



Capsular Bag Rescue in Traumatic Cataract with Extensive Zonular Dialysis: Combined CTS, CTR, Anterior Vitrectomy, and Iridodialysis Repair

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Abstract: Traumatic cataract with extensive zonular dialysis presents a surgical challenge, particularly when accompanied by iris injury and vitreous prolapse. Capsular support devices may facilitate preservation of the capsular bag and in-the-bag intraocular lens (IOL) implantation. We reported a 59-year-old man presented with decreased right-eye vision after a blunt trauma from a rebounding stone. Findings included hyphema, corneal abrasion, traumatic cataract, lens subluxation, and iridodialysis. Intraocular pressure (IOP) subsequently increased to 35 mmHg. After anterior segment inflammation and IOP were controlled, phacoemulsification was performed approximately two months after injury. Intraoperative zonular dialysis extended from approximately 10 to 4 o'clock. A capsular tension segment (CTS) was secured to the sclera at a single site between 7 and 8 o'clock using a 10-0 polypropylene suture, and a capsular tension ring (CTR) provided circumferential support within the bag. A three-piece IOL was implanted in the bag. Vitreous prolapse during implantation required anterior vitrectomy, and the associated iridodialysis was repaired. At the last documented follow-up, approximately one week postoperatively, visual acuity was 6/20, improving to 6/7.5 with pinhole. IOP was 20 mmHg without pressure-lowering medication. In conclusion, a scleral-fixated CTS combined with an in-the-bag CTR permitted capsular bag preservation and IOL implantation in this eye with extensive traumatic zonular dialysis. Associated vitreous prolapse and iridodialysis were addressed during the same operation. Longer follow-up is needed to assess sustained visual recovery and bag-IOL stability.

Keywords: traumatic cataract; zonular dialysis; capsular tension segment; capsular tension ring

INTRODUCTION

Traumatic cataract is a potentially vision-threatening consequence of blunt or penetrating ocular trauma. In blunt trauma, forces transmitted through the globe may affect several anterior segment structures, producing hyphema, corneal injury, iris sphincter damage, iridodialysis, zonular dialysis, lens subluxation, and cataract formation.¹ Surgical management is often more complex than routine age-related cataract surgery because media clarity, capsular integrity, zonular support, and vitreous status may all be compromised.²

When zonular dialysis is present, maintaining the capsular bag becomes a central surgical objective. Capsular tension rings (CTRs) were developed to redistribute forces around the capsular equator, maintain the circular contour of the capsular bag, reduce capsular collapse, and facilitate posterior chamber intraocular lens (IOL) implantation.³⁻⁵ However, extensive or focal zonular loss may require additional segmental support because a standard CTR alone may be insufficient for severe localized dialysis.

Capsular tension segments (CTSs) provide focal capsular support and may be combined with a CTR when both localized and circumferential stabilization are required.⁵⁻⁷ This case illustrates a traumatic cataract with extensive zonular dialysis, post-traumatic ocular hypertension, vitreous prolapse, and iridodialysis that was managed by combined CTS and CTR placement, anterior vitrectomy, and iris repair.

Case Presentation

A 59-year-old male presented with pain and decreased vision in the right eye following blunt ocular trauma from a rebounding stone while hammering. He had no history of previous ocular surgery. Initial right-eye visual acuity was 1/60, and intraocular pressure was 10 mmHg. Slit-lamp examination showed eyelid edema, conjunctival injection, corneal edema with Descemet folds, positive fluorescein staining, a negative Seidel test, grade 2 hyphema, and an irregular mid-dilated pupil. The crystalline lens showed traumatic cataract changes. The preoperative anterior segment findings are shown in Figure 1.

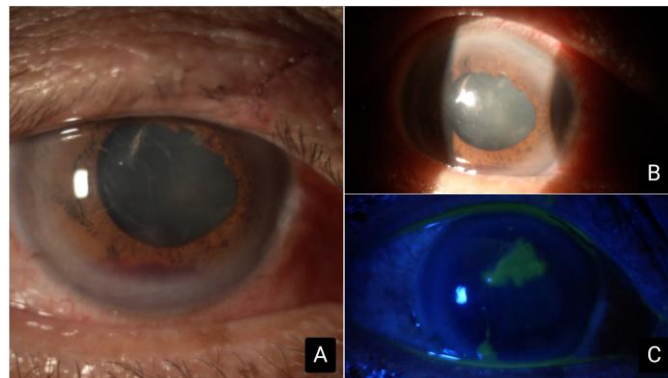


Figure 1. Preoperative anterior segment findings. (A) traumatic cataract with irregular pupil and lens instability; (B) superior iridodialysis from approximately 12 to 2 o'clock; and (C) corneal abrasion after blunt ocular trauma

During early follow-up, ocular pain decreased but blurred vision persisted. Examination revealed persistent hyphema, corneal abrasion, a subluxated cataractous lens, and phacodonesis, indicating zonular compromise. One week after trauma, intraocular pressure increased to 35 mmHg, indicating post-traumatic ocular hypertension.

After the anterior segment inflammation and intraocular pressure were controlled, surgical management was planned. The rationale for a staged approach was to allow the acute inflammatory response to subside, the hyphema to clear, and the corneal surface and clarity to improve, while establishing adequate pressure control before complex anterior segment

reconstruction. These considerations are consistent with individualized timing of traumatic cataract surgery based on ocular stability and associated injuries.⁸ Preoperatively, the right eye had traumatic cataract with lens subluxation, residual corneal scarring, and a history of post-traumatic ocular hypertension. Phacoemulsification with IOL implantation was performed approximately two months after the initial injury.

Intraoperatively, extensive zonular dialysis was identified from approximately 10 to 4 o'clock, involving approximately six clock hours. A capsular tension segment (CTS) was placed to provide focal capsular support. A polymethyl methacrylate capsular tension ring (CTR; Type 4, 13.0-mm nominal diameter and 11.0-mm compressed diameter) was inserted into the capsular bag to provide circumferential support. The CTS was secured to the sclera at a single fixation site between 7 and 8 o'clock using a 10-0 polypropylene suture on a straight needle (MANI), with a 3-1-1 knot configuration. The scleral fixation suture was attached only to the CTS; the CTR remained within the capsular bag without direct scleral suturing. Following capsular stabilization and cataract removal by phacoemulsification, a three-piece IOL was implanted in the capsular bag.

During IOL placement, vitreous prolapse was encountered and anterior vitrectomy was performed. The associated iridodialysis, clinically located superiorly from approximately 12 to 2 o'clock, was repaired using a 10-0 suture. The procedure was completed successfully with preservation of the capsular bag and restoration of anterior segment anatomy. The operative sequence is illustrated in Figure 2.

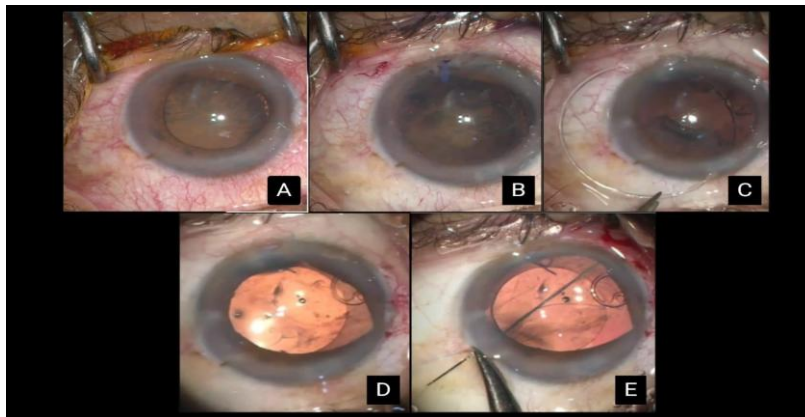


Figure 2. Intraoperative surgical management. Sequential intraoperative images showing (A) lens subluxation with zonular dialysis; (B) capsular tension segment placement; (C) capsular tension ring insertion; (D) intraocular lens implantation, and (E) iridodialysis

At the last documented follow-up, approximately one week after surgery, the right eye was pseudophakic (Figure 3). Intraocular pressure was 20 mmHg without pressure-lowering medication, and visual acuity was 6/20, improving to 6/7.5 with pinhole. Phacoemulsification, IOL implantation, anterior vitrectomy, and iridodialysis repair were completed during the same operative session, approximately two months after the injury. The interval from injury to the final reported assessment was therefore approximately two months and one week. The interval between injury and initial presentation was not documented; consequently, the admission-to-surgery interval could not be determined precisely.

Timeline

Injury: blunt right-eye trauma from a rebounding stone. **Initial presentation:** interval after injury not documented. **One week after injury:** IOP increased to 35 mmHg. **Approximately two months after injury:** phacoemulsification, CTS scleral fixation, CTR insertion, IOL implantation, anterior vitrectomy, and iridodialysis repair in one operative session. **One week after surgery:** final documented visual acuity and IOP assessment.

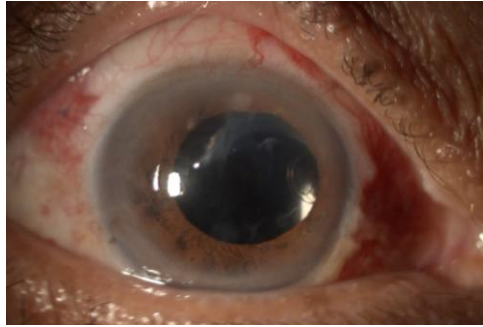


Figure 3. Postoperative anterior segment appearance at one week following phacoemulsification, in-the-bag IOL implantation, capsular support, and iridodialysis repair.

DISCUSSION

This case demonstrates the surgical complexity of traumatic cataract when multiple anterior segment structures are involved. Blunt trauma can produce a combination of hyphema, corneal abrasion or scarring, iris root disruption, zonular dialysis, and traumatic lens subluxation.¹ In such cases, careful preoperative assessment is necessary, but the true extent of zonular damage may only become evident intraoperatively.

Preoperative assessment should consider both clinically visible lens instability and zonular injury concealed by opaque media. In a prospective study of 143 traumatized eyes with opaque media, Bhatt et al. detected zonular abnormalities by ultrasound biomicroscopy (UBM) in 79 eyes (55.2%), including both zonular tears and stretching. UBM also allowed the circumferential extent of the defect to be described in clock hours.⁹ These findings support UBM as an adjunct when slit-lamp examination cannot adequately define zonular support. However, the study population was selected for trauma with opaque media; the reported proportion should not be interpreted as the prevalence of zonular injury in all traumatic cataracts. For the present case, the extent of dialysis was established intraoperatively.

The timing of cataract extraction must be interpreted in the context of the associated injuries. Tabatabaei et al. randomized 60 eyes with traumatic cataract after open-globe injury to surgery within the first week or at one to two months. Six-month best-corrected visual acuity did not differ significantly, although intraoperative zonulysis was more frequent in the delayed group.¹⁰ The trial excluded several complex presentations, including lens material in the anterior chamber and posterior segment involvement requiring pars plana vitrectomy. Its results therefore do not establish an optimal two-month delay for a closed-globe injury with extensive zonular dialysis. In this patient, the interval is best understood as an individualized period of ocular stabilization, rather than a universally recommended waiting time. Persistent lens-induced inflammation or uncontrolled pressure would require reconsideration of delayed intervention.⁸

The principal surgical decision in this case was whether the capsular bag could be preserved. Retaining an adequately stabilized bag permits posterior chamber IOL placement while avoiding alternative fixation in selected eyes. In a retrospective, noncomparative series of 41 traumatic cataracts with at least six clock hours of zonulysis, Chee and Jap preserved the bag with a Cionni modified CTR in 36 eyes and a CTS-CTR combination in two eyes; preservation was unsuccessful in three eyes with total zonulysis.² This is directly relevant to the extent of zonular injury described here, but the small number treated with the combined approach does not establish superiority over other methods.

A standard CTR redistributes equatorial forces across the remaining zonules and maintains the contour of the capsular bag.³⁻⁵ It does not independently provide scleral fixation. A CTS can provide localized support and, when secured to the sclera through its fixation eyelet, can supply an additional anchoring point for a bag with inadequate residual zonular support.⁵⁻⁷ Georgopoulos et al⁴ reported favorable results with a standard CTR in 17 eyes with traumatic zonular dialysis of 80-160 degrees. The approximately 180-degree defect in this case lies beyond that series' reported

range, so those findings should not be generalized to imply that a standard CTR alone is sufficient. Device selection depends on the remaining zonules, capsular integrity, and intraoperative stability. In this eye, the scleral-sutured CTS provided a fixation point, while the unsutured CTR provided circumferential support within the bag. The one-week outcome cannot establish the long-term durability of this reconstruction.

Capsular bag preservation should remain conditional on achieving safe support. When the bag cannot be retained or adequately stabilized, alternatives include anterior chamber IOL implantation, iris fixation, and scleral fixation. An American Academy of Ophthalmology assessment of 45 studies found insufficient evidence to establish the superiority of any single IOL implantation technique in the absence of zonular support; most included studies provided level III evidence.¹¹ Accordingly, an alternative fixation method should be selected according to the condition of the iris, cornea, angle, and posterior segment, together with surgical expertise. The present case demonstrates the feasibility of preserving the bag in one eye and does not provide a comparative assessment of these alternatives.

Anterior vitrectomy was another key step. Zonular disruption can permit vitreous to enter the anterior chamber during lens extraction or IOL implantation. When prolapse occurs, the surgical objective is controlled removal of anteriorly displaced vitreous while minimizing traction, rather than pulling vitreous strands through the incision. The choice of an anterior or posterior approach depends on the location of the lens, capsular support, and associated vitreoretinal pathology.^{1,8} In the present operation, anterior vitrectomy was performed when vitreous prolapse was recognized during IOL implantation. This is an essential part of managing the observed complication, but a favorable early result should not be interpreted as excluding subsequent retinal or macular complications.

Repair of iridodialysis also contributed to anterior segment reconstruction. Iris root defects may produce glare, photophobia, monocular diplopia, and cosmetic disturbance, although the functional impact depends on the size and position of the defect.¹² The cited report by Peng et al. describes a different, double-armed flanged polypropylene technique for wide iridodialysis; it supports the reconstructive principle rather than validating the specific 10-0 suture technique used here. In this patient, the superior iris root was repaired after lens implantation and vitreous management. Because postoperative glare and photophobia were not quantified, symptom relief should not be inferred solely from the anatomical appearance.

Pressure surveillance remains important after the initial episode has resolved. In a prospective study of closed-globe injuries, Sihota et al¹³ identified hyphema, lens displacement, elevated baseline IOP, greater angle recession, and heavier trabecular pigmentation as features associated with chronic traumatic glaucoma. The hyphema and lens subluxation in this case therefore justify continued attention to pressure and angle status. Gonioscopy when the eye permits examination, serial tonometry, and optic nerve assessment can help distinguish transient post-traumatic pressure elevation from persistent glaucoma. An IOP of 20 mmHg without pressure-lowering medication at one week represents an early postoperative pressure outcome, but does not establish sustained pressure control or exclude later glaucoma. Angle recession was not documented in this case.

The early postoperative outcome was favorable, with an IOP of 20 mmHg without pressure-lowering medication and visual acuity of 6/20 improving to 6/7.5 with pinhole at approximately one week. Eyes with zonular dialysis require follow-up beyond early visual recovery, given the potential for surgical and postoperative complications.¹⁴ Werner et al. described 23 explanted CTR-IOL-capsular bag complexes after late subluxation or dislocation.¹⁵ Most cases were associated with pseudoexfoliation rather than trauma, so this series cannot quantify the risk in the present patient. Nevertheless, it demonstrates that CTR implantation does not guarantee permanent bag-IOL stability. Subsequent assessment should document IOL centration, capsular contraction, inflammation, pressure, and posterior segment findings as clinically indicated.^{6,8}

The principal limitations are the single-patient design and the one-week postoperative observation period. Pinhole acuity indicates potential visual improvement but is not equivalent to

a formal postoperative refraction or best-corrected visual acuity measurement. Longer follow-up with refraction and assessment of IOL position is necessary before sustained functional recovery can be established. Since cataract extraction, capsular support, anterior vitrectomy, and iris repair were performed together, the contribution of each component cannot be separated. This report therefore provides an example of early anatomical and visual rehabilitation, rather than evidence of comparative efficacy or long-term safety.

CONCLUSION

Traumatic cataract with extensive zonular dialysis requires careful assessment of residual capsular support and readiness to manage associated vitreous and iris injuries. In this case, a scleral-fixated CTS combined with an in-the-bag CTR permitted capsular bag preservation and in-the-bag IOL implantation, while anterior vitrectomy and iridodialysis repair addressed additional anterior segment damage. The favorable one-week outcome supports the feasibility of this approach in a selected eye. Confirmation of long-term visual recovery and bag-IOL stability requires further follow-up.

Conflict of Interest

The author declares no conflict of interest related to this study.

Author Contributions

All authors approved the final version of the manuscript. Moreover, the authors declare that no AI-assisted technologies were used in the writing of this manuscript.

REFERENCES

1. Okoye GS, Gurnani B. Traumatic cataract. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2026 Jan. Updated 2023 Aug 27. PMID: 37603642. Available from: <https://www.statpearls.uk/point-of-care/144554>
2. Chee SP, Jap A. Management of traumatic severely subluxated cataracts. *Am J Ophthalmol*. 2011;151(5):866-71.e1. Doi: <https://doi.org/10.1016/j.ajo.2010.10.035>
3. Gimbel HV, Sun R, Heston JP. Management of zonular dialysis in phacoemulsification and IOL implantation using the capsular tension ring. *Ophthalmic Surg Lasers*. 1997;28(4):273-281. Doi: <https://doi.org/10.3928/1542-8877-19970401-03>
4. Georgopoulos GT, Papaconstantinou D, Georgalas I, Koutsandrea C, Margetis I, Moschos MM. Management of large traumatic zonular dialysis with phacoemulsification and IOL implantation using the capsular tension ring. *Acta Ophthalmol Scand*. 2007;85(6):653-7. Doi: <https://doi.org/10.1111/j.1600-0420.2007.00901.x>
5. Hasane K, Ahmed I. Capsular tension rings: update on endocapsular support devices. *Ophthalmol Clin North Am*. 2006;19(4):507-19. Doi: <https://doi.org/10.1016/j.ohc.2006.07.001>
6. Weber CH, Cionni RJ. All about capsular tension rings. *Curr Opin Ophthalmol*. 2015;26(1):10-5. Doi: <https://doi.org/10.1097/ICU.0000000000000118>
7. Singh MK, Ambati BK, Crandall AS. New capsular tension segment with 2-point fixation for zonular weakness. *J Cataract Refract Surg*. 2017;43(5):590-2. doi: <https://doi.org/10.1016/j.jcrs.2017.04.021>
8. Soleimani M, Cheraqpour K, Salari F, Fadakar K, Habeel S, Bahamoori SM, et al. All about traumatic cataracts: narrative review. *J Cataract Refract Surg*. 2024;50(7):760-6. Doi: <https://doi.org/10.1097/j.jcrs.0000000000001424>
9. Bhatt V, Bhatt D, Barot R, Sheth J. Ultrasound biomicroscopy for zonular evaluation in eyes with ocular trauma. *Clin Ophthalmol*. 2021;15:3285-91. Doi: <https://doi.org/10.2147/OPHTH.S323349>
10. Tabatabaei SA, Rajabi MB, Tabatabaei SM, Soleimani M, Rahimi F, Yaseri M. Early versus late traumatic cataract surgery and intraocular lens implantation. *Eye (Lond)*. 2017;31(8):1199-204. Doi: <https://doi.org/10.1038/eye.2017.57>
11. Shen JF, Deng S, Hammersmith KM, Kuo AN, Li JY, Weikert MP, et al. Intraocular lens implantation in the absence of zonular support: an outcomes and safety update: a report by the American Academy of Ophthalmology. *Ophthalmology*. 2020;127(9):1234-1258. Doi: <https://doi.org/10.1016/j.ophtha.2020.03.005>
12. Peng T, Guo H, Wang Y, Zhou L, Bao X. Case report: double-armed flanged polypropylene suture for repairing wide iridodialysis. *Front Med (Lausanne)*. 2023;9:1084538. Doi: <https://doi.org/10.3389/fmed.2022.1084538>

13. Sihota R, Kumar S, Gupta V, Dada T, Kashyap S, Insan R, et al. Early predictors of traumatic glaucoma after closed globe injury: trabecular pigmentation, widened angle recess, and higher baseline intraocular pressure. *Arch Ophthalmol*. 2008;126(7):921-6. Doi: <https://doi.org/10.1001/archophth.126.7.921>
14. Aiello F, Rampat R, Afflitto G, Din N, Mandal N, Maurino V. Zonular dialysis and cataract surgery: results from a UK tertiary eye care referral centre. *Can J Ophthalmol*. 2024;59(2):67-72. Doi: <https://doi.org/10.1016/j.jcjo.2022.12.001>
15. Werner L, Zaugg B, Neuhann T, Burrow M, Tetz M. In-the-bag capsular tension ring and intraocular lens subluxation or dislocation: a series of 23 cases. *Ophthalmology*. 2012;119(2):266-71. Doi: <https://doi.org/10.1016/j.opthta.2011.08.016>