

# Intraocular lens implantation performed first to protect the posterior capsule in Morgagnian cataracts during phacoemulsification

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## Abstract

• This study evaluated the safety of a modified method to implant an intraocular lens (IOL) into the capsular bag immediately after capsulorhexis with a whole or partial nucleus to protect the posterior capsule (PC) during phacoemulsification in a series of 12 Morgagnian cataracts. For 3 cases of hypermature cataracts with smaller and rigid nuclei, after a complete capsulorhexis, an IOL was directly inserted into the capsular bag, which protected the PC during the subsequent phacoemulsification process in the iris plate. For the other 9 cases with larger and softer nuclei, after the nucleus was partially emulsified, the IOL was inserted into the bag. Even with an obvious surge for some cases, the surgeries were uneventful in all 12 cases, with no PC rent or vitreous loss. IOL implantation into the

capsular bag with a whole or partial nucleus can provide effective protection for the PC for hypermature cataract during phacoemulsification.

• **KEYWORDS:** intraocular lens; hypermature cataract; Morgagnian cataract; phacoemulsification; posterior capsule

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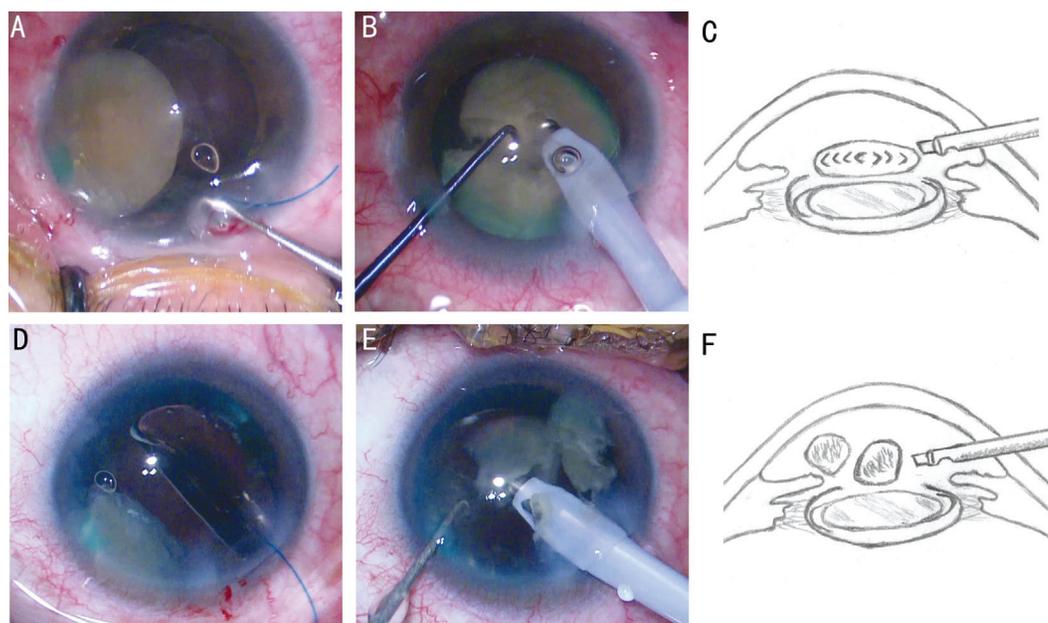
## INTRODUCTION

Morgagnian cataracts are a challenge for almost all ophthalmic surgeons during phacoemulsification, as this type of cataract exhibits a fibrous anterior capsule, a liquid cortex, an expanding capsular bag, zonular weakness, and a hard nucleus<sup>[1-3]</sup>. Even with surgical expertise and caution, the loss of corneal endothelial cells, posterior capsule (PC) rupture, and related posterior complications are sometimes inevitable. Some experts have recently suggested the use of different techniques for these difficult cataract cases. These techniques include the visco-shell technique<sup>[4]</sup> and intraocular lens (IOL) scaffold technique<sup>[1]</sup>, both of which have achieved satisfactory results. Here, we report our results using the IOL scaffold technique to protect the PC immediately after capsulorhexis with the whole nucleus or part of the nucleus phacoemulsified in a series of Morgagnian cataracts.

## SUBJECTS AND METHODS

**Ethical Approval** This retrospective study was approved by the Ethics Committee of the First People's Hospital of Xianyang, and all procedures were performed in accordance with the principles outlined in the Declaration of Helsinki. All patients signed an individual consent form before cataract surgery.

From January 1, 2016 to December 12, 2018, patients with a clinical diagnosis of Morgagnian cataracts based on slit lamp microscopy who underwent phacoemulsification with IOL implantation to protect the PC right after capsulorhexis or partial emulsification of nuclei were retrospectively reviewed.



**Figure 1** Diagram of IOL implantation first to protect the PC in Morgagnian cataract during phacoemulsification A: Insertion of the IOL into the capsular bag under a whole lens nucleus using a Sinsky hook; B: Phaco-chop of the whole lens nucleus performed in the iris plane after the IOL was placed in the bag to protect the PC; C: Schematic diagram of phacoemulsification of the whole nucleus in the iris plane with the IOL in the capsular bag; D: Insertion of the IOL into the capsular bag under a partial nucleus using a Sinsky hook; E: Phaco-chop of the partial nucleus performed in the iris plane after the IOL was placed in the bag to protect the PC; F: Schematic diagram of phacoemulsification of the partial nucleus in the iris plane with the IOL in the capsular bag.

After topical anesthesia was applied, a 1-mm side port clear corneal incision was made, followed by an injection of indocine green (ICG, 0.5%, Ruidu<sup>®</sup>, Dandong, China) to stain the anterior capsule for 15s before it was replaced by balanced saline solution. An ophthalmic viscosurgical device (OVD), 1.5% sodium hyaluronate (Shanghai Qisheng Biological Agent Co., China), was used to fill the anterior chamber. A 2.8-mm, 3-step, clear corneal incision was made at 90 degrees to the right of the side port incision. Capsulorhexis was initiated by pinching the anterior capsule with forceps, and the liquid cortex was then aspirated from the capsular bag with a 5 mL syringe. A 5.5-mm continuous curvilinear capsulorhexis (CCC) was then performed with forceps. No hydroprocesses were performed, and some of the OVD was injected into the capsular bag to tilt the lens nucleus and provide more space between the nucleus and the rim of the CCC. A 3-piece IOL was implanted with the assistance of a Sinsky hook and a spatula to prolapse the lens nucleus into the anterior chamber and to provide space for the IOL in the capsular bag. A venture system phaco machine (Stellaris, Bausch & Lomb, Rochester, New York, USA) was set to a smaller perimeter than normal and used at a vacuum pressure of 280 mm Hg, a bottle height of 85 cm, and 40% power. The phaco-chop technique was used with the phaco tip bevel down (Figure 1A-1C).

For some cases of hypermature cataracts, IOL was inserted into the capsular bag after the partial nucleus was phacoemulsified. The routine procedures were performed as mentioned

previously, with the difference being the timing of IOL implantation. In all the cases selected for this series, the anterior chamber was shallow, and the pressure in the posterior chambers was increased. After the integrity of PC was verified, the IOL was carefully inserted into the capsular bag, as some pieces of nucleus could be found in the anterior chamber or in the bag (Figure 1D-1F). Then, the residual nuclear pieces were emulsified, and the cortex and OVD were aspirated.

## RESULTS

In total, 12 cases of Morgagnian cataracts with IOL to protect the PC were identified among 5500 routine phacoemulsification. Among these, the IOL was inserted into the capsular bag immediately after capsulorhexis and before phacoemulsification in 3 cases, and in the other 9 cases, the IOL was implanted after part of the lens nucleus was emulsified. On day one post-operation, some corneal edema with some folds in Decemet's membrane was observed in most cases and resolved within 1wk. Temporarily high IOP was found in 3 eyes, which was controlled by tapping some of the aqueous, and resolved within 2d. In 2 eyes with uneventful surgery, obvious macular degeneration was found after surgery (Table 1).

## DISCUSSION

Although the incidence of Morgagnian cataract is decreasing, it remains common in China, especially in rural and underdeveloped areas. Even when treated by experienced clinicians, the rate of surgical complications when treating

**Table 1 Clinical and demographic data of the cases of Morgagnian cataract**

Cases	Gender	Age, y	Right/Left	VA (preop.)	Timing of IOL implantation	BCVA (1wk postop.)
No.1	Male	72	Right	LP	After the nucleus was partially emulsified	20/25
No.2	Male	68	Left	LP	After the nucleus was partially emulsified	20/20
No.3	Female	82	Left	LP	After the nucleus was partially emulsified	20/40
No.4	Female	77	Left	HM	After capsulorhexis	20/25
No.5	Female	64	Right	HM	After the nucleus was partially emulsified	20/20
No.6 <sup>a</sup>	Male	86	Right	HM	After the nucleus was partially emulsified	20/200
No.7	Male	69	Left	LP	After the nucleus was partially emulsified	20/25
No.8	Male	74	Left	HM	After the nucleus was partially emulsified	20/25
No.9 <sup>a</sup>	Female	74	Right	HM	After capsulorhexis	20/200
No.10	Female	73	Right	HM	After capsulorhexis	20/25
No.11	Male	73	Left	LP	After the nucleus was partially emulsified	20/25
No.12	Male	68	Left	LP	After the nucleus was partially emulsified	20/32

VA: Visual acuity; IOL: Intraocular lens; BCVA: Best corrected visual acuity; LP: Light perception; HM: Hand motion. <sup>a</sup>Obvious macular degeneration was observed after surgery.

this type of cataract is much higher than that when treating cataracts of other stages and types and can include shrinkage and fibrosis of the anterior capsule, weak zonules, a liquid cortex, an enlarged capsular bag, and a hard nucleus with indeterminate thickness<sup>[5-7]</sup>. Several groups have attempted to use the IOL as a shell to protect the PC during phacoemulsification<sup>[1,8]</sup>; this approach resulted in a lower incidence of PC rupture and nucleus drop into the vitreous cavity<sup>[9]</sup>. In addition, estimating the thickness of the hard nucleus was difficult, and therefore, we decided to insert the IOL into the capsular bag after capsulorhexis to protect the PC and perform a much safer phacoemulsification. Several points need to be addressed regarding this process.

For the 3 cases of hypermature cataracts, after successful capsulorhexis, we found that the nucleus was as rigid as N5 and less than 5.5 mm in diameter, and we presumed that the thickness would be thin; thus, the IOL was inserted into the bag before phacoemulsification. In such a situation, special care should be taken, as the whole rigid nucleus is in the bag after capsulorhexis. With the help of ophthalmic OVD and a Sinsky hook, the isolated nucleus was moved into the anterior chamber, followed by IOL implantation into the bag. As the zonules might be weak, no pressure should be exerted into the capsular bag, and since the nucleus was in the anterior chamber, slightly more phase power might damage the corneal endothelial cells.

For the other 9 cases, we found that the nucleus was relatively large (above 5.5-6 mm in diameter) and not as rigid (less than N4); thus, we could start a routine phacoemulsification process with careful maneuvers. During phacoemulsification, the phaco needle should not be buried as deep as usual because the nucleus in these cases can be rather thin, and no epinucleus can be used to protect the exposed PC. The chopping process should be observed clearly; and only the isolated nucleus

should be found in the capsular bag so that the chopper can easily pass the equator of the nucleus and horizontally split it into two pieces. No pressure should be exerted on the capsular bag, as the zonules might be relatively weak in such a case. As fragments of the nucleus are removed, the PC may be found to have integrity. Then, the decision to insert the IOL before all of the nucleus material is emulsified can be made if the anterior chamber becomes shallower or if the pressure of the posterior chamber increases. After the IOL was located in the bag, the residual nucleus could be emulsified as usual at the iris plateau, similar to the technique reported by Luo *et al*<sup>[8]</sup> for dense nuclear cataract cases<sup>[10]</sup>.

As the IOL was in the bag, the whole or partial nucleus was emulsified in the iris plate. We found that in most cases the zonules were weak, and the setting of bottle height and vacuum were slightly lower than usual. Special care needed to be taken as the OVD was injected into the anterior chamber, lowering the speed at which the lens pieces were emulsified, especially the last piece, avoiding obvious surge during the surgery. Moreover, we used the bevel-down technique to attempt to limit the phaco energy to the nucleus rather than the cornea.

In conclusion, Morgagnian cataracts are a very difficult type of cataract to treat with surgery with a high incidence of complications. IOL implantation into the capsular bag can provide effective protection for the PC for a subsequent phacoemulsification and may increase surgical safety and produce satisfactory results, especially in cases with a hard nucleus with underdetermined thickness.

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