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*Case Report*

# Trifocal Intraocular Lens Implantation in Pediatric Traumatic Cataract: Functional Recovery Including Stereopsis

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## Abstract

Purpose: To report visual and binocular outcomes after trifocal Intraocular Lens (IOL) implantation in a pediatric patient with traumatic cataract.

Observations: A 6-year-old girl presented with decreased vision in her left eye following periorbital trauma 18 months prior. Best-Corrected Visual Acuity (BCVA) was 20/125 in the affected eye, with highly variable refraction (cycloplegic: +5.75 -6.50 ×163°). Slit-lamp examination revealed a posterior subcapsular cataract. Axial length was 22.02 mm; IOL power was calculated using the Barrett Universal II formula, yielding a target of +28.0 D; a +27.0 D Physiol trifocal IOL was implanted. Preoperative stereopsis was 1980″ (TNO test). Postoperative management included topical therapy and occlusion of the dominant eye. BCVA improved to 20/25 at one month. At 11 months of follow-up, BCVA was 0.8, near visual acuity was 0.6 without correction, refractive spherical equivalent was stable at +0.75 D and stereopsis had improved to 480″. The IOL remained well-centred throughout, with no posterior capsular opacification and no macular changes on OCT.

Conclusions and importance: In carefully selected pediatric cases, trifocal IOL implantation may not only restore visual acuity at multiple distances but also improve binocular function, including stereopsis. This functional outcome may represent a relevant advantage over monofocal approaches in selected patients.

**Keywords:** Pediatric Cataract; Trifocal IOL; Stereopsis; Traumatic Cataract; Binocular Vision; Visual Rehabilitation

## Introduction

Pediatric cataract surgery presents unique challenges, particularly regarding visual rehabilitation and the restoration of binocular function. While monofocal Intraocular Lenses (IOLs) remain the standard of care, they do not address pseudophakic loss of accommodation, often requiring additional optical correction for near tasks and potentially limiting binocular integration in children with active visual development [1,2].

Multifocal IOLs have shown favourable results in adults and, more recently, in selected pediatric cases. However, their use in children remains limited due to concerns regarding optical quality, neuroadaptation and long-term refractive changes associated with ocular growth. Evidence on trifocal IOLs in pediatric patients is especially scarce. We report a case of unilateral pediatric traumatic cataract treated with trifocal IOL implantation, highlighting not only visual acuity recovery across distances but also clinically significant improvement in stereoacuity, with follow-up extending to 11 months.

**Case Report**

A 6-year-old girl was referred to our department with suspected visual impairment of the left eye. She had a history of periorbital blunt trauma 18 months earlier, without documented ophthalmologic evaluation at that time. Previous attempts at optical correction had been unsuccessful, with multiple prescription changes over the preceding months. Her past medical and family history were unremarkable and no known drug allergies were recorded.

On examination, BCVA was 20/20 in the right eye and 20/125 in the left eye. Cycloplegic refraction was +5.75-6.50 ×163° in the left eye and +1.25 -0.25 ×180° in the right eye. Slit-lamp examination revealed a posterior subcapsular cataract in the left eye (Fig. 1), with no phacodonesis or zonular laxity. Fundoscopic examination of both eyes was within normal limits, with no evidence of vitreous, macular or retinal pathology. Preoperative stereopsis, assessed with the TNO test, was 1980", indicating severely impaired binocular function. Ocular motility was full, with orthotropia at near and distance.

Optical biometry was performed with the Argos optical biometer (Movu, USA). Key preoperative measurements for the operated left eye were: axial length 22.02 mm, K1 42.34 D @163° / K2 42.83 D @73°, anterior chamber depth 3.55 mm, central corneal thickness 546 μm, white-to-white 12.36 mm and preoperative endothelial cell count 2839 cells/mm² (Table 1). IOL power was calculated using the Barrett Universal II formula, yielding a target power of +28.0 D; a +27.0 D Physiol trifocal IOL (FineVision HP POD F GF, Physiol, Liège, Belgium) was selected to allow a mild residual hypermetropic outcome as a buffer for expected emmetropisation.

| Parameter | OD (fellow eye) | OS (operated eye) |
|---|---|---|
| Axial length (mm) | 22.78 | 22.02 |
| K1 (D @ axis) | 42.41 D @ 164° | 42.34 D @ 163° |
| K2 (D @ axis) | 43.01 D @ 74° | 42.83 D @ 73° |
| Mean K (D) | 42.71 | 42.58 |
| ACD (mm) | 3.57 | 3.55 |
| CCT (μm) | 544 | 546 |
| WTW (mm) | 12.31 | 12.36 |
| Cylinder (D @ axis) | -0.61 @ 164° | -0.49 @ 163° |
| IOL power (formula) | — | +28.0 D (Barrett Universal II) |
| IOL implanted | — | Physiol FineVision HP +27.0 D |
| Endothelial cells (cells/mm²) | — | 2839 (preop) / 2650 (6 months) |

**Table 1:** Preoperative biometric data (Argos optical biometer, 04/03/2025). ACD: Anterior Chamber Depth; CCT: Central Corneal Thickness; WTW: White-To-White.

Surgery was performed under general anaesthesia. Phacoaspiration with implantation of the trifocal IOL was performed through a 2.2 mm clear corneal incision with manual continuous curvilinear capsulorhexis. Intraoperative findings confirmed intact zonular support and an intact posterior capsule, allowing in-the-bag IOL placement with good centration and stability (Fig. 1-4). No intraoperative complications occurred.

Postoperative treatment included topical tobramycin/dexamethasone in tapering doses and oral prednisolone. Patching therapy of the dominant right eye was initiated on postoperative day 5 and progressively reduced over approximately 12 weeks (from full-time to 4 hours/day, then 2 hours/day, then discontinued).

The patient was reviewed at multiple time points over an 11-month postoperative period (Table 2). BCVA in the operated eye reached 20/20 at the 2-week visit. Refractive stability was observed from the first month onwards, with postoperative spherical equivalent ranging between +0.75 and +1.00 D. Stereoacuity improved from 1980″ preoperatively to 480″, sustained through the 6-month visit. Intraocular pressure was within normal limits at all visits. The IOL remained well-centred throughout, with no posterior capsular opacification detected, no inflammatory reaction and no macular structural changes on OCT. Endothelial cell count at 6 months was 2650 cells/mm² (loss of approximately 6.7%), within the expected range following uncomplicated paediatric cataract surgery [3].

| Date | Follow-up | BCVA OS | SE OS (D) | TNO (") | IOP OS (mmHg) | Findings |
|---|---|---|---|---|---|---|
| 19/03/2025 | Day 0 | 0.25 sc | — | — | — | Corneal oedema, mydriasis |
| 24/03/2025 | Day 5 | 0.5 cc | +0.25 | 240 | — | IOL centred, no inflammation |
| 28/03/2025 | Day 9 | 0.6 cc | +0.50 | 240 | — | IOL centred, no inflammation |
| 04/04/2025 | 2 weeks | 1.0 cc | +1.00 | 480 | — | Normal, OCT normal |
| 14/04/2025 | 1 month | 1.0 cc | +0.87 | 480 | 14 | Normal, OCT normal, no OCP |
| 12/05/2025 | ~2 months | 0.9 cc | +0.87 | 480 | 14 | Normal, OCT normal, no OCP |
| 24/06/2025 | ~3 months | 0.9 cc | +0.75 | 480 | 14 | Normal, OCT normal, no OCP |
| 30/09/2025 | 6 months | 0.8 cc | +0.87 | 480 | 15.3 | Normal, OCT normal, ECD 2650 |
| 24/02/2026 | 11 months | 0.8 cc | +0.75 | 1980 | 15.4 | Normal, OCT normal, no OCP |

**Table 2:** Postoperative follow-up summary. BCVA: best-corrected visual acuity; sc: sine correctione; cc: cum correctione; SE: spherical equivalent; TNO: stereoacuity test (arc seconds); IOP: intraocular pressure; OCP: posterior capsular opacification; ECD: endothelial cell density.

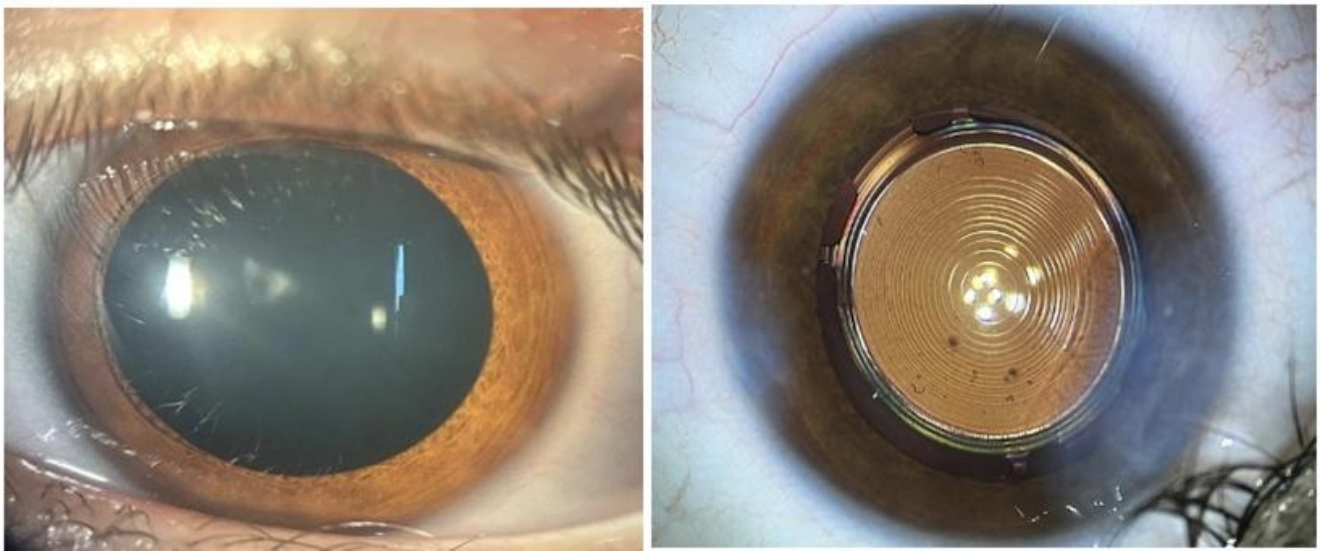

**Figure 1:** Preoperative slit-lamp photograph of the left eye showing posterior subcapsular cataract responsible for decreased visual acuity and refractive instability (left panel) and retroillumination view of the trifocal IOL following implantation showing correct centration and in-the-bag positioning (right panel).

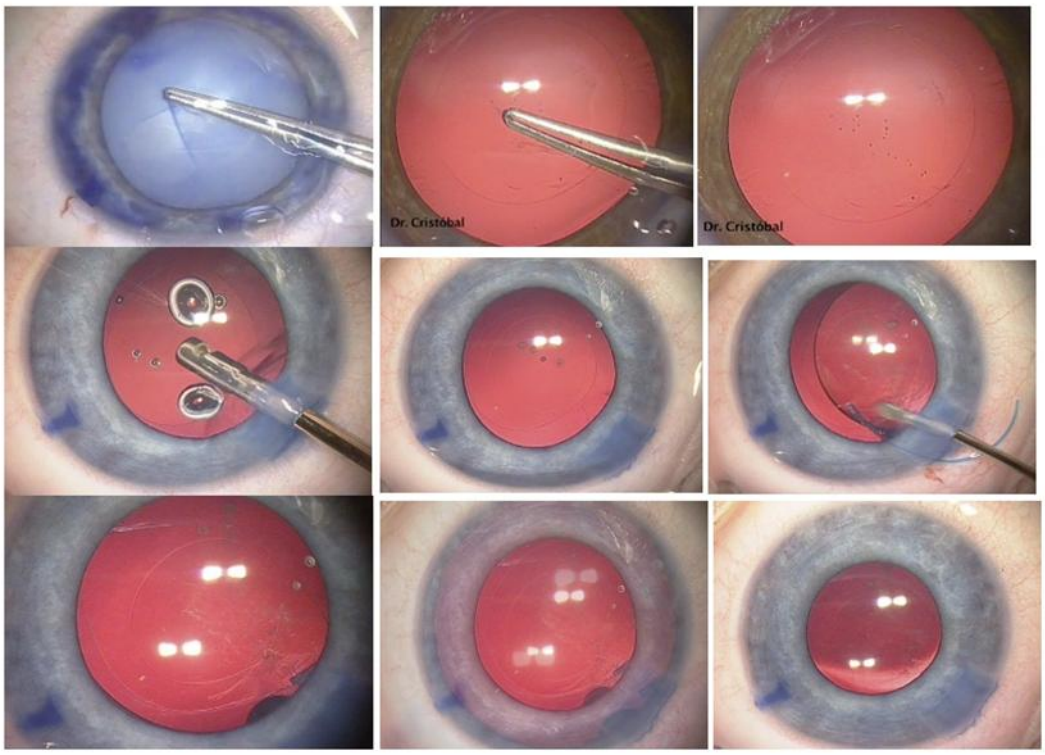


**Figure 2:** Intraoperative surgical sequence showing key steps of phacoemulsification and trifocal IOL implantation: corneal incision and capsulorhexis; lens aspiration; IOL loading and insertion; final positioning in the capsular bag with good centration and stability.

**Figure 3:** Intraoperative sequence showing trifocal IOL unfolding in the capsular bag. Left: IOL partially unfolded; centre: IOL positioning; right: final centred position.

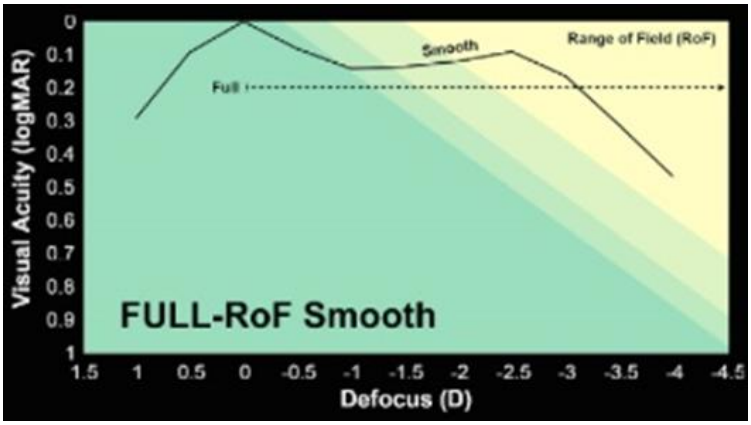


**Figure 4:** Defocus curve of the Physiol FineVision HP POD F GF trifocal IOL (Full-RoF Smooth profile), demonstrating continuous range of functional visual acuity from distance to near. logMAR: logarithm of the minimum angle of resolution; D: dioptres.

## Discussion

The use of multifocal IOLs in pediatric cataract surgery remains controversial but is gaining attention in selected cases. The primary advantage lies in providing functional vision at multiple distances simultaneously, potentially reducing spectacle dependence and supporting binocular integration during a period of active visual development-an outcome not achievable with monofocal implants [4-8].

In the present case, the marked and sustained improvement in stereoacuity from 1980″ preoperatively to 480″ at 3 and 6 months supports the hypothesis that trifocal optics may facilitate binocular integration when neural plasticity is preserved. The transient worsening observed at 11 months (480″ to 1980″) coincided with the discontinuation of patching therapy and the corresponding shift in binocular demand; this finding warrants continued monitoring but does not detract from the overall functional trajectory.

Previous reports of trifocal IOL implantation in children are scarce. Lucas, et al., reported a trifocal toric IOL in a paediatric traumatic cataract with favourable visual outcomes and Timur, et al., described bilateral trifocal implantation in a paediatric case with satisfactory binocular results [9,10]. Cristóbal, et al. and Ram, et al., have reported multifocal IOL outcomes in children above 5 years of age, with BCVA reaching 0.8–1.0 and stereoacuity improving to 100-480″ in appropriately selected patients, consistent with our findings [3,8]. However, published data on binocular vision outcomes specifically following trifocal IOL implantation in children remain limited and our case contributes to this evidence base.

Careful patient selection is paramount. Ideal candidates include children above 4-5 years of age with late-onset or traumatic unilateral cataract, intact and emmetropic fellow eye, preserved binocular potential, orthotropia or well-controlled strabismus, absence of significant ocular comorbidities and families capable of compliance with postoperative patching therapy. Accurate biometry and stable in-the-bag placement are prerequisites for predictable optical performance. The use of a validated modern formula (Barrett Universal II) in this case ensured appropriate IOL power selection.

The potential disadvantages of trifocal optics must be explicitly acknowledged. Reduced contrast sensitivity and dysphotopsia particularly haloes and glare are inherent to diffractive designs. In paediatric patients, the ability to report these symptoms may be limited and their impact on visual development is not fully characterised. Neuroadaptation in children may proceed more effectively than in adults, but the timeline remains uncertain. Refractive unpredictability related to ongoing axial growth and emmetropisation is a further concern; the deliberate selection of a +27.0 D IOL rather than the formula-predicted +28.0 D was intended to partially mitigate this by accepting a mild residual hypermetropic buffer. Finally, trifocal IOL use in paediatric patients is off-label and parental informed consent must explicitly address all these uncertainties.

The present report has acknowledged limitations: single case, absence of formal suppression testing, incomplete documentation of the traumatic mechanism and a follow-up of 11 months. Further prospective studies with larger cohorts, standardised binocular vision batteries and longer follow-up are required to define the role of trifocal IOLs in paediatric cataract surgery.

## Conclusion

Trifocal intraocular lens implantation may represent a viable option for visual rehabilitation in carefully selected pediatric cataract patients. Beyond restoring visual acuity at near and distance, it may contribute to meaningful recovery of binocular function, including stereopsis. Further studies with larger cohorts and long-term follow-up are required to better define the role of trifocal IOLs in this population.

## Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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**Data Availability Statement**

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

**Ethical Statement**

Written informed consent was obtained from the patient's legal guardians prior to surgery, explicitly addressing the off-label use of trifocal IOL technology in a paediatric patient, associated risks, uncertainties regarding long-term refractive outcomes and the possibility of future refractive intervention. The study was conducted in accordance with the principles of the Declaration of Helsinki.

**Informed Consent Statement**

Informed consent was obtained from all participants included in the study.

**Authors' Contributions**

All authors contributed equally to this paper.

**References**

1. Jing M, Zhang J, Ding Y, Huang Y. Multifocal intraocular lens implantation in children with unilateral congenital cataracts. J Cataract Refract Surg. 2024;50(1):18-23.
2. Asif MI, Raj N, Kalra N. Premium intraocular lenses in children. Eur J Ophthalmol. 2023;33(4):1517-28.
3. Ram J, Agarwal A, Kumar J, Gupta A. Bilateral implantation of multifocal versus monofocal intraocular lens in children above 5 years of age. Graefes Arch Clin Exp Ophthalmol. 2014;252:441-7.
4. Ding Y, Du Q, Liu X, Huang Y. Comparison of axial growth with multifocal and monofocal intraocular lenses in unilateral pediatric cataract surgery. Graefes Arch Clin Exp Ophthalmol. 2024;262(12):3889-96.
5. Ravalico G, Baccara F, Rinaldi G. Contrast sensitivity in multifocal intraocular lenses. J Cataract Refract Surg. 1993;19(1):22-5.
6. Sen HN, Sarikkola AU, Uusitalo RJ, Laatikainen L. Quality of vision after AMO Array multifocal intraocular lens implantation. J Cataract Refract Surg. 2004;30(12):2483-93.
7. de Silva SR, Evans JR, Kirthi V. Multifocal versus monofocal intraocular lenses after cataract extraction. Cochrane Database Syst Rev. 2016;12:CD003169.
8. Cristóbal JA, Remón L, Del Buey MÁ, Montés-Micó R. Multifocal intraocular lenses for unilateral cataract in children. J Cataract Refract Surg. 2010;36:2035-40.
9. Lucas MM, Vianna C, Prescott CR, Ferraz LO. Trifocal toric intraocular lens implantation in pediatric traumatic cataract. Am J Ophthalmol Case Rep. 2020;17:100575.
10. Timur MY, Auffarth GU, Son HS, Huber C, Beisse F. Bilateral trifocal IOL implantation in a pediatric case of cataract following steroid therapy for acute lymphoblastic leukemia. Am J Ophthalmol Case Rep. 2019;13:46-9.

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