

CCC, PCCC, or Membrane Capture

Implanting an IOL in the absence of capsular bag fixation.

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The objectives of IOL implantation are (1) a centered lens, (2) capsular fixation, and (3) a barrier to vitreous migration. In the absence of bag fixation, these objectives may be achieved by optic capture using either anterior continuous curvilinear capsulorhexis (CCC) capture, posterior CCC (PCCC) capture, or capsular membrane capture.

An absence of bag fixation can occur at any stage of primary cataract surgery (Table 1) and is almost certain to occur in secondary IOL surgery, such as during removal and replacement, repositioning, or secondary IOL placement after extracapsular cataract extraction (Table 2). The surgeon usually cannot reopen a fused capsular bag for bag fixation of an IOL. He may remove a defective IOL from a fused capsular bag by sliding the loops out of the membrane; if this is not possible, he may cut off the loops and leave them in the membrane. He may use a similar removal technique for an eccentric IOL with only one loop in the bag.

The surgeon may easily remove from but not reposition into the capsular bag a mobile sulcus IOL, which may cause uveitis, glaucoma, or hypema (UGH) syndrome. In some cases, he may form a new CCC peripheral to the original one (which is fused to the posterior capsule) to create a bag sulcus for the IOL loops, but this option is rarely possible.

Aphakia after extracapsular cataract extraction usually provides a capsular membrane for sulcus IOL placement but not bag placement. These surgical challenges lend themselves to secondary surgical techniques that utilize

membrane IOL capture. This article discusses surgical alternatives for optic capture that maximize the potential for capsular bag IOL fixation in primary and secondary surgery (Table 3).

CCC IOL FIXATION

Various capsule and membrane optic capture techniques have been described in detail in the literature.¹ Surgeons may perform the capsulorhexis fixation method of optic capture when an intact anterior capsulorhexis opening is present and the capsular bag's integrity is compromised. Most often, the surgeon performs anterior capsulorhexis IOL fixation when a large posterior capsular tear—although it has not extended around the equator of the capsule to the CCC—is too large to convert to a PCCC or to safely receive an IOL. If vitreous prolapse has occurred,

TABLE 1. ABSENCE OF CAPSULAR BAG FIXATION OF IOLs DURING CATARACT AND IOL SURGERY

Complication	Type
Traumatic capsular tear	<ul style="list-style-type: none"> • Anterior • Anterior and posterior • Equatorial
Iatrogenic capsular tear	<ul style="list-style-type: none"> • Anterior • Posterior • Anterior and posterior • Equatorial

TABLE 2. ABSENCE OF IOL CAPSULAR BAG FIXATION DURING SECONDARY IOL SURGERY

Procedure	Complication
Removal and replacement	<ul style="list-style-type: none"> • IOL material degradation • Nd:YAG-pitted IOLs
Repositioning	<ul style="list-style-type: none"> • Subluxated sulcus IOL • Eccentric IOLs (one loop out of the bag) • Mobile sulcus IOLs causing UGH syndrome
Secondary IOL placement	<ul style="list-style-type: none"> • Aphakia after extracapsular cataract extraction

the surgeon should perform an anterior vitrectomy, while taking care to avoid extending the posterior capsular tear and violating the anterior capsular edge with the vitrectomy handpiece. Once he has removed all of the prolapsed vitreous, the surgeon may place viscoelastic into the anterior chamber and ciliary sulcus before inserting the IOL into the ciliary sulcus. If he deems the anterior capsulorhexis opening to be reasonably centered and smaller than the IOL's optic, he may place the optic through the capsulorhexis using gentle pressure on first one side and then the other of the IOL's anterior surface, 90° away from the haptic-optic junctions. The haptics remain in the ciliary sulcus while the surgeon captures the IOL's optic posteriorly through the capsulorhexis opening.

SULCUS-PLACED HAPTICS AND OPTIC CAPTURE THROUGH THE PCCC

The surgeon may consider this technique as an alternative to sulcus IOL placement in cases in which the anterior CCC has more than one large tear to the equator of the capsule that compromises the secure placement of the haptics into the capsular bag. In addition, an intact PCCC must be present, either as a result of a primary PCCC or a small posterior tear that is converted into a PCCC.² In this situation, the surgeon may position the IOL in the ciliary sulcus and capture the optic posteriorly through the anterior and posterior capsulorhexis openings. This approach

maintains centration of the IOL and prevents Elshnig pearl formation posterior to the IOL. I recommend that surgeons use a highly viscous viscoelastic material during the capture to avoid extending an anterior capsular leaflet tear to the PCCC.

HAPTICS IN THE CAPSULAR BAG AND OPTIC CAPTURE THROUGH THE PCCC

The surgeon performs a posterior capture of the IOL optic under an ocular viscoelastic device. He applies gentle pressure to one half of the IOL's optic, 90° from the haptic-optic junction, and then exerts slow and gentle pressure on the second half of the optic through the capsulorhexis opening. The physician should perform an anterior vitrectomy if vitreous herniates through the posterior capsulorhexis opening.

The technique of posterior capsulorhexis with optic capture has been used to prevent secondary opacification of the visual axis in children, but it may also be appropriate in adults.³ In localities where access to Nd:YAG lasers is limited, or if the patient is unable to sit up or cooperate for an Nd:YAG capsulotomy, this technique may be considered as a method to eliminate the need for surgical discission of the opacified posterior capsule. Also, the technique of optic capture has the advantage of preventing vitreous herniation that may occur if the surgeon performs a primary posterior capsulotomy in the absence of optic capture.

TABLE 3. OPTIC CAPTURE OPTIONS

Position of Haptics	Optic Capture Procedure
Haptics in sulcus	<ul style="list-style-type: none"> • CCC optic capture • PCCC optic capture—CCC torn
Haptics in capsular bag	<ul style="list-style-type: none"> • CCC optic capture after posterior capsular tear too extensive for conversion to a PCCC • CCC optic capture for anterior piggyback IOL • PCCC optic capture <ul style="list-style-type: none"> <i>Pediatric</i> <ul style="list-style-type: none"> - without anterior vitrectomy - after anterior vitrectomy <i>Adult</i> <ul style="list-style-type: none"> - disability, ie, ankylosing spondylitis - dementia - geographic limitations
Haptics in sulcus, anterior to capsular membrane	<ul style="list-style-type: none"> • Membrane optic capture
Haptics posterior to capsular membrane (dislocated)	<ul style="list-style-type: none"> • Membrane optic capture

HAPTICS IN THE CAPSULAR BAG AND OPTIC CAPTURE THROUGH A CCC

Bringing the IOL's optic anteriorly through the CCC effectively achieves a reverse capsulorhexis fixation. This technique is useful when a large posterior capsular tear occurs or a small tear extends after the surgeon places an IOL in the capsular bag, thus making stable IOL fixation uncertain. The surgeon may also use this technique if, while he performs a PCCC under an in-the-bag IOL's optic, a radial tear of the PCCC occurs that renders the IOL unstable within the capsular bag. The surgeon may then bring the IOL's optic forward and capture it through the anterior CCC, thus creating IOL stability and ensuring lens centration. Another use of this technique is to bring the optic of a piggyback IOL out of the capsular bag while leaving the haptics in the bag. This approach may reduce the incidence of pearl accumulation in the interface between the two IOLs while maintaining capsular fixation of the second IOL.

HAPTICS IN THE SULCUS AND IOL CAPTURE THROUGH A MEMBRANE OPENING

This technique is useful for secondary procedures such as repositioning decentered IOLs or fixating replacement IOLs (when in-the-bag lenses must be replaced for reasons such as optical degradation from Nd:YAG pits, calcification or crystallization). Decentration of the IOL may occur because of poor initial positioning, such as one haptic in the sulcus and one in the bag. This problem may also occur because of asymmetric contraction of the capsular bag. The surgeon may bring the IOL into the sulcus or perform an IOL replacement by placing the haptics in the sulcus and capturing the optic through the capsular membrane opening. The surgeon may use a vitrector to enlarge a membrane opening that is too small or eccentric. If no opening is present, he may use a PCCC or the anterior vitrectomy handpiece to make an opening slightly smaller than the size of the optic through which to perform the optic capture. Capsular membrane openings that are enlarged or made with the vitrector usually resist tearing and extension because of the fibrosis located between the capsules or on the capsule around the previous opening. Capturing the IOL's optic through the membrane opening achieves better long-term centration of the IOL and avoids, or at least minimizes, the chaffing of uveal tissues.

This technique is particularly useful if the IOL being repositioned (1) has an overall length that may be appropriate for the capsular bag but not long enough for the sulcus or (2) has haptics that are crimped and no longer suitable for sulcus placement. Capturing the IOL through the membrane opening can achieve IOL stability, eliminate IOL movement, and minimize the risk of late displacement.

Another benefit of IOL capture through a membrane opening is that it creates a tight barrier between the anterior and posterior segments. This barrier can eliminate the possibility of the vitreous' moving forward into the anterior chamber, a situation that may result in vitreous traction. The barrier can also decrease the risk of vitreous factors' diffusing to the anterior segment and imparting possible toxic effects to the trabecular meshwork.

PARS PLANA IOL REPOSITIONING WITH OPTIC CAPTURE

This technique is useful in the presence of a non-plate-haptic posterior chamber IOL that has subluxated or completely dislocated posteriorly into the vitreous. A circumstance such as this can occur after an Nd:YAG capsulotomy.

A posterior segment surgeon performs pars plana IOL repositioning with optic capture from behind the capsular membrane after completing the vitrectomy. He leaves the haptics posterior to the capsular membrane and pushes the IOL's optic anteriorly through the opening in the membrane. If the capsular opening is too small or the membrane has become fibrotic, scarred, and too stiff to capture the IOL's optic, he may be able to fashion an appropriately sized opening in the membrane remnant with the vitrector. This opening, at least in one meridian, needs to be slightly smaller (approximately 1 mm) than the diameter of the optic to be able to capture the optic and provide adequate support.

SUMMARY

These capture techniques provide alternatives to simple sulcus placement, sutured sulcus placement, iris suturing, iris fixation, or IOL placement in the anterior chamber. By considering these alternatives, the surgeon extends the possibilities of capsular fixation of the IOL in either primary or secondary surgical scenarios and reduces the risk of UGH syndrome and other complications from IOL/tissue contact and interaction. ■

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