Anatomic and Refractive Outcome After Laser Photocoagulation for Type-1 Prethreshold Retinopathy of Prematurity at a Tertiary Center in Turkey

Türkiye'de Üçüncü Basamak Bir Merkezde Tip-1 Eşik Öncesi Prematüre Retinopatisinde Uygulanan Lazer Fotokoagülasyon Sonrası Anatomik ve Refraktif Sonuçlar

Murat GÜNAY,[a]
Gökhan ÇELİK,[a]
Betül ÖNAL GÜNAY,[b]
Hüsnü Fahri OVALI,[c]
Cenap Mahmut ESENÜLKÜ[d]

Clinics of
[a]Ophthalmology,
[c]Neonatology,
Zeynep Kamil Maternity and Children's Disease Training and Research Hospital,
[b]Clinic of Ophthalmology,
Ümraniye Training and Research Hospital, İstanbul
[d]Clinic of Ophthalmology,
Trabzon Kanuni Training and Research Hospital, Trabzon

Geliş Tarihi/*Received:* 30.06.2014
Kabul Tarihi/*Accepted:* 13.09.2014

Yazışma Adresi/*Correspondence:*
Murat GÜNAY
Zeynep Kamil Maternity and Children's Disease Training and Research Hospital,
Clinic of Ophthalmology, İstanbul, TÜRKİYE/TURKEY
drmurat301@yahoo.com.tr

ABSTRACT Objective: To evaluate the anatomic and refractive outcomes 1-year after successful laser photocoagulation (LPC) for Type-1 prethreshold retinopathy of prematurity (ROP) at a tertiary center in Turkey. **Material and Methods:** The study group included infants with Type-1 prethreshold ROP who underwent LPC treatment. The control group included infants who had successfully regressed Type-2 prethreshold ROP without any anatomic sequelae. After 1-year anatomic and refractive outcomes of the eyes were assessed. **Results:** The study group included 41 infants [(82 eyes; mean gestational age (GA): 28.4±2.03 weeks, mean birth weight (BW): 1115.02±330.88 g)] and the control group included 39 infants (78 eyes; mean GA: 28.5 ± 2.05 weeks; mean BW: 1175±285.56 g). Both groups did not differ significantly in GA, BW and follow-up period ($p>0.05$). The postconceptional age (PCA) at the time of LPC treatment was 36.10±1.50 weeks. The mean number of laser spots applied per eye was 1184.56±299.31. At the end of corrected 1-year age, refractive error was significantly less myopic in control group (1.95±1.42D) compared to study group (-0.32±2.22D) ($p<0.05$). Eyes with Zone I ROP were more myopic compared to eyes with Zone II ROP ($p<0.01$) The prevalence of high myopia was 4.9% in study group. **Conclusion:** All children in our study did not develop any anatomic sequelae at the end of the study. Risk factors for myopia in Type-1 prethreshold ROP were Zone I involvement and greater number of laser spots.

Key Words: Laser coagulation; retinopathy of prematurity; refraction, ocular; treatment outcome

ÖZET Amaç: Türkiye'de üçüncü basamak bir merkezde Tip-1 eşik öncesi prematüre retinopatisinde (PR) uygulanan başarılı lazer fotokoagülasyon (LFK) sonrası birinci yılda anatomik ve refraktif sonuçları değerlendirmek. **Gereç ve Yöntemler:** Lazer tedavisi gören Tip-1 eşik öncesi PR olguları çalışma grubunu oluşturmakta idi. Kontrol grubunda ise anatomik sekel gözlenmeyen spontan regrese Tip-2 eşik öncesi PR olguları mevcuttu. Prematüre olguların gözlerine ait anatomik ve refraktif sonuçlar 1 yıl sonunda değerlendirildi. **Bulgular:** Çalışma grubunda toplam 41 bebek olgu mevcuttu (82 göz, ortalama doğum haftası (DH): 28,4±2,03 hafta; ortalama doğum ağırlığı (DA): 1115,02±330,88 g). Kontrol grubunda ise toplam 39 olgu mevcuttu (78 göz, ortalama DH: 28,5±2,05 hafta; ortalama DA: 1175±285,56 g). İki grup arasında DH, DA ve takip süreleri açısından herhangi bir farklılık yoktu ($p>0,05$). Lazer tedavisi 36,10±1,50 postkonsepsiyonel haftada (PKH) uygulandı. Göz başına uygulanan lazer spot sayısı 1184,56±299,31 idi. Düzeltilmiş 1 yaşında refraksiyon, kontrol grubunda (1,95±1,42D) çalışma grubuna (-0,32±2,22D) kıyasla anlamlı olarak daha az oranda miyopik idi ($p<0,05$). Zon I PR olan gözler Zon II PR olan gözlere oranla daha miyopik idi ($p<0,01$). Çalışma grubunda yüksek miyopi sıklığı %4,9 idi. **Sonuç:** Çalışma sonunda hiçbir çocukta herhangibir anatomik sekel gözlenmedi. Tip-1 eşik öncesi PR'de gözlenen myopi açısından risk faktörleri Zon I tutulum ve yüksek lazer spot sayısı olarak bulundu.

Anahtar Kelimeler: Lazer koagülasyon; prematüre retinopatisi; refraksiyon, oküler; tedavi sonucu

Turkiye Klinikleri J Ophthalmol 2014;23(4):222-7

Retinopathy of prematurity (ROP) is a proliferative vascular disorder of the retina and it is a major cause of childhood blindness in developed and developing countries. It affects infants born with early gestational age (GA) and low birth weight (BW).[1]

The treatment of the disease has been established in CRYO-ROP (The Cryotherapy for Retinopathy of Prematurity) study and cryotherapy in threshold ROP revealed a rate 44% of unfavorable outcome at the end of 1-year follow-up.[2] However, subsequent studies reported a higher incidence of unfavorable structural and functional results after treatment of threshold ROP either by cryotherapy or laser photocoagulation (LPC).[3-7]

The guidelines for the treatment of the disease have changed after ETROP (Early Treatment for Retinopathy of Prematurity) trial and LPC has become the main treatment modality of ROP. This study identified patients as Type-1 and Type-2 prethreshold ROP and recommended treatment for Type-1 prethreshold ROP that had a high risk of progression. Furthermore, this was the touchstone study displaying better structural and functional outcomes in the management of ROP. Thus, unfavorable functional results showed a reduction from 19,5% to 14,5% and unfavorable structural outcomes were reduced from 15,6% to 9,1%.[8]

Subgroup analysis from ETROP study revealed reduced unfavorable anatomic and functional outcomes with early treatment of Type-1 prethreshold ROP.[9] But no information exists in the literature about the clinical outcomes after laser treatment for Type-1 prethreshold ROP from our country. Herein, this study demonstrates the anatomic and refractive results of eyes with Type-1 prethreshold ROP after laser treatment during a 1-year follow-up period at a tertiary center in Turkey.

MATERIAL AND METHODS

The study was carried out in Zeynep Kamil Maternity and Children's Diseases Training and Research Hospital which is one of the largest ROP screening and treatment center in Turkey. A local ethical approval was taken for the study. And the study was concordant to the tenets of the Helsinki Decleration. Several parameters were evaluated including; gestational age (GA) and birth weight (BW) of the neonates, zone and stage of ROP, time of the disease regression, postconceptional age (PCA) at the time of laser treatment, number of laser spots applied for each eye, retinal structural findings and refractive measurements.

A detailed informed consent was obtained from all parents before the laser procedures. A near-confluent laser ablation was performed in all patients with a diode laser device (Iridex; Oculight SL, Mountain View, 810-nm infrared laser ,CA, USA) under topical anesthesia by using a 28-D condensing lens. Laser treatments were performed under supervision of a neonatologist and no infant developed any systemic deterioration during treatments. All patients were ordered topical antibiotic and steroid drops for one week postoperatively. The early postoperative follow-up was done at one week. Plus disease disappeared and inactivation of ROP was achieved successfully in all eyes at the end of first week after treatment. There was no per- or post-operative complication seen during the study period.

The follow-up examinations were performed by ophthalmologists experienced in ROP screening and treatment (M.G and G.C). The anatomic and functional outcome of all patients including refractive error, retinal structural sequelae, presence of strabismus, anisometropia or nystagmus were evaluated at 1-year corrected age.

ASSESSMENT OF ANATOMIC AND REFRACTIVE STATUS

A detailed retinal examination was performed in all visits. The presence of retinal anatomic sequelae such as dragging of disc, narrowing of arcades, vitreoretinal membranes, localized tractional tissues or retinal detachment were studied. The follow-up scheme for retinal anatomic evaluation included weekly visits after laser therapy until a complete regression of the neovascularizations and plus disease in study group. Two to three weeks and subsequent monthly visits ensued up to 4 months postnatally until ensuring the clinical stabilization

of the retina. Similar follow-up procedure was executed for the infants in control group who did not require laser treatment.

At corrected 1-year age, all infants were screened for refractive disorders and retinal situation. The refractive statement of the patients were assessed by cycloplegic retinoscopy or automatic refractometry (Welch Allyn; Sure Sight Autorefractor, New York, USA) 30 minutes after instilling 1% cyclopentolate hydrochloride twice with 10 minutes intervals. Spherical equivalent (SE) measurements were used in the present study. The refractive error was classified as myopia (SE ≥-0.25 D) and hyperopia (SE ≥0.25 D). For the design of the current study, high myopia was defined as SE ≥5D and mild to moderate myopia as SE <5D.

NCSS (Number Cruncher Statistical System) 2007&PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA) programme was used for the ststistical analysis. Descriptive statistical data were given as mean, standart deviation, median, frequency, minimum and maximum. Student t test was used in comparison of normally distributed data and Mann Whitney U test was used to compare nonparametric values. Spearman's correlation test was performed for the correlation between the two continuous variables. $p<0.01$ and $p<0.05$ were both considered statistically significant.

RESULTS

Totally 80 infants were retrieved for this retrospective study. The study group consist of 82 eyes of 41 infants who had bilateral LPC treatment and the control group included 78 eyes of 39 infants who had successfully regressed Type-2 prethreshold ROP with no need of LPC treatment. The distribution of GA and BW of the infants and the clinical characteristics of the study group were given in Table 1 2. The mean number of laser spots in Zone I ROP was 1686.78±355.51 (1235-2100) and in Zone II ROP was 1064.41±190.19 (800-1520) with statistically significant difference ($p<0.01$).

The study and control groups did not differ in GA, BW and follow-up period ($p>0.05$).

TABLE 1: Distribution of gestational age and birth weight.

	Study Group (n=41) Mean±SD	Control Group (n=39) Mean±SD
Gestational age (weeks)	28.41±2.03	28.05±2.05
Birth weight (g)	1115.02±330.88	1175.49±285.56

Study group: Infants with Type-1 prethreshold ROP; Control group: Infants with Type-2 prethreshold ROP.

TABLE 2: Clinical characteristics of the study group.

	N: 41 infants (82 eyes)
Mean PCA at treatment time (weeks)	36.10±1.50
NLS	1184.56±299.31 (800-2100)
Zone I ROP	18 eyes (22%)
Zone II ROP	64 eyes (78%)
Stage 2 ROP	3 eyes (3.7%)
Stage 3 ROP	79 eyes (96.3%)

PCA: Postconceptional age; NLS: number of laser spots; ROP: Retinopathy of prematurity.
Study group: Infants with Type-1 prethreshold ROP.

No per- or post-operative complications were observed in study group such as anterior segment ischemia or intraocular hemorrhage. All eyes in the study group showed regression of plus disease within 2 weeks after laser treatment. No supplemental LPC sessions were needed. No infants in both groups had unfavorable anatomic outcome at 1-year corrected age.

At 1-year corrected age, refractive error was less myopic in control group (1.95±1.42D SE [median: 2D; range -1D to +5D) compared to study group (-0.32±2.22D SE [median: -0.25D SE; range -6D to +3.5D) with statistically significant difference ($p<0.01$). In study group, 40 eyes (48.8%) had hyperopia (range between 0.25D to 3.5D SE), 38 eyes (46.3%) had mild to moderate degrees of myopia (range between -0.25D to -4.25D SE) and 4 eyes (4.9%) had higher degrees of myopia (range between -5D to -6D SE). Distribution of refractive error in both groups is shown in Figure 1 and 2.

Eyes with greater number of laser spots were more myopic compared to eyes with lower number of laser spots ($p<0.05$). Also eyes with Zone I ROP were more myopic compared to eyes with

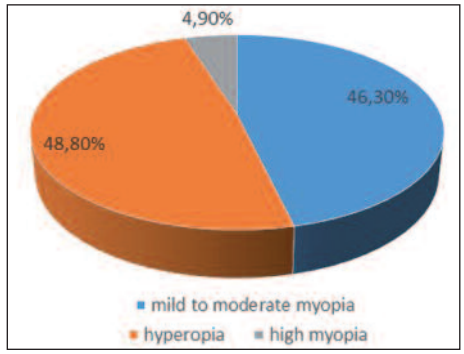

FIGURE 1: Distribution of refractive error in study group.
(See color figure at http://www.turkiyeklinikleri.com/journal/oftalmoloji-dergisi/1300-0365/)

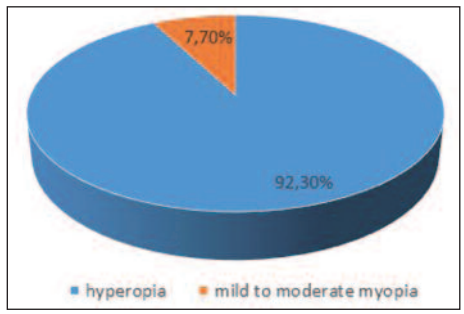

FIGURE 2: Distribution of refractive error in control group.
(See color figure at http://www.turkiyeklinikleri.com/journal/oftalmoloji-dergisi/1300-0365/)

Zone II ROP ($p<0.01$). We did not observe a relationship between the stage of ROP with refractive error ($p>0.05$) (Table 3).

Two (4.9 %) infants had strabismus (esotropia) at 1-year corrected age. These 2 infants developing strabismus had no nystagmus or anisometropia. Other infants in both groups had no anisometropia, strabismus or nystagmus at the end of the study.

DISCUSSION

Ocular structural and functional sequelae of ROP after cryo or laser therapy have been well documented in past literature. Although the cryoablation of the avascular retina was a saver method in its era, higher prevalance of long-term unsatisfactory results have been observed including residual anatomic sequelae, higher degrees of refractive errors, anisometropia, amblyopia, strabismus or nystagmus.[10-13] Since subsequent studies have reported better favorable outcomes with LPC treatment, it has replaced cryotherapy as the treatment of the disease worldwide.[14,15] After the introduction of ETROP trial, treatment was considered earlier than the threshold level of the disease for Type-1 prethreshold ROP. This study showed improved visual functions in Type-1 prethreshold eyes during early and long-term follow-up periods.[16] Also several studies from Turkey reported screening and treatment results of ROP but no information exist about the anatomic and refractive outcome after laser treatment of Type-1 prethreshold ROP.[17-22] Therefore, we composed this study to evaluate the clinical outcomes of infants with Type-1 prethreshold ROP after LPC treatment at 1-year corrected age.

Various laser ablation modalities have been described such as additional laser burns to the ridge and vascular retina posterior to the ridge achieving better favorable structural outcomes with a low incidence of additional laser sessions.[23-25] In our routine practice, following laser ablation of the whole avascular retina, we perform one to two rows of laser application to the vascular retina posterior to the ridge. We did not observe any laser related complication during our study period. Successful inactivation of the disease was achieved in all cases with no need of any additional laser sessions.

Miscellaneous retinal structural sequelae have been denoted in different reports.[24-26] In a study, higher rates of unfavorable anatomic results after laser treatment for threshold ROP was shown such as; peripheral vitreous membranes, disc drag, narrowing of arcades and macular heterotopia.[26] We did not observe any peripheral or posterior pole changes during our study period. All eyes had favorable anatomic outcome at the end of 1-year corrected age.

TABLE 3: Correlation of default risk factors with refractive error.

	Mean refractive error (SE)
Number of laser spots	r: -0.480 p: 0.002**
Zone of involvement	r: 0.455 p: 0.003*
Stage of ROP	r: 0.096 p: 0.550

r: Spearman correlation coefficient *p<0.01; **p<0.05.
ROP: Retinopathy of prematurity; SE: Spherical equivalent.

Several studies reported the refractive results of threshold ROP after LPC treatment. In a study, after performing LPC treatment in 93 eyes, the mean refractive error and the incidence of myopia was observed as -4.71D SE and 80.4% at the end of 1-year follow-up.[26] Algawi et al. showed 40% of myopia in 15 eyes after LPC and 92% of myopia in 25 eyes after cryotherapy.[27] In another study mean refractive error was -2.10D SE in 43 laser treated eyes at the end of 11-years follow-up.[28] Connolly et al. also showed higher degrees of myopia after cryotherapy (mean SE; -7.65D) compared to laser treatment (mean SE; -4.48D) in their cohort of patients.[11] In contrast to these studies, Kiesselbach et al. showed a predominance of hyperopia after laser treatment with an incidence of 14% of myopia.[29] In another study including 28 eyes with Zone I ROP and 60 eyes with Zone II ROP, the mean refractive error was found as -3.80D SE (range between -19D to +4D).[30] Besides, Sahni et al. showed that eyes who underwent treatment either with laser or cryo ablation, were more myopic compared to the eyes who had spontaneously regressed ROP.[31] Also in another study Morrison et al. stated that children with regressed ROP without any structural abnormality had no significant refractive error at early follow-up visits. But 2 years after the initial examination 3.4% of these children developed anisometropia and myopic astigmatism. The authors concluded that children with successfully regressed ROP need close vision screening programmes in their later periods.[32] In our current study, the mean refractive error and the incidence of high myopia were -0.32D SE and 4.9% in laser treated infants. Furthermore, lower degrees of myopia were observed in spontaneously regressed Type-2 prethreshold ROP eyes compared to laser treated Type-1 prethreshold ROP eyes as stated in previous reports.

A study evaluating structural and refractive outcome of Type-1 prethreshold ROP 1-year after laser treatment in Asian-Indian eyes reported a lower degree of refractive error (0.75D SE) than our study. The authors also reported an association between high myopia with greater number of laser spots and greater number of total clock hours of ROP. But the disadvantageous of this study was the lack of a control group in which a meaningful refractive comparison of the laser treated eyes could be provided.[33] In our study, we found higher myopic refractive error in study group compared to control group. And there was a significant relationship of myopia with higher number of laser spots but not with the stage of ROP. Also Zone I involvement of the disease caused higher myopic refraction compared to Zone II involvement of the disease. This means that more posterior location of ROP results in more myopic refraction eventually.

Strabismus, anisometropia and nistagmus have been reported at the end of early and long-term follow-up period after laser treatment for ROP.[26] We did not see any evidence of nystagmus or anisometropia. Nevermore, we observed strabismus in 2 laser treated infants (4.9%) at the end of the study.

Our results suggested that LPC treatment in Type-1 prethreshold ROP results in better structural and refractive outcome. This was in conformity with previous reports in the literature.[9,33] Despite successful anatomic outcome during the study period, we reported a total prevalance 51,2 % of myopia and 4,9% of strabismus at 1-year age. Hence, these children need to be long-term followed-up in terms of visual and functional outcome.

REFERENCES

1. Palmer EA, Flynn JT, Hardy RJ, Phelps DL, Phillips CL, Schaffer DB, et al. Incidence and early course of retinopathy of prematurity. The Cryotherapy for Retinopathy of Prematurity Cooperative Group. Ophthalmology 1991;98 (11):1628-40.
2. Multicenter trial of cryotherapy for retinopathy of prematurity. Preliminary results. Cryotherapy for Retinopathy of Prematurity Cooperative Group. Arch Ophthalmol 1988;106(4): 471-9.
3. Ng EY, Connolly BP, McNamara JA, Regillo CD, Vander JF, Tasman W. A comparison of laser photocoagulation with cryotherapy for threshold retinopathy of prematurity at 10 years: part 1. Visual function and structural outcome. Ophthalmology 2002;109(5):928-34; discussion 935.
4. McLoone EM, O'Keefe M, McLoone SF, Lanigan BM. Long-term refractive and biometric outcomes following diode laser therapy for retinopathy of prematurity. J AAPOS 2006;10(5):454-9.
5. The natural ocular outcome of premature birth and retinopathy. Status at 1 year. Cryotherapy for Retinopathy of Prematurity Cooperative Group. Arch Ophthalmol 1994;112(7):903-12.
6. Quinn GE, Dobson V, Kivlin J, Kaufman LM, Repka MX, Reynolds JD, et al. Prevalence of myopia between 3 months and 5 1/2 years in preterm infants with and without retinopathy of prematurity. Cryotherapy for Retinopathy of Prematurity Cooperative Group. Ophthalmology 1998;105(7):1292-300.
7. Knight-Nanan DM, O'Keefe M. Refractive outcome in eyes with retinopathy of prematurity treated with cryotherapy or diode laser: 3 year follow up. Br J Ophthalmol 1996;80(11):998-1001.
8. Early Treatment for Retinopathy Of Prematurity Cooperative Group. Revised indications for the treatment of retinopathy of prematurity: results of the early treatment for retinopathy of prematurity randomized trial. Arch Ophthalmol 2003;121(12):1684-94.
9. Good WV; Early Treatment for Retinopathy of Prematurity Cooperative Group. Final results of the Early Treatment for Retinopathy of Prematurity (ETROP) randomized trial. Trans Am Ophthalmol Soc 2004;102:233-48; discussion 248-50.
10. White JE, Repka MX. Randomized comparison of diode laser photocoagulation versus cryotherapy for threshold retinopathy of prematurity: 3-year outcome. J Pediatr Ophthalmol Strabismus 1997;34(2):83-7; quiz 121-2.
11. Paysse EA, Lindsey JL, Coats DK, Contant CF Jr, Steinkuller PG. Therapeutic outcomes of cryotherapy versus transpupillary diode laser photocoagulation for threshold retinopathy of prematurity. J AAPOS 1999;3(4):234-40.
12. Pearce IA, Pennie FC, Gannon LM, Weindling AM, Clark DI. Three year visual outcome for treated stage 3 retinopathy of prematurity: cryotherapy versus laser. Br J Ophthalmol 1998;82(11):1254-9.
13. Shalev B, Farr AK, Repka MX. Randomized comparison of diode laser photocoagulation versus cryotherapy for threshold retinopathy of prematurity: seven-year outcome. Am J Ophthalmol 2001;132(1):76-80.
14. Connolly BP, Ng EY, McNamara JA, Regillo CD, Vander JF, Tasman W. A comparison of laser photocoagulation with cryotherapy for threshold retinopathy of prematurity at 10 years: part 2. Refractive outcome. Ophthalmology 2002;109(5):936-41.
15. Axer-Siegel R, Maharshak I, Snir M, Friling R, Ehrlich R, Sherf I, et al. Diode laser treatment of retinopathy of prematurity: anatomical and refractive outcomes. Retina 2008;28(6):839-46.
16. Early Treatment for Retinopathy of Prematurity Cooperative Group, Good WV, Hardy RJ, Dobson V, Palmer EA, Phelps DL, Tung B, et al. Final visual acuity results in the early treatment for retinopathy of prematurity study. Arch Ophthalmol 2010;128(6):663-71.
17. Akçakaya AA, Yaylali SA, Erbil HH, Sadigov F, Aybar A, Aydin N, et al. Screening for retinopathy of prematurity in a tertiary hospital in Istanbul: incidence and risk factors. J Pediatr Ophthalmol Strabismus 2012;49(1):21-5.
18. Mutlu FM, Küçükevcilioğlu M, Ceylan OM, Altınsoy HI, Sarıcı SU. Risk factor analysis for long-term unfavorable ocular outcomes in children treated for retinopathy of prematurity. Turk J Pediatr 2013;55(1):35-41.
19. Ziylan S, Serin D, Karslioglu S. Myopia in preterm children at 12 to 24 months of age. J Pediatr Ophthalmol Strabismus 2006;43(3): 152-6.
20. Küçükevcilioğlu M, Mutlu FM, Sarıcı SU, Ceylan OM, Altınsoy HI, Kılıç S, et al. Frequency, risk factors and outcomes of retinopathy of prematurity in a tertiary care hospital in Turkey. Turk J Pediatr 2013;55(5):467-74.
21. Mutlu FM, Altinsoy HI, Mumcuoglu T, Kerimoglu H, Kiliç S, Kul M, et al. Screening for retinopathy of prematurity in a tertiary care newborn unit in Turkey: frequency, outcomes, and risk factor analysis. J Pediatr Ophthalmol Strabismus 2008;45(5):291-8.
22. Erol N. [Treatment of retinopathy of prematurity]. Turkiye Klinikleri J Ophthalmol-Special Topics 2011;4(2):27-32.
23. Rezai KA, Eliott D, Ferrone PJ, Kim RW. Near confluent laser photocoagulation for the treatment of threshold retinopathy of prematurity. Arch Ophthalmol 2005;123(5):621-6.
24. Steinmetz RL, Brooks HL Jr. Diode laser photocoagulation to the ridge and avascular retina in threshold retinopathy of prematurity. Retina 2002;22(1):48-52.
25. O'Keefe M, Burke J, Algawi K, Goggin M. Diode laser photocoagulation to the vascular retina for progressively advancing retinopathy of prematurity. Br J Ophthalmol 1995;79(11): 1012-4.
26. Dhawan A, Dogra M, Vinekar A, Gupta A, Dutta S. Structural sequelae and refractive outcome after successful laser treatment for threshold retinopathy of prematurity. J Pediatr Ophthalmol Strabismus 2008;45(6):356-61.
27. Algawi K, Goggin M, O'Keefe M. Refractive outcome following diode laser versus cryotherapy for eyes with retinopathy of prematurity. Br J Ophthalmol 1994;78(8):612-4.
28. McLoone E, O'Keefe M, McLoone S, Lanigan B. Long term functional and structural outcomes of laser therapy for retinopathy of prematurity. Br J Ophthalmol 2006;90(6):754-9.
29. Kieselbach GF, Ramharter A, Baldissera I, Kralinger MT. Laser photocoagulation for retinopathy of prematurity: structural and functional outcome. Acta Ophthalmol Scand 2006;84(1):21-6.
30. Gonzalez VH, Giuliari GP, Banda RM, Guel DA, Wingard M. Confluent laser photocoagulation for the treatment of retinopathy of prematurity. J Pediatr Ophthalmol Strabismus 2010;47(2):81-5; quiz 86-7.
31. Sahni J, Subhedar NV, Clark D. Treated threshold stage 3 versus spontaneously regressed subthreshold stage 3 retinopathy of prematurity: a study of motility, refractive, and anatomical outcomes at 6 months and 36 months. Br J Ophthalmol 2005;89(2):154-9.
32. Morrison DG, Emanuel M, Donahue SP. Risk of refractive pathology after spontaneously regressed ROP in emmetropic patients. J Pediatr Ophthalmol Strabismus 2010;47(3):141-4.
33. Katoch D, Sanghi G, Dogra MR, Beke N, Gupta A. Structural sequelae and refractive outcome 1 year after laser treatment for type 1 prethreshold retinopathy of prematurity in Asian Indian eyes. Indian J Ophthalmol 2011;59(6):423-6.