myopia occurrence (2–5). What is the cause of myopia in premature infants is not well understood, and the factors that may have a role, alone or in combination, include an increase in corneal curvature power (6–7), axial elongation (8–10) or a decrease in anterior chamber depth, and a higher refractive power of the lens (11).

In most of studies it has been stressed that the refractive status of these eyes stabilizes by one year of age, therefore the present study was aimed to find out the status of refraction in mild cases of ROP (regressed cases of ROP stage 2) at one year of age in Indian population.

## MATERIALS AND METHODS

Babies having birth weights of 1250 g or less or with a gestational age of 30 weeks or less underwent examinations between 4 and 6 weeks of chronological age. Informed consent was obtained from the parents of all participants before testing. Retina specialist (BPG) examined all cases and confirmed the diagnosis of ROP. The funduscopy results of the preterm babies were classified according to the international classification of ROP (12).

Also, we conducted refractive error examination under cycloplegia in all cases of regressed ROP stage 2 at one year, i.e patients with a history of ROP but whose condition had completely disappeared without leaving cicatricial retinopathy, regardless of treatment. We included 88 eyes for this study, however, we were able to follow up only 80 eyes. This study was conducted at a tertiary eye care center from 2000 to 2002. The cycloplegic refraction was conducted with instillation of 2.5% phenylephrine and 1% tropicamide three times at 5-minute intervals. When cycloplegia and dilatation of the pupils were sufficient, the test was conducted with retinoscopy. All patients who were uncooperative were sedated. The refractive values, including astigmatic power (plus cylinder) and axis, were converted to spherical equivalents, The refractive value was recorded as a spherical equivalent, and myopia was defined as high when the spherical equivalent was equal to or higher than –4.0 dioptres. Other studies have taken –6 as high myopia. Eyes were classified into the following three groups: M-0 (no myopia) consisted of eyes with emmetropia; M-1 (no high myopia) comprised eyes of below –4.0 dioptres myopia; and M-2 (high myopia) included eyes with myopia at a degree equal to or higher than –4.0 dioptres. Similarly, eyes in the hypermetropia group were classified as H-1 eye with hypermetropia less than 4 dioptres and H-2 hypermetropia more than 4 dioptres. The four prism dioptre criterion was used, as in our country in medical examination for fitness for technical group of services, cases of less than 4 dioptres can be

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cleared by a single ophthalmologist, while candidates having more than 4 diopter refractive errors are examined by a special board of three ophthalmologists, and it decides their fitness.

Babies with other ocular abnormalities, developmental delay, neurological anomalies or any other syndrome were excluded. Babies with a family history of high refractive error were also excluded.

## RESULTS

A total of 88 eyes were recruited for this study, however, 4 patients were excluded from it. A total of 80 eyes of 40 patients were examined (56 eyes of 28 males and 24 eyes of 12 females). Cycloplegic refraction was conducted on all eyes at one year. In accordance with the ROP-based classification, all eyes had ROP stage 2 at the initial examination. However, at the follow up at one-year condition had completely disappeared without leaving cicatricial retinopathy, regardless of treatment.

According to the classification based on the spherical equivalent determined through a cycloplegic refraction conducted at one year of age, 39 (48.75%) eyes were classified into the M-0 group (eyes with emmetropia), 18 eyes (22.5%) were classified into the M-1 group (eyes with myopia below –4.0 dioptres), and 07 eyes (8.75%) were classified into the M-2 group (eyes with myopia above –4.0 dioptres). Twelve eyes (15%) belonged to H-1 group, i.e hypermetropia less than 4 dioptres and 4 (5%) eyes were in H-2 group, i. e. hypermetropia more than 4 dioptres.

The mean cycloplegic refraction in spherical equivalents group – M-1 was 1.05 D, while in M-2 it was 4.5 D. On the other hand, in group H-I it was 1.0 D and in 4.68 D group H-2. The mean astigmatism was less than one dioptre in all the groups. The most common axis for astigmatism was 90 degrees.

## DISCUSSION

It is generally agreed that refractive errors are part and parcel of lives of premature babies. Furthermore, the degree and frequency of myopia are proportional to changes in cicatricial retinopathy (13–16), but there remains some controversy over the refractive abnormalities in eyes in which ROP disappeared spontaneously. There are some studies which say that this status is not different from premature babies, while others say that they have a higher incidence of myopia irrespective of ROP status. While Schaffer et al. (17) and Kim et al. (15) report finding the degree and frequency of myopia in these cases to be similar to those in eyes without ROP, Fledelius (18) and Holmström et al. (19) maintain that the frequency of myopia was high in premature infants regardless of ROP. The mechanisms of myopia in premature infants are not clearly understood. Shapiro et al. (20) have reported a finding of no refractive change related to prematurity in subjects without ROP ranging in age from 6 months to 3.5 years. According to a longitudinal observation of refractive values in prematurely born subjects, prematurity-related myopia occurs at a relatively early stage in life, continuing from 6 months of age to 3 years and stabilizing thereafter. Gallo et al (10) concluded that in children born preterm the corneal refractive power seems to play a major role in myopia development.

In contrast, Quinn et al. (21) have reported finding that the refractive status in prematurely born infants changed to myopia between the ages of 3 months and 1 year but did not change thereafter. Furthermore, it is said that refraction stabilizes in these eyes by one year of age, that is why the present study was conducted at one year of age. In this study, 39 (48.75%) eyes were classified into the M-0 group (eyes with emmetropia), 18 eyes (22.5%) were classified into the M-1 group (eyes with myopia below –4.0 dioptres), and 7 eyes (8.75%) were classified into the M-2 group (eyes with myopia above –4.0 dioptres). 12 eyes (15%) belonged to group H-1, i.e hypermetropia less than 4 dioptres and 4 eyes (5%) were in group H-2, i.e hypermetropia more than 4 dioptres. One important aspect in our study is presence of hypermetropia, 20% of eyes were hypermetropic, and this aspect should be kept in mind, because in children hypermetropia is more associated with amblyopia than myopia and needs correction. The presence of hypermetropic refractive error has not been emphasized in other studies. The second aspect of this study is that in most of cases, refractive error was small and astigmatism was less than one dioptre in all the groups. High myopia and hypermetropia were seen in a comparatively less number of patients, and the difference in the amount of refractive error in the myopia and hypermetropia groups was not statistically significant.

There are controversies regarding the influence of cryotherapy on prematurity-related myopia. Some studies report an association of myopia with cryotherapy (22). According to studies by Nissenkorn et al. (23), no difference in the degree and frequency of myopia was found between the eyes that had cicatricial retinopathy without treatment and the eyes that had cicatricial retinopathy after cryotherapy, which suggests that cryotherapy itself did not cause myopia. We did not study this aspect, so we cannot comment on it. There is also a debate which of the refractive elements, including the keratometric value, depth of anterior chamber, thickness of lens, and axial length, have an influence on the overall refractive status in cases of prematurity-related myopia. The occurrence of myopia is related more strongly to whether or not there is cicatricial retinopathy than whether or not there is cryotherapy. Also, the degree of myopia was found to be related to the depth of the anterior chamber, the thickness of the lens, and the change in axial length but not to keratometric value (24). We did not study these, so we cannot comment on them.

## CONCLUSION

Findings of our small study suggest that refractive error is quite common in regressed cases of stage 2 ROP, though myopia is more common than hypermetropia. Hypermetropia is also present in a significant number of patients.

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