Long-Term Outcome of Nd:YAG Laser Posterior Capsulotomy in Children: Procedural Strategies and Visual Outcome

SE HYUN CHOI, YONG DAE KIM, YOUNG SUK YU, MEE KUM KIM, AND HYUK JIN CHOI

• PURPOSE: To evaluate the long-term outcome of neodymium:yttrium-aluminum-garnet (Nd:YAG) laser posterior capsulotomy after cataract surgery in children.
• DESIGN: Retrospective case series.
• METHODS: Electronic medical records of pediatric patients who underwent Nd:YAG laser posterior capsulotomy between January 1, 2008, and October 31, 2012, and followed up for more than 5 years were reviewed.
• RESULTS: Thirty-one eyes of 25 patients were included. Only compliant patients assessed during slit-lamp examination and anterior segment photography underwent laser treatment. The mean age at the time of initial laser treatment was 9.04 ± 3.51 years (minimum 56 months), and the mean interval between cataract surgery and initial laser treatment was 28.1 ± 22.1 months. Posterior capsular openings were successfully made in 26 (83.9%) eyes with a single attempt and in 3 (9.7%) eyes with a second attempt. Overall success rate was 93.5%. The logMAR best-corrected visual acuity was significantly improved from 0.61 ± 0.36 to 0.19 ± 0.25 at 1 month posttreatment ($P < .0001$) and well maintained, at least for 5 years of follow-up, without serious complications. The recurrence of posterior capsular opacity was observed in 7 (24.1%) eyes, which was successfully managed by repeated laser procedure or surgical capsulectomy.
• CONCLUSIONS: By selecting compliant patients and repeated attempts, Nd:YAG laser posterior capsulotomy can be successfully performed in a pediatric population without serious complications. Laser treatment is also a good option for managing recurred posterior capsular opacity. Restored visual acuity can be maintained for at least 5 years. (Am J Ophthalmol 2019;197:121–127.

IN THE PEDIATRIC POPULATION, CATARACTS ARE ONE OF the common causes of treatable blindness.[1–3] Surgical cataract extraction combined with simultaneous or staged intraocular lens (IOL) implantation should be performed in a timely manner to prevent permanent amblyopia. Posterior capsular opacity (PCO) in the visual axis is the most common complication of cataract surgery in children, and it results in visual impairment requiring secondary intervention.[4–8] Primary posterior capsulectomy with anterior vitrectomy has been performed to prevent secondary cataract formation at the time of initial surgery and is a standard treatment in younger pediatric cataract patients.[9,10] However, maintaining an intact posterior capsule is sometimes beneficial for better structural stability, less operative time, and evasion of possible complications, such as IOL instability, IOL damage, elevation of intraocular pressure (IOP), increased risk of postsurgical endophthalmitis, and other retinal problems, such as retinal detachment or cystoid macular edema.[11,12] Moreover, PCO could develop after primary posterior capsulectomy with anterior vitrectomy.[13] For these reasons, posterior capsulectomy may not be performed as a routine procedure in relatively older patients.[14]

Meanwhile, adequate management of PCO is an important problem after pediatric cataract surgery. To achieve adequate visual development and prevent amblyopia, prompt treatment of PCO should not be postponed. PCO also interferes with accurate measurement of refraction, which is essential for visual rehabilitation after cataract surgery. The current management options for PCO are secondary surgical capsulectomy under general anesthesia or neodymium:yttrium-aluminum-garnet (Nd:YAG) laser capsulotomy. The latter has the benefit of being a noninvasive office-based procedure that does not require high-level skills, but it has the disadvantage of not being able to be performed in noncooperative children.[15,16] This difficulty is often neglected in the course of the procedure and thus leads to failure. For successful treatment of postoperative PCO in pediatric patients, it is crucial to select compliant patients or to make patients adapt to the unfamiliar treatment environment.

The purpose of this study was to evaluate the long-term outcome of Nd:YAG laser posterior capsulotomy in

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selected pediatric patients with PCO after successful cataract surgery.

METHODS

• **STUDY DESIGN AND SUBJECTS:** This was a retrospective study approved by the Institutional Review Board of Seoul National University Hospital (IRB No. 1712-020-903). All the research was conducted following the tenets of the Declaration of Helsinki.

We reviewed the medical charts of patients who visited Seoul National University Children's Hospital; underwent cataract surgery when they were younger than 15 years old; underwent Nd:YAG laser posterior capsulotomy between January 1, 2008, and October 31, 2012; and met the following inclusion criteria: (1) a history of cataract extraction with primary posterior chamber IOL implantation; (2) subsequent development of PCO involving a visual axis associated with decreased visual acuity or disturbance of manual refraction; and (3) a minimum of a 5-year follow-up after the laser treatment.

The exclusion criteria were the following: (1) less than 5 years of follow-up after the laser treatment, (2) inability to measure the visual acuity, (3) previous intraocular surgery other than cataract surgery, and (4) corneal disease, retinal pathology, or any other severe ocular disease that could significantly affect visual acuity.

• **CATARACT SURGERY:** All the surgeries were performed by a single surgeon (Y.S.Y.). After general anesthesia, 2 scleral tunnels were made 2 mm from the limbus and after the superficial scleral flap, they were made 3 mm from the limbus. Round-shaped anterior capsulectomy and cataract extraction were conducted with the ocutome unit (Storz; Premiere, St. Louis, Missouri, USA). One scleral incision was extended to 3 mm in width and the IOL was implanted in the bag. The viscoelastic in the anterior chamber and capsular bag was meticulously removed, and the sclera and conjunctiva were repaired. Primary posterior capsulectomy and anterior vitrectomy were performed in patients with cataracts involving the posterior capsule or in selected patients 4 years old or younger.

After the operation, topical prednisolone acetate 1% (Pred Forte; Allergan, Irvine, California, USA) and levofloxacin 0.5% (Cravit; Santen Pharmaceutical, Osaka, Japan) eye drops were administered 4 times a day. Postoperative examinations were performed at 1 day, at 1 week, at 1 month, at 3 months, and thereafter, depending on the patient's condition.

• **SELECTION AND PREPARATION OF THE PATIENT:** The patients' pupils were dilated using 0.5% tropicamide and 0.5% phenylephrine eye drops. A slit-lamp examination was done to assess the type, location, and severity of PCO, during which the patient's cooperation was initially estimated. Then, anterior segment photographs were obtained via a digital camera mounted on a slit lamp. During the procedure, the examiner evaluated the patient's compliance once again and recorded any problems, such as poor fixing and concentration on a target light, involuntary saccadic movement or nystagmus, excessive Bell's phenomenon, and unstable head position on the chin rest. Only cooperative patients were advised to proceed to a laser capsulotomy. Just before the procedure, proparacaine 0.5% was administered for regional anesthesia and apraclonidine 0.5% was instilled for the prevention of a postprocedure IOP spike.

• **NEODYMIUM:YTTRIUM-ALUMINUM-GARNET LASER POSTERIOR CAPSULOTOMY:** Nd:YAG laser (Visulas YAG III; Carl Zeiss Meditec, Inc, Dublin, California, USA) posterior capsulotomy was performed by a single surgeon (H.J.C.) at an outpatient office facility with the patient in the sitting position. Ocular Abraham Capsulotomy YAG Laser Lens (Ocular Instruments, Bellevue, Washington, USA) was applied to the eye with hydroxypropyl methylcellulose medium to facilitate accurate focusing of the laser on the posterior capsule and to stabilize the eye.[17,18] Individually adjusted single-burst shots were applied starting at 0.9 mJ and were gradually increased in power until the capsule was adequately opened. Beginning superiorly near the 12 o'clock position, a cruciate opening was created. The number of laser applications, the total amount of laser power, and any complications, including IOL pitting, were recorded. If the patient's cooperation was becoming worse during the procedure, the procedure was interrupted and resumed after a 10- to 20-minute break. If the procedure was impossible to finish in the subsequent session owing to the patient's continuous poor cooperation, the second trial was conducted 2 weeks later. The patients who eventually failed in the second trial were advised to undergo surgical posterior capsulectomy.

• **POSTTREATMENT MANAGEMENT AND FOLLOW-UP:** IOP was measured 1 hour after the procedure using a pneumatic or Goldmann applanation tonometer, depending on the patient's toleration. A follow-up examination including best-corrected visual acuity (BCVA), IOP, and slit-lamp examination was conducted at 1 week, 1 month, 6 months, and 1 year and, thereafter, every year after the laser treatment. During the follow-up, the patients were advised to continue amblyopia treatment if necessary.

• **STATISTICAL ANALYSIS:** All the statistical tests were performed using Prism software (GraphPad Prism version 7; GraphPad Inc, La Jolla, California, USA). Visual acuity was converted from decimal units to the logarithm of the minimal angle of resolution (logMAR) for subsequent statistical analysis. To compare the changes over time, the data were analyzed with the paired *t* test. The

TABLE 1. Patient Demographics and Cataract Surgery Characteristics

Characteristic	Result
Sex (male:female)	12:13
Laterality (right:left)	19:12
Age at cataract operation (y)	
Mean ± SD	6.7 ± 3.2
Range	1.8-14.4
Cataract classifications	
Congenital cataract	13 (41.9)
Infantile/juvenile cataract	14 (45.2)
Steroid-induced cataract	2 (6.5)
Traumatic cataract	1 (3.2)
Cataract associated with diabetes mellitus	1 (3.2)
Cataract type	
Anterior capsular opacity	1 (3.2)
Cortical opacity	2 (6.5)
Nuclear opacity	12 (38.7)
Posterior subcapsular opacity	16 (51.6)
Posterior capsulectomy during cataract surgery	3 (9.7)
IOL type	
Hydrophobic acrylic (SA60AT, Alcon)	23 (74.2)
Polymethyl methacrylate (LK55A, Lucid Korea)	7 (22.6)
Polymethyl methacrylate (811B, Pharmacia)	1 (3.2)

IOL = intraocular lens; SD = standard deviation.
Data indicate number (%) of eyes, unless specified.

nonparametric Mann-Whitney *U* test was used for a comparison between the 2 groups. The data are presented as the mean ± standard deviation (SD). The differences were considered significant at $P < .05$.

RESULTS

A CONSECUTIVE SERIES OF 31 EYES OF 25 PATIENTS WITH PCO being treated with Nd:YAG posterior capsulotomy were identified and included in the study. Of these, 12 were male (48%). Infantile/juvenile cataract and nuclear posterior subcapsular opacity were the most common presentations. The age at the time of cataract extraction and IOL implantation was 6.7 ± 3.2 (range, 3-14) years. Primary posterior capsulectomy with anterior vitrectomy during cataract operation was conducted in 3 eyes (9.7%) of 3 patients. Foldable single-piece hydrophobic acrylic IOL (SA60AT; Alcon Laboratories, Inc, Fort Worth, Texas, USA) was implanted in the majority of patients (Table 1).

The age at the time of laser capsulotomy was 9.0 ± 3.5 (range, 4.6-17.3) years, and the interval between cataract surgery and initial laser treatment was 28.1 ± 22.1 (range, 5-122) months. Posterior capsular openings were successfully completed with a single attempt in 83.9% of eyes (26 of 31 eyes) (Figure 1); however 5 eyes failed the first trial owing to poor cooperation. Three eyes of 5 patients who failed the first attempt successfully received laser treatment at the second attempt after a 2-week interval. In the remaining 2 eyes, the PCO was surgically removed under general anesthesia. The Nd:YAG laser energy settings of the single shot ranged from 0.9 to 3.5 mJ, depending on the density of the membrane. The average energy per shot was 1.67 ± 0.36 (range, 1.03-2.47) mJ, the mean number of laser applications was 60.4 ± 21.0 (range, 28-109), and the total amount of laser energy was 99.5 ± 36.1 (range, 49-190) mJ. Complications were encountered during the procedure and early posttreatment follow-up period: (1) clinically insignificant laser pitting (1 or 2 marks) on the IOL in 5 eyes (17.2%) owing to abrupt eye movement and (2) transient elevation of IOP in 4 eyes (14.0%), which was normalized by short-term topical antiglaucoma medication. Otherwise, there were no significant complications (Table 2).

Of the 29 eyes with successful initial capsule openings made with laser treatment, 7 eyes (24.1%) required further procedures owing to reproliferation of lens materials blocking the visual axis. The rate of survival in terms of the need for additional treatment is shown in Figure 2. Secondary laser treatments were successfully conducted in 5 eyes, and surgical removal of PCO was advised in 2 eyes. However, posterior capsulectomy and anterior vitrectomy were performed in only 1 patient, at 9.7 months after the first laser treatment, because the other patient refused additional treatment. The interval between the first laser treatment and clinically significant recurrence detection was 30.9 ± 30.0 (range, 5-81) months, and the interval from the initial laser treatment to the second laser treatment was 32.2 ± 30.3 months.

The logMAR BCVA after cataract surgery was 0.23 ± 0.26 in all patients and 0.21 ± 0.25 in 29 patients who succeeded initial laser treatment. The logMAR BCVA before laser treatment was significantly worse than BCVA after cataract surgery ($P < .0001$, paired *t* test). BCVA was significantly improved from 0.61 ± 0.36 before laser treatment to 0.19 ± 0.25 at 1 month ($P < .0001$), 0.16 ± 0.18 at 6 months ($P < .0001$), and 0.25 ± 0.24 at 5 years ($P < .0001$) after the treatment. There was no significant difference of BCVA between postoperative 1 month and 5 years after the laser therapy ($P < .28$, paired *t* test) (Figure 3). There were no patients who lost their visual acuity during the follow-up period (mean 73.7 ± 10.2 [range, 57-100] months) after the laser treatment. In 6 patients who had been followed up for more than 7 years, the logMAR BCVA after 7 years was 0.31 ± 0.28 and there was no statistically significant change when compared to logMAR BCVA 0.21 ± 0.35 at 1 month after the laser treatment ($P = .250$).

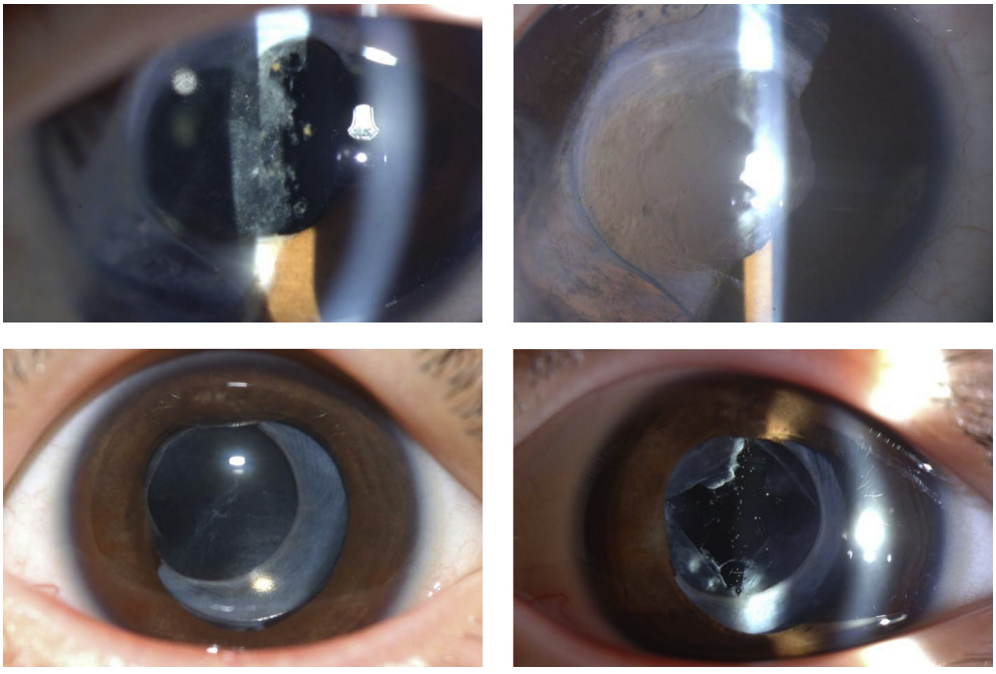

FIGURE 1. Anterior segment photograph showing (Left) pre–laser treatment and (Right) post–laser treatment status of 2 patients. (Top) Successfully opened visual axis after treatment with Nd:YAG laser in a patient with Elschning-pearl type posterior capsular opacity (PCO). (Bottom) Nd:YAG laser was successfully performed in a patient with fibrosis-type PCO. Clinically insignificant pitting of intraocular lens occurred.

DISCUSSION

IN THIS STUDY, ND:YAG LASER POSTERIOR CAPSULOTOMY was attempted in 31 eyes of 25 selected patients between the ages of 55 months and 17 years. A posterior capsular opening was successfully made in 29 of 31 eyes (93.5%; 26 eyes [83.9%] at the initial attempt and in 3 eyes [9.7%] at the second attempt) without any major complications and the youngest patient's age was 56 months. The BCVA was significantly improved by the laser procedure and well maintained during at least 5 years of follow-up. During the follow-up periods, clinically significant recurrence of PCO was observed in 7 of 29 (24.1%) eyes, which was successfully managed by repeated Nd:YAG laser posterior capsulotomy or surgical posterior capsulectomy.

Maintaining a clear visual axis is crucial for visual development in any growing child,[19] and thus, treatment of clinically significant PCO after cataract surgery has been of special concern to ophthalmologists. Although the benefits of Nd:YAG laser posterior capsulotomy for the management of PCO in pediatric patients have been well documented elsewhere,[20] the procedure is not always successfully completed in pediatric patients. It is important to select cooperative patients before the procedure and to provide them a comfortable environment during the procedure. Accordingly, to select compliant patients, our ophthalmologists roughly screened their concentration and patience during a slit-lamp examination. Taking anterior segment photographs was a time-consuming procedure but was a valuable tool, not only for the examiners to reevaluate the patient's compliance but also for the patients to adapt to unfamiliar situations. While our ophthalmologists took the photographs, the patients were able to rehearse following the target light and to establish their own comfortable head and body posture on the machine. During the capsulotomy procedure, we tried to avoid an overly dark environment and allowed patients' parents to give physical and mental support from the side. It is noteworthy to achieve a final success rate of 93.5% (29 of 31 eyes), which suggests the necessity of careful screening of the candidates. In the remaining 2 eyes in 2 patients (55 and 60 months of age) with whom the laser procedure eventually failed owing to poor cooperation, surgical posterior capsulectomy was conducted under general anesthesia.

In the pediatric situation, we considered specific strategies to conduct successful posterior capsulotomy. The Microruptor III (Meridian AG, Thun, Switzerland) has been proposed as a useful tool to treat patients in the supine position (awake or anesthetized) by rotating the laser delivery system 90 degrees.[15] However, the device is not available in most hospitals because the number of pediatric patients requiring this device is limited. The technique for Nd:YAG capsulotomy under general anesthesia in a sitting position using a conventional Nd:YAG laser device also has been reported.[16] It can be a viable option

TABLE 2. Overview of Nd:YAG Laser Posterior Capsulotomy

Characteristic	Result
Initial Nd:YAG laser posterior capsulotomy	
Age at laser treatment (y)	
Mean ± SD	9.0 ± 3.5
Range	4.6-17.3
Time from cataract surgery to laser treatment (mo)	
Mean ± SD	28.1 ± 22.1
Range	5-122
Treatment results	
Success at first attempt	26 (83.9)
Success at second attempt	3 (9.7)
Failure	2 (6.5)
Complications in 29 successful cases	
IOL pitting	5 (17.2)
Transient IOP elevation	4 (14.0)
Recurrence of posterior capsular opacity	
Eyes	7 (24.1)
Time from initial laser treatment to recurrence (mo)	
Mean ± SD	30.9 ± 30.0
Range	5-81
Treatments (number of eyes)	
Repeated laser treatment	5
Surgical removal	1
Refused treatment	1

IOP = intraocular pressure; SD = standard deviation.
Data indicate number (%) of eyes, unless specified.

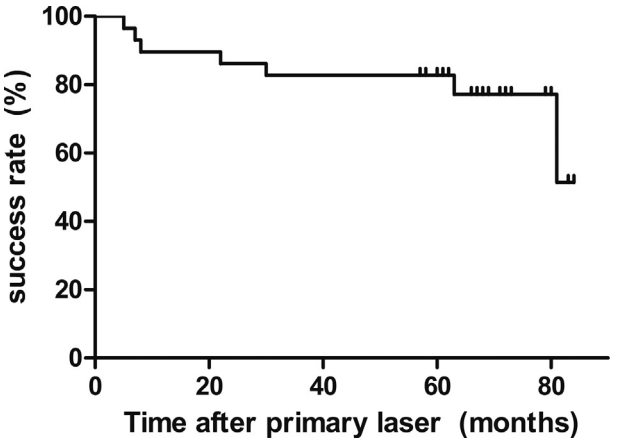

FIGURE 2. Kaplan-Meier curve showing the probability of continuing success to maintain a clear visual axis after the first posterior capsular opening with Nd:YAG laser treatment, based on life table data from 29 eyes.

for children who are not compliant and who failed the laser treatment, but the risk of general anesthesia must be considered. Instead, we selected compliant pediatric patients and performed Nd:YAG laser posterior capsulotomy in a manner similar to adult cases, using an ordinary capsulotomy contact lens. Although children often were reluctant to have something placed on the eyeball, trial and error enabled us to place the contact lens on the ocular surface in most cases. Once the patient accepted the capsulotomy contact lens, it helped to reduce involuntary eyeball movement and to accurately focus the laser beam onto the posterior capsule. However, placing a contact lens on the eye surface itself might reduce the patients' compliance, so trying laser treatment without contact lens can be a viable option for those who cannot tolerate the lens.

The minimum laser energy (0.9-3.5 mJ) to make an opening in the opacified posterior capsule was not different than in adult patients, whereas the total number of laser applications (60.4 ± 21.0, 28-109) and total delivered energy (99.5 ± 36.1 mJ, 49-190 mJ) were relatively higher.

In our study, the mean time interval between cataract surgery and Nd:YAG laser posterior capsulotomy was 28.1 ± 22.1 months, which was longer than reported elsewhere.[21–23] It was noteworthy that recovered BCVA was well maintained during at least 5 years of follow-up, although additional procedures were necessary for the reopacified posterior capsules in some patients.

There has been little report of complications after Nd:YAG laser posterior capsulotomy in the pediatric population. Atkinson and Hiles[15] reported a slight increase in IOP after treatment. In our study, there were no significant short- and long-term posttreatment complications, except transient IOP elevation in 4 cases (13.8%), which was solved by short-term use of antiglaucoma eye drops. During the follow-up, clinically significant reopacification of the posterior capsule or anterior hyaloid face was observed in 7 eyes (24.1%) with a mean interval of 30.9 ± 30.0 months (range, 5-81 months) from the first Nd:YAG laser posterior capsulotomy. The recurrence rate over a relatively long period of time was much lower compared to previous studies, which reported a high recurrence rate of 57%–60%.[10,24,25] Meanwhile, the reopacified posterior capsule was successfully treated by repeated Nd:YAG laser posterior capsulotomy in 5 eyes and by surgical posterior capsulotomy in 1 eye, which implies Nd:YAG laser posterior capsulotomy would also be a valuable option for recurred PCO.

Although primary posterior capsulectomy with anterior vitrectomy is effective for prevention of PCO development, it cannot ensure a perfect defense of visual axis reopacification.[13] Considering that the minimum age at the time of the laser procedure was 56 months and the minimum interval between cataract surgery and laser treatment was 6 months in this study, it might be considered safe to primarily perform posterior capsulectomy and anterior vitrectomy in patients younger than 50 months old (eg, in infants).[23] Indeed, primary posterior capsulectomy and anterior vitrectomy were performed concurrently with cataract surgery in 3 eyes (9.7%) of 3 patients who were less than 4 years old in this study.

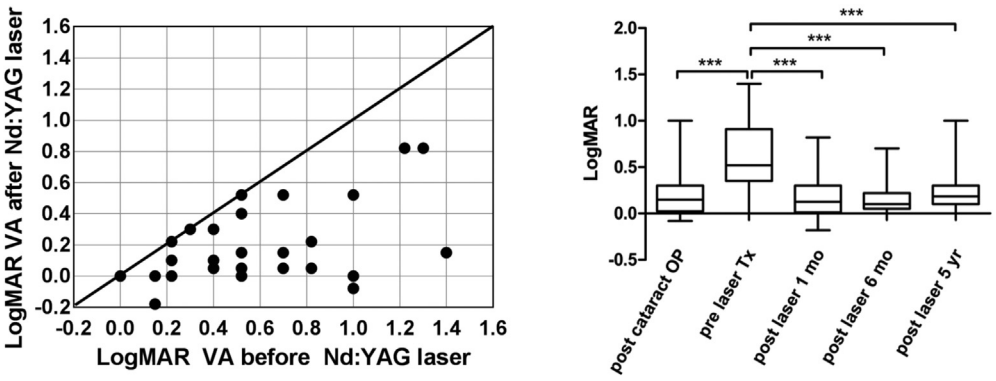

FIGURE 3. (Left) Visual acuity prior to laser treatment is plotted against visual acuity after laser treatment. After the laser treatment, all of the points are on the line or fall below the solid line (indicating equal visual acuity). (Right) The logMAR best-corrected visual acuity is significantly improved after the laser treatment, and the effect is maintained for 5 years.

In conclusion, Nd:YAG laser posterior capsulotomy is an effective treatment option for PCO after cataract surgery in the pediatric population. Restored visual acuity can be maintained for at least 5 years without any major complications. The selection of compliant patients and the provision of a familiar environment are crucial for successful treatment.

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REFERENCES

1. Foster A, Gilbert C, Rahi J. Epidemiology of cataract in childhood: a global perspective. *J Cataract Refract Surg* 1997; 23(Suppl 1):601–604.
2. Stayte M, Reeves B, Wortham C. Ocular and vision defects in preschool children. *Br J Ophthalmol* 1993;77(4):228–232.
3. Stewart-Brown SL, Haslum MN. Partial sight and blindness in children of the 1970 birth cohort at 10 years of age. *J Epidemiol Community Health* 1988;42(1):17–23.
4. Apple DJ, Solomon KD, Tetz MR, et al. Posterior capsule opacification. *Surv Ophthalmol* 1992;37(2):73–116.
5. Zwaan J, Mullaney PB, Awad A, al-Mesfer S, Wheeler DT. Pediatric intraocular lens implantation. Surgical results and complications in more than 300 patients. *Ophthalmology* 1998;105(1):112–118. discussion 118-119.
6. Lambert SR, Lynn M, Drews-Botsch C, et al. A comparison of grating visual acuity, strabismus, and reoperation outcomes among children with aphakia and pseudophakia after unilateral cataract surgery during the first six months of life. *J AAPOS* 2001;5(2):70–75.
7. Plager DA, Yang S, Neely D, Sprunger D, Sondhi N. Complications in the first year following cataract surgery with and without IOL in infants and older children. *J AAPOS* 2002; 6(1):9–14.
8. Kugelberg M, Kugelberg U, Bobrova N, Tronina S, Zetterstrom C. After-cataract in children having cataract surgery with or without anterior vitrectomy implanted with a single-piece AcrySof IOL. *J Cataract Refract Surg* 2005; 31(4):757–762.
9. Keech RV, Tongue AC, Scott WE. Complications after surgery for congenital and infantile cataracts. *Am J Ophthalmol* 1989;108(2):136–141.
10. Koch DD, Kohnen T. A retrospective comparison of techniques to prevent secondary cataract formation following posterior chamber intraocular lens implantation in infants and children. *Trans Am Ophthalmol Soc* 1997;95:351–360. discussion 361-365.
11. Hoyt CS, Nickel B. Aphakic cystoid macular edema: occurrence in infants and children after transpupillary lensectomy and anterior vitrectomy. *Arch Ophthalmol* 1982;100(5): 746–749.
12. Hiles DA, Watson BA. Complications of implant surgery in children. *J Am Intraocul Implant Soc* 1979;5(1):24–32.
13. Alexandrakis G, Peterseim MM, Wilson ME. Clinical outcomes of pars plana capsulotomy with anterior vitrectomy in pediatric cataract surgery. *J AAPOS* 2002;6(3):163–167.
14. Magli A, Forte R, Rombetto L. Long-term outcome of primary versus secondary intraocular lens implantation after simultaneous removal of bilateral congenital cataract. *Graefes Arch Clin Exp Ophthalmol* 2013;251(1):309–314.
15. Atkinson CS, Hiles DA. Treatment of secondary posterior capsular membranes with the Nd:YAG laser in a pediatric population. *Am J Ophthalmol* 1994;118(4):496–501.
16. Longmuir S, Titler S, Johnson T, Kitzmann A. Nd:YAG laser capsulotomy under general anesthesia in the sitting position. *J AAPOS* 2013;17(4):417–419.
17. Dickerson DE, Gilmore JE, Gross J. The Abraham lens with the neodymium-YAG laser. *J Am Intraocul Implant Soc* 1983;9(4):438–440.

18. Mainster MA, Sliney DH, Belcher CD 3rd, Buzney SM. Laser photodisruptors. Damage mechanisms, instrument design and safety. *Ophthalmology* 1983;90(8):973–991.
19. Birch EE, Stager DR. The critical period for surgical treatment of dense congenital unilateral cataract. *Invest Ophthalmol Vis Sci* 1996;37(8):1532–1538.
20. Stager DR Jr, Wang X, Weakley DR Jr, Felius J. The effectiveness of Nd:YAG laser capsulotomy for the treatment of posterior capsule opacification in children with acrylic intraocular lenses. *J AAPOS* 2006;10(2):159–163.
21. Jensen AA, Basti S, Greenwald MJ, Mets MB. When may the posterior capsule be preserved in pediatric intraocular lens surgery? *Ophthalmology* 2002;109(2):324–327. discussion 328.
22. Er H, Doganay S, Evereklioglu C, Erten A, Cumurcu T, Bayramlar H. Retrospective comparison of surgical techniques to prevent secondary opacification in pediatric cataracts. *J Pediatr Ophthalmol Strabismus* 2000;37(5):294–298.
23. O'Keefe M, Fenton S, Lanigan B. Visual outcomes and complications of posterior chamber intraocular lens implantation in the first year of life. *J Cataract Refract Surg* 2001;27(12):2006–2011.
24. Hutcheson KA, Drack AV, Ellish NJ, Lambert SR. Anterior hyaloid face opacification after pediatric Nd:YAG laser capsulotomy. *J AAPOS* 1999;3(5):303–307.
25. Mullner-Eidenbock A, Amon M, Moser E, et al. Morphological and functional results of AcrySof intraocular lens implantation in children: prospective randomized study of age-related surgical management. *J Cataract Refract Surg* 2003;29(2):285–293.