

LASER CAPSULOTOMY IN CHILDREN WITH SECONDARY CATARACTS: INDIVIDUALIZING THE APPROACH BASED ON CLINICAL AND OPHTHALMOLOGICAL DATA

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Abstract

This study evaluates the effectiveness of an individualized approach to Nd:YAG laser capsulotomy in pediatric patients with secondary cataracts. A total of 135 children (270 eyes), aged 8 months to 13 years (mean age: 6.1 ± 2.3 years), were examined after previous cataract surgery. Laser parameters were selected based on posterior capsule fibrosis density, age, and intraocular lens (IOL) type. At the 12-month follow-up, 89.6% (242 eyes) retained a clear visual axis and 83.3% (225 eyes) showed improvement by at least 2 Snellen lines. Complication rate was reduced to 7.8%. The individualized method enhances safety and visual outcomes in pediatric laser treatment.

Keywords:

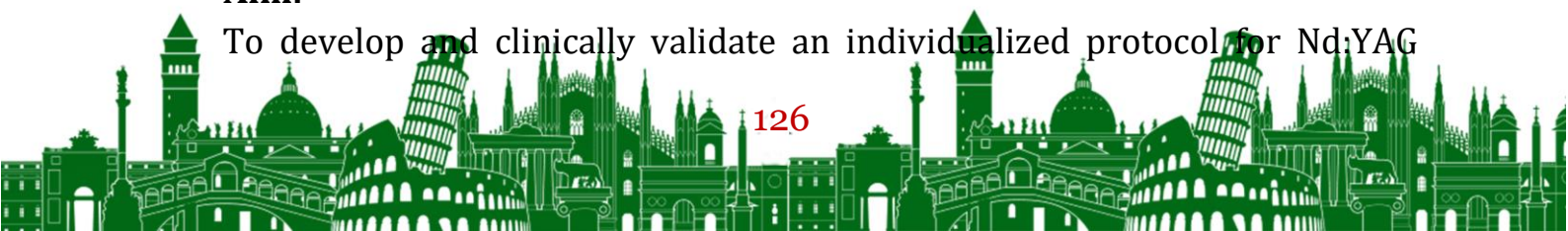
secondary cataract, pediatric ophthalmology, Nd:YAG laser, capsulotomy, individualized treatment, intraocular lens, laser safety

Relevance

Secondary cataract is one of the most common postoperative complications following pediatric cataract extraction, particularly in children under 6 years old. Incidence rates can reach up to 75–85%, and if left untreated, the condition may lead to irreversible amblyopia. Nd:YAG laser capsulotomy is the primary treatment, but pediatric patients require specific considerations due to their ocular anatomy and limited cooperation. Standard laser settings are often insufficient, increasing the risk of complications such as intraocular pressure spikes, synechiae, and vitreous prolapse. This highlights the need for a more tailored approach based on clinical parameters like age, fibrotic density, and IOL type. Implementing an individualized strategy could improve visual rehabilitation and reduce adverse outcomes. This study addresses the gap in standardized pediatric laser protocols and provides evidence for adjusting laser settings according to specific patient characteristics, offering an important step toward optimized pediatric ophthalmic care.

Aim:

To develop and clinically validate an individualized protocol for Nd:YAG



laser capsulotomy in children with secondary cataracts based on clinical and ophthalmological factors.

Materials and Methods

The study included 135 children (270 eyes) aged between 8 months and 13 years, with prior surgery for congenital or acquired cataract. Preoperative evaluation included slit-lamp biomicroscopy, posterior segment OCT, and indirect ophthalmoscopy to assess posterior capsule opacification. Laser settings (energy, pulse count, opening diameter) were individualized. General anesthesia or IV sedation was used in 32 children under 4 years. Patients were followed up at 1, 3, 6, and 12 months. Outcomes measured were visual acuity, visual axis clarity, intraocular pressure, and complications. Data were analyzed using Student's t-test and χ^2 test, with significance at $p < 0.05$.

Results

At 12-month follow-up, 89.6% (242 eyes) demonstrated a clear optical axis, and 83.3% (225 eyes) had a visual acuity gain of ≥ 2 Snellen lines. Complications occurred in 7.8% (21 eyes): elevated intraocular pressure in 4.8% (13 eyes), anterior uveitis in 2.2% (6 eyes), and posterior synechiae in 0.7% (2 eyes). Repeat laser treatment was required in 9.6% of cases, primarily among children under 3 years. Compared to a historical control group treated with fixed parameters, complication rates were 1.7 times lower ($p < 0.01$), and visual improvements were significantly better ($p < 0.05$), supporting the effectiveness of individualized capsulotomy protocols

Conclusion

An individualized Nd:YAG laser approach significantly improves outcomes in pediatric patients with secondary cataracts. Adjusting laser parameters based on patient age, fibrosis density, and IOL type results in clearer visual axes, better visual acuity, and fewer complications. The success rate of maintaining optical clarity (89.6%) and visual improvement (83.3%) confirms the clinical value of personalization. The protocol also demonstrated a lower need for retreatment and minimized intraoperative risks. These findings support the adoption of tailored strategies in routine pediatric ophthalmic practice and suggest the potential for standardizing individualized algorithms to improve long-term visual rehabilitation in children after cataract surgery.

Literature:

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