

# Retinoscopy Values and Contact Lens Application in Rehabilitation of Infantile Aphakia

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## ABSTRACT

**Purpose:** Infantile cataracts are among the important conditions that cause amblyopia related visual impairment in childhood. There are difficulties of obtaining accurate measurements of aphakic corrections in babies after cataract extraction. For infant aphakia, when measurements cannot be taken, there are some recommendations for using contact lenses of +32.00 D for babies up to 6 months and +29.00 D for babies of 6-12 months. A study was conducted to test the accuracy of these recommendations and it was intended to make some recommendations for the development of rehabilitation of infantile aphakia.

**Material and Methods:** The files of the babies, younger than 12 months, whom cataract extraction was performed and retinoscopic values were determined, between May 2010 and April 2013, were reviewed.

**Results:** Of the 36 patients, whose files were accessed, 24 were male and 12 were female; the mean age was 5 months and ages ranged from 1 month to 11 months. The retinoscopic values of the patients were between +7.25 D and + 21.50 D; mean and standard deviation of spherical equivalents were + 16.38±2.92 for right eyes; and + 16.26±3.03 for left eyes. Considering the vertex correction and visual spheres of the patients, the majority of the contact lens values were ranged between +18.00 and +28.00 D.

**Conclusion:** The recommendations of correction of infantile aphakia with +32.00 D contact lenses up to 6 month infants and +29.00 D for 6-12 months infants are inappropriate. If these recommendations are applied, up to +10.00 D of different correction might be found in the patients in the research group. Although the standard degree of contact lenses could be used in cases where measurements cannot be taken; accurate contact lens measurement should be performed in the earliest possible time and best possible contact lens degrees should be prescribed to the aphakic infants.

**Keywords:** Infantile aphakia, Retinoscopy, Amblyopia, Rehabilitation, Contact lens.

## INTRODUCTION

Childhood cataracts are considered among diseases that cause preventable vision loss. Based on foreign data, it can be estimated that annually 180 to 900 (500 in average) new pediatric cataract cases are seen in our country.<sup>1,2</sup> Infantile cataracts requires approaches differing from those in adult cataract due to reasons such as rapid development of optic system, inflammatory response, being critical period in maturation of visual function and causing strabismus.<sup>3-6</sup> In pediatric cataracts, it can be possible to achieve visual potential of child via aphakia correction appropriate to condition of patient by meticulous surgical technique, appropriate medication and amblyopia, in other words, rehabilitation process .

Currently, it is known that contact lens (CL) has major

advantages compared to intraocular lens (IOL) following unilateral cataract surgery.<sup>7</sup> There are advantages including less adverse effect and need for secondary intervention in CL group. In addition, no significant difference was detected median visual acuity values within 5 years after surgery in CL group.<sup>7</sup> Thus, it is generally accepted that aphakia correction using CL is more safe and preferable option in infantile cataract compared to correction using IOL.

Although correction using CL has advantages, there are major challenges in determination of CL appropriateness by measurement of refractive state due to failure in correct measurements in infants. Because of challenges in determination of CL value and appropriateness, there are recommendations and practices regarding use age-based

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contact lens parameters in aphakia correction in pediatric patients. Based on these suggestions, it is recommended to use +32.00 D CL within first 6 months and +29.00 D CL at 6-12 month. In this study, it was aimed to appropriateness of these recommendations regarding determination of age-adjusted CL value by measuring retinoscopy values in patients with infantile cataract. In addition, our manuscript proposes some practical recommendations regarding habilitation and rehabilitation processes in children with infantile cataract in Turkey.

## **MATERIAL-METHOD**

In this study, we reviewed post-operative retinoscopy values and other data of infants aged <12 months who underwent cataract extraction and became aphakic at Ophthalmology Department of Yuzuncu Yil University University School of Medicine between May, 2010 and April, 2013. All parents gave written informed consent before surgery. Surgical indication was determined in cataracts defined to be larger enough to cover visual axis of patients by clinical appearance and retinoscopy. In surgery, anterior capsulorhexis (5 mm in size) by administration of viscoelastic material following corneal incision under general anesthesia; followed by lens aspiration via bimanual irrigation from 2 corneal side-port incisions. Then, anterior vitrectomy was performed via viscoelastic material-assisted posterior capsulotomy/capsulorhexis and ocutome; and 1-3 sutures were used to close incision sites in order to prevent leakage.

Neutralization retinoscopy was performed within 1-7 days following surgery and refractive state was determined. Measurements were made under anesthesia in infants who will undergo general anesthesia for a second intervention or suture removal while awoken in children in whom retinoscopy was feasible. Due to importance of vertex distance, it was attempted to maintain vertex distance of 12 mm in both eyes, which is accepted as eye glass plane. Retinoscopy values at horizontal and vertical axes were determined by subtracting working distance adjustment from diopter value where retinoscopy reflection was neutralized. After estimation of retinoscopy value, spherical equivalents were defined and CL value was determined by taking "visual sphere", visual area of interest based on vertex distant correction and age, into account.

The "Visual sphere" is defined as the area where infant display visual interest.<sup>8</sup> For instance, visual interest is directed to hand at 3 months of age while it may reach up to a few meters at 1 year of age. Accommodation standard value was added to eyeglass and CL value in order to achieve focusing on nearer objects since infant has no accommodation due to aphakia. Visual sphere is

approximately 20-50 cm in diameter in infants with visual interest to hand and toys in his/her hands during first month of life; correction was made based on visual sphere of 50 cm-2 m in diameter in infants with visual interest directed to more distant area. The study was approved by Ethics Committee of Yuzuncu Yil University (approval date: 28.12.2016; approval# 5).

## **FINDINGS**

Of 36 patients with files available, 24 were boys and 12 were girls. Mean age was 5 months ranging from 1 to 11 months. It was seen that retinoscopy values ranged from +7.25 D to +21.50 D. Hastalarin retinoskopik degerlerinin +7.25 D ile + 21.50 D. Mean spherical equivalents were + 16.38 ± 2.92 for right eyes and + 16.26 ± 3.03 for left eyes. (Table 1). In our study group,

CL value was approximately +10 D in an infant with retinoscopic value of +7.25 when vertex correction and visual sphere were taken into account. In addition, a CL value up to +31.00 D was required in a patient with retinoscopic value of +21.50 D when vertex correction and visual sphere were taken into account. Given the vertex correction and visual spheres of the patients, the majority of the contact lens values were ranged from +18.00 to +28.00 D.

It was seen that an inaccurate correction up to 10 D occurred when CL recommendation of +32.00 D within first 6 months and +29.00 D at 6-12 months in infants in our study group. In children with normal ocular structure, +3.00 D of anisometropia is within range that can cause amblyopia; however, it is apparent that visual rehabilitation will be highly challenging and that significant visual gain cannot be achieved in case of correction failure up to +10.00 D.

## **DISCUSSION**

As visual development is ongoing in children, delay in cataract surgery and aphakia correction as well as failure in rehabilitation process can lead irrecoverable vision loss. In infants who are at critical period for visual development, a few weeks without aphakia correction have potential to disrupt visual due to blur image over retina.

Thus, rehabilitation process including aphakia correction and amblyopia treatment is as important as excellence of surgical technique in pediatric cataract cases where IOL could not be implanted. Although these procedures are termed as rehabilitation in infantile aphakia, we think that it will more accurate to term this process as habilitation in congenital cataract since majority of cases have no previous experience of vision.

**Table 1.** Spherical equivalents and their frequency in study group.

Right Eye Spherical Equivalent	Frequency	Left Eye Spherical Equivalent	Frequency
+8.75	1	+ 7.25	1
+10.00	1	+ 11.00	1
+11.00	1	+ 12.50	1
+14.00	4	+ 13.00	2
+15.00	3	+ 13.50	1
+16.00	4	+ 14.00	3
+17.00	6	+ 15.00	4
+17.75	1	+ 16.00	1
+18.00	4	+ 17.00	8
+20.00	5	+ 18.00	4
+21.50	1	+ 19.00	1
		+ 20.00	5
		+ 21.50	1
not-available*	5	not-available	3
Total	36	Total	36

\*Patients not measurable and didn't come for control exams.

In our country, there were recommendations for age-CL use according to age (months) and it is seen that these recommendations are applied in lesser extent. According to these recommendations, CL correction is applied as +32.00 D up to 6 months and +29.00 D at 6-12 months. Although it is emphasized that these recommendations are valid in conditions where measurement could not be achieved, it can be still observed that standard CL value is applied without attempting for measurement. Our study showed that it is inappropriate to determine CL value according to infant's age.

Bases on results in Infant Aphakia Treatment Study (IATS), one of the largest studies on infantile cataract in recent years, baseline refractive state was found as %18.59 D in average in patient left aphakic. Again, it was seen that baseline refractive state ranged from +12.46 D and +25.36 D with standard deviation of 2.84 D. Given these values, it is considered that CL values ranging from +14.00 to +40.00 D are required. The results are in agreement with our study, indicating age-adjusted CL is not valid.<sup>9</sup>

Retinoscopy remains to be most reliable method in selection of eyeglass and contact lens degree by determination of refractive state in aphakic infants.<sup>10</sup> As determination of appropriate correction value is highly effective in visual function, retinoscopic measurement should be performed as meticulously as possible with patience. If retinoscopic measurement cannot be achieved while patient is awake, examination under sedation should be considered. Since reliability of measurement under sedation varies, it is

attempted to performed measurement while the patient is awake.

Even CL is prescribed to infant, eyeglass should have to be preferred in unilateral or bilateral cataracts, This can provide more clear image on retina when CL use is not possible. In addition, retinoscopic measurement over eyeglass is easier. In the treatment of normal amblyopia, eyemasking duration is determined according to age. However, vision is markedly low in unilateral infantile cataract; thus, infants can exhibit significant reaction to masking. In such cases, it should be prefer to follow masking recommendations according to age.

In the literature, mean keratometry values have been reported as 46.3±2.8 D in baseline measurements, 44.6±2.3 D at year one and 44.3±1.75 D at year 5 in pediatric cataracts. Again, keratometric astigmatism of 1.98±1.37 has been detected in baseline measurements of infants.<sup>11</sup> The parents should be instructed that, following CL correction, there may be need to correct remaining astigmatism and refractive error if required.

It is recommended to prescribe CL based on estimated values by some authors when failed to measure radius of corneal curvature.<sup>10,12</sup> It is suggested that radius varies from 7.1 and 7.4 for neonatal infants and that it should be increased after 6 months. If keratometry measurement can be performed, it is recommended that CL should have a radius of curvature 0.3 smoother than mean K value and that CL diameter should be larger by 2-3 mm than cornea.<sup>10,12</sup>

These recommendations are valid for silicone elastomer lenses and it should be anticipated that keratometry and cornea diameter will be increased while retinoscopy value will be decreased by advancing age; thus, CL parameters should be controlled according to such changes.<sup>10,12</sup>

The IATS has reported that 7.5 mm is applied as primary curvature value at baseline in most cases (90%).<sup>11</sup> In IATS study, it is recommended to control horizontal or vertical central localization by fluorescein dye and Cobalt blue.

It has been reported that lenses should cover cornea and limbus; have central localization and be mobile allowing lacrimal fluid. Although it is almost impossible to meet such conditions without anesthesia in infancy and younger ages, it is important to attempt lens centricity and mobility regarding lens use without complication.

It should be preferred to repeat measurement after inserting the lens estimated to be appropriate when determining CL value in infantile aphakia. Due to higher elasticity of cornea in infants, it can be seen that lens affects corneal refractivity after insertion of silicone elastomer contact lens, requiring alteration of CL value. It should be preferred to perform masking by eyeglasses over CL. It can be surprising to parents that expensive contact lens supplied without trial is incompatible. Thus, it is needed for provision trial lenses in a wide range by supplier and contribution of insurance services to CL costs in pediatric aphakia. In addition, clinicians should emphasize importance of contact lens provision in appropriate diversity and timely manner by discussing suppliers and health authorities.

In studies evaluating long-term visual acuity in children underwent cataract surgery, there are some variations in mean visual acuity. Ledoux et al.<sup>13</sup> reported visual acuity >20/40 (0.5) in 75% of patients while rate of patients with visual acuity 20/60 was reported as 60% in a Mexican study.<sup>14</sup> There is a significant difference in success rate between these studies, which is explained by the difference in economical and medical development level.<sup>15</sup> In studies evaluating long-term visual function in children with infantile cataract in Turkey, final visual acuity seems to be low.<sup>6,16</sup> In most comprehensive study on infantile cataract, visual acuity <20/200 can be achieved in approximately half of patients using CL.

It should be expected that visual function can be at lower

levels in children who underwent surgery within first year where surgery is more challenging with higher likelihood of complication and amblyopia. Thus, all interventions should be performed in timely manner in childhood cataract that carries significant potential for visual disability and amblyopia and it should be attempted to gain all possible visual gains. In addition, parents should be informed that vision could not develop normally and there is likelihood of strabismus.

As such, realistic expectations should be created to decrease concerns and disappointment of parents if visual loss or amblyopia occur.

There are significant challenges in prescription of appropriate pediatric aphakic contact lenses and their use. CL degree according to age, which is still seen in clinical practice should be reserved as last resort and it should be attempted to perform correction appropriate to refractive state as soon as possible. The fact that there is a significant difference between retinoscopic value and vertex correction, need for portable keratometry and limitations in trial lenses make correct prescription of pediatric aphakic contact lens. In addition, the fact that contact lenses are expensive and require several weeks for provision make visual rehabilitation challenging. Despite all these difficulties, meticulous approach can make it possible to proceed habilitation and rehabilitation processes in childhood cataract and infants can achieve their visual potential.

In conclusion, it can be suggested that vision loss or visual disability due to childhood cataract and other causes could not be completely prevented. However, it is possible to decrease vision loss and strabismus due to infantile cataract by appropriate measure. Due to longer life expectancy in children, treatment success becomes more important in childhood cataract. It is possible to reduce vision loss, amblyopia and strabismus resulting from infantile cataract by establishing correct approaches and providing sufficient rehabilitation.

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## REFERENCES

1. Ozdemir G, Karel F. Konjenital Kataraktlar: Epidemiyoloji, Siniflama, Etiyopatogenez. T Klin J Ophthalmol. 1999; 8:135-41.
2. Ceyhan D, Yasar T, Caglar C. Cocukluk cagi gorme kayiplari azaltilabilir mi? Turk J Ophthalmol. 2013. 43:3; 195-201.
3. Recep OF, Hasiripi H. Cocukluk cagi kataraktlarında tedavi ve gorsel rehabilitasyon. Turkiye Klinikleri J Ophthalmol 1994; 3 (2): 153-60.
4. Aktas Z, Hondur A, Ozdek S, Onol M. Pediatrik katarakt cerrahisinde guncel yaklasimlar. Glo-Kat; 2010; 5:1-5.
5. Forbes BJ, Suqin G. Update on the surgical management of pediatric cataracts. J Pediatr Ophthalmol Strabismus. 2006;43:143-51.
6. Yilmaz SG, Bozbiyik DI, Kose S ve ark. Tek taraflı cocukluk cagi kataraktli olgularımızda katarakt cerrahisinin gec donem sonuclari. Turkish J Ophthalmol 2012;42:103-10.
7. The Infant Aphakia Treatment Study Group. A Randomized Clinical Trial Comparing Contact Lens to Intraocular Lens Correction of Monocular Aphakia During Infancy: HOTV optotype acuity at age 4.5 years and clinical findings at age 5 years. JAMA Ophthalmol. 2014;132: 676-82.
8. Hyvarinen L. Vision Evaluation of Infants and Children. in Lighthouse Handbook on Vision Impairment and Vision Rehabilitation Vol II.ch 43. Eds. Silverstone B, Lang M.A. Rosenthal B.P. Faye E.E.Oxford University Press New York. 2000: 799-831
9. Lambert SR, Cotsonis G, DuBois L et al. Infant Aphakia Treatment Study Group. Comparison of the rate of refractive growth in aphakic eyes versus pseudophakic eyes in the Infant Aphakia Treatment Study. J Cataract Refract Surg. 2016;42:1768-73.
10. Lindsay RG. Contact lens management of infantile aphakia. Clin Exp Optom 2010; 93:13-4.
11. Russel B, DuBois L, Lynn M et al. Infant Aphakia Treatment Study Group. Infant Aphakia Treatment Study Contact Lens Experience to Age 5 years. Eye Contact Lens. 2017;43:352-7.
12. Speedwell L. Contact lenses for children. Hoyt CS, Taylor D. In Pediatric Ophthalmology and Strabismus (4th Edition). Philadelphia; Elsevier Limited.2013:1045-50.
13. Ledoux DM, Trivedi RH, Wilson ME et al. Pediatric cataract extraction with intraocular lens implantation: visual acuity outcome when measured at age four years and older. J AAPOS 2007; 11:218–24.
14. Congdon NG, Ruiz S, Suzuki M et al. Determinants of pediatric cataract program outcomes and follow-up in a large series in Mexico. J Cataract Refract Surg 2007; 33:1775–80.
15. Lin AA, Buckley EG. Update on pediatric cataract surgery and intraocular lens implantation. Current Opinion in Ophthalmology 2010, 21:55–9.
16. Sari A, Adiguzel U, Kurtulus UC ve ark. Pediatrik kataraktlarda cerrahi yaklasim ve kısa donem sonuclarimiz. Glo-Kat 2008; 3:171-5.