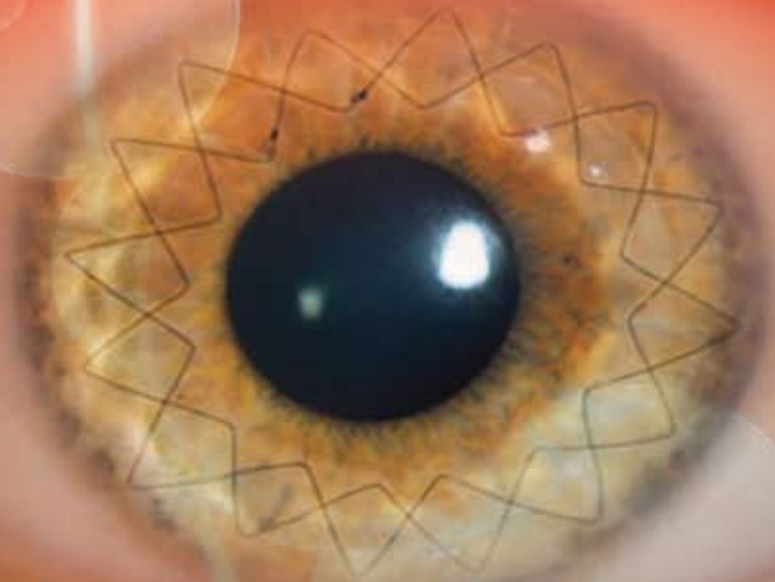
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Expert Techniques in Ophthalmic Surgery



SECOND EDITION

Parul Ichhpujani • George L Spaeth
Myron Yanoff

JAYPEE

Expert Techniques in OPHTHALMIC SURGERY

Second Edition

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CHAPTER 10

Manual Small-incision Cataract Surgery

Rengaraj Venkatesh, Geoffrey Tabin, Michael Feilmeier, Benjamin Thomas, Sanduk Ruit

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INTRODUCTION

Cataract is the leading cause of blindness [as defined by the World Health Organization, best-corrected visual acuity (BCVA) in the better eye of <20/400] throughout the world and is responsible for ~50% of blindness in the developing world, affecting nearly 20 million people. As this number continues to grow, the need for a high-quality, cost-effective cataract surgical technique becomes more obvious.

It is well established that the combination of continuous curvilinear capsulorhexis (CCC), phacoemulsification, and in-the-bag placement of an intraocular lens (IOL) is the standard of care in developed nations for the treatment of most visually disabling cataracts. Phacoemulsification allows the removal of cataracts through small (<3.0 mm) self-sealing incisions, resulting in minimal surgically induced astigmatism and rapid visual rehabilitation. However, the high cost of purchasing and maintaining a phacoemulsification machine; the dependence on unreliable amenities, such as electricity; and the limited availability of appropriate training for technicians and surgeons are significant obstacles currently limiting the widespread use of this technique in the developing world, where 90% of cataract blindness exists.

Manual small-incision cataract surgery (MSICS), a remarkable technique first described by Blumenthal in 1994, has received significant international attention as a low-cost, low-technology, high-quality alternative to phacoemulsification. MSICS is similar to extracapsular cataract extraction (ECCE) in that it involves the removal of an intact crystalline lens from the eye while maintaining the integrity of the posterior capsule. However, in contrast to traditional ECCE, in MSICS, the lens is explanted through a 6.0- to 7.0-mm wedge-shaped, multiplanar, self-sealing sclerocorneal tunnel that is large enough to allow the removal of the nucleus and insertion of a rigid posterior chamber IOL. A major advantage of this innovative technique is the self-sealing nature of the incision, effectively eliminating the need for suturing of the wound. This allows for less surgically induced astigmatism, more rapid visual rehabilitation, and improved long-term wound stability. In addition, surgeons properly trained in MSICS can routinely perform surgeries in <5 minutes, with outcomes comparable with phacoemulsification in the setting of advanced cataracts. In this chapter, we describe the different MSICS techniques and their employment throughout the world (Table 10.1).

GENERAL SURGICAL TECHNIQUE

Placing a Bridle Suture

Manual small-incision cataract surgery can be performed through either a superior or a temporal scleral tunnel. When using a superior tunnel, a bridle suture may be placed beneath the tendon of the superior rectus muscle to facilitate surgical exposure. In cases with a temporal

Table 10.1: List of instruments necessary for the manual small-incision cataract surgery procedure.

Dish for gauze pads	Toothed forceps (0.12 or 0.3)	Cautery (low-temp or wet-field)
Gauze pads	Bevel-up crescent blade	25–27-gauge needle
5% betadine	Microkeratome blade	1-mL syringe
Eyelid speculum	Viscoelastic	3-mL syringe
4-0 silk	27-gauge cannula	Sinskey hook
Needle driver	Simcoe I/A cannula	Rigid posterior chamber intraocular lens
Superior rectus forceps	Tying forceps	
Westcott scissors	Vannas scissors	

approach, the lateral rectus muscle can be used. The bridle suture is useful in the following ways:

- To maneuver and fixate the globe during certain steps of surgery, such as tunneling
- To provide counter-tractional force during procedures, such as nucleus removal and epinucleus delivery, thereby making these procedures easier and less traumatic.

Creating a Scleral Tunnel

Site

The size of the external incision is approximately 6–7 mm and, hence, substantially larger than that required for instrumental phacoemulsification. A temporal tunnel is preferred over a superior tunnel for the following reasons:

- It tends to counteract the preexisting against-the-rule astigmatism, which is predominantly present in the elderly.
- It minimizes the crowding effect of the brow, especially in deep sockets, and facilitates intraoperative exposure.
- It permits the globe to remain parallel to the axis of the microscope, allowing the red reflex to be better appreciated, providing better visibility.

Initial Incision

A fornix-based conjunctival flap of around 7 mm is made. After Tenon's capsule is dissected off, light cautery is applied. A 30–50% thickness external scleral groove of around 6–7 mm in width is made ~2 mm posterior to the surgical limbus. The incision should be tangential to the limbus (or frown-shaped) to limit postoperative astigmatism and improve wound stability. The size of the wound is determined by the size of the nucleus, and accurate estimation of nuclear size will improve with experience. However, as a rule, beginning surgeons should begin with a 7-mm external incision (Fig. 10.1).

Sclerocorneal Tunneling

A sclerocorneal tunnel is created using an angled, bevel-up crescent blade. The blade is gently advanced parallel to the ocular surface to create a single plane tunnel of uniform thickness ~1.5 mm into the clear cornea (Figs. 10.2 and 10.3). The wound should be trapezoidal in appearance, with the internal portion of the tunnel extending limbus to limbus. The anterior chamber should not be entered at this point.

The depth of the incision is the single most important aspect of the tunnel. A tunnel that is too shallow will result in buttonholes and an unstable wound. A tunnel that is too deep can result in early entry into the anterior chamber, difficulty in anterior chamber stability, iris prolapse, and an unstable wound.

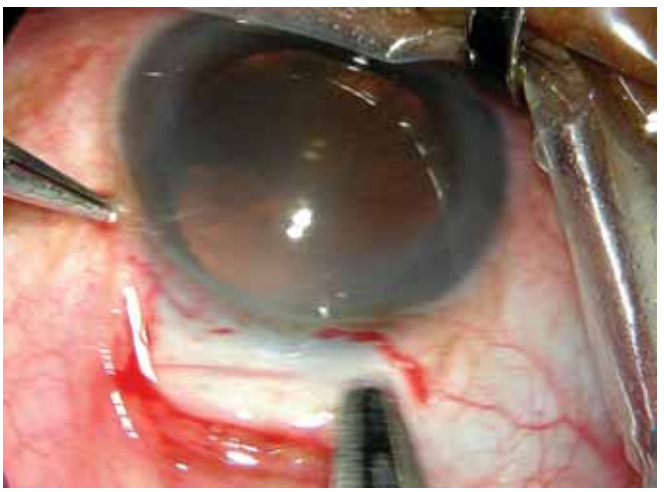


Fig. 10.1: External 7.0-mm scleral incision.

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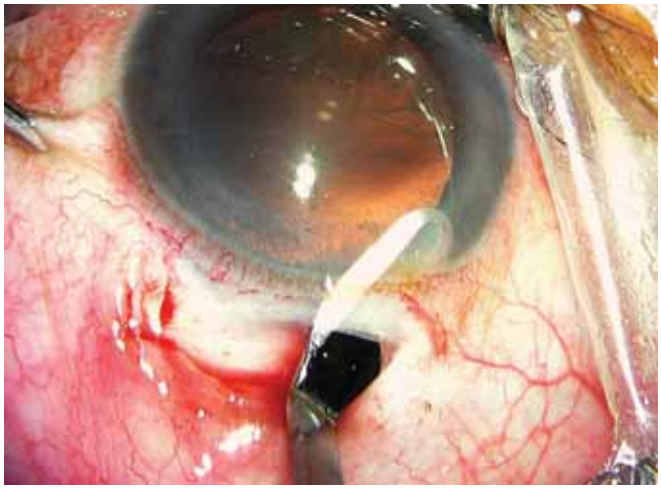


Fig. 10.2: Sclerocorneal tunnel.

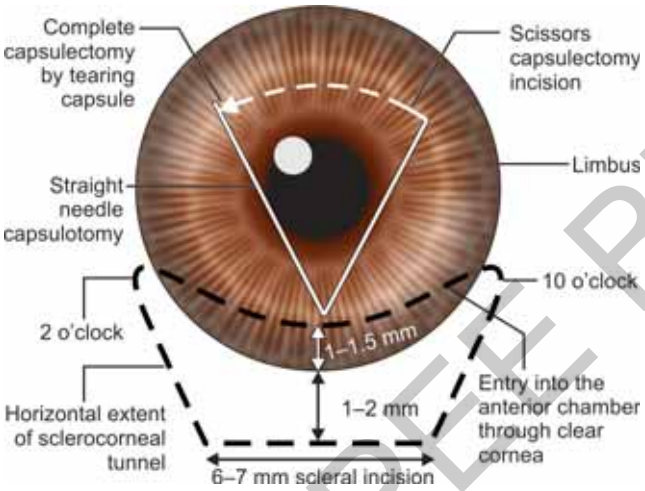


Fig. 10.3: Manual small-incision cataract surgery diagram with a triangular (V-shaped) capsulotomy.

Source: Ruit S, Paudyal G, Gurung R, Tabin G, Moran D, Brian G. Clin Experiment Ophthalmol. 2000;28(4):274-9.

Creating a Side Port Entry

One side port entry can be made using a #15 super blade at the 10 o'clock position or perpendicular to the tunnel in the clear cornea. It is useful (but not required) for the following:

- Injection of viscoelastic
- Subincisional cortical aspiration
- Injection of balanced saline solution (BSS) into the anterior chamber at the end of the procedure to adjust the intraocular pressure to a physiologic level.

Making the Internal Corneal Incision

A sharp 3.2-mm-angled keratome is used to enter the anterior chamber after viscoelastic has been injected. The heel of the keratome is raised until the blade becomes parallel to the iris plane, resulting in a dimple on the corneal surface. The keratome is then advanced anteriorly in the iris plane until the anterior chamber is entered and the internal wound is visualized as a straight line (Fig. 10.4). The initial incision is then extended from side to side for the full extent of the tunnel. During extension of the incision, care should be taken to keep the internal incision in the same plane.

Performing the Capsulotomy

Several different capsulotomy techniques are possible with MSICS surgery. CCC may provide optimal IOL positioning but can be difficult in the setting of large mature, hypermature, or morgagnian cataracts, and in the setting of poor surgical visibility because of corneal scars, pterygium, and suboptimal operating microscopes, all of which are common circumstances in the developing world. The triangular capsulotomy and can-opener capsulotomy can be particularly useful in these suboptimal surgical settings, especially when capsular staining techniques are not available (*see* Fig. 10.3).

If performing a CCC, the size of the capsulorhexis should be based on the size and the density of the cataract. It should have a minimum diameter of 5–6 mm and may need to be as large as 7–8 mm in diameter for more mature

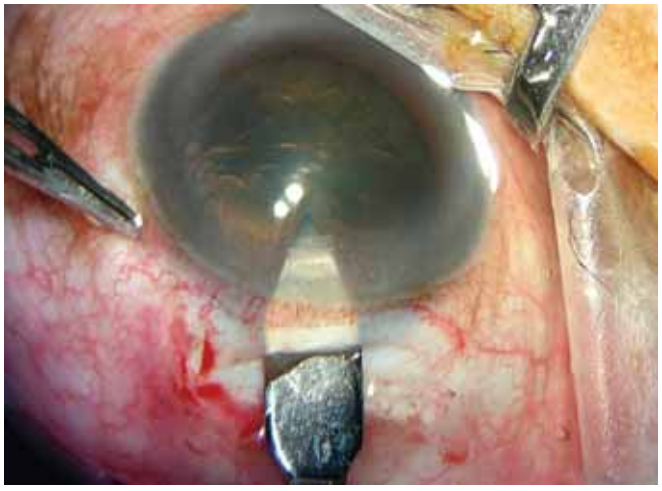


Fig. 10.4: Creation of the internal corneal incision using a microkeratome blade.

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cataracts. If the CCC is too small for prolapse of the lens into the anterior chamber, the surgeon can make eight or more radial relaxing incisions or convert to "can-opener" capsulotomy. Capsular staining is helpful in cases with white or dense brown cataracts.

However, if performing a CCC is not feasible, MSICS can also be safely performed using a "can-opener" or triangular (V-shaped) capsulotomy. In cases of mature and hypermature cataracts, a can-opener or triangular capsulotomy is actually preferred, because it facilitates prolapse of the nucleus into the anterior chamber.

If the surgeon uses a triangular capsulotomy, this step can be performed prior to creation of the internal corneal incision and entry into the anterior chamber. A straight 25–27-gauge needle attached to a 1-mL syringe filled with BSS is advanced into the sclerocorneal tunnel just posterior to the limbus, angled parallel to the iris plane, and then advanced into the anterior chamber. Using the bevel tip of the needle, a linear cut is made from 4 to 12 o'clock and then from 8 to 12 o'clock, so the two incisions meet at 12 o'clock (assuming a superiorly placed sclerocorneal tunnel; *see* Fig. 10.3). Thus, a triangular, or V-shaped, flap of anterior lens capsule is created with its base still attached. The apex of the "V" should be oriented toward the surgeon, and the base of the capsulotomy away from the surgeon.[1] Each point of the triangle should be ~3 mm from the center of the pupil. Next, the apex is lifted with the tip of the needle and peeled away from the surgeon. This confirms the capsulotomy incisions are connected at the apex.

Performing Hydrodissection

Hydrodissection is performed using a 27-gauge bent-tip cannula attached to a syringe filled with BSS. In the presence of a CCC, this procedure is completed in one smooth step by injecting the fluid beneath the anterior capsular rim (Fig. 10.5). However, in the presence of a can-opener or triangular capsulotomy, small amounts of fluid can be injected in multiple areas so as to "unshackle" the nucleus from the confines of the cortical, but one must be careful not to cause an extension which could lead to posterior nuclear loss. At the end of a successful hydrodissection, the nucleus should be freely mobile within the capsular bag. Alternatively, hydrodissection can be performed with an irrigating Simcoe cannula. This low-pressure system is ideal in the setting of a triangular capsulotomy.

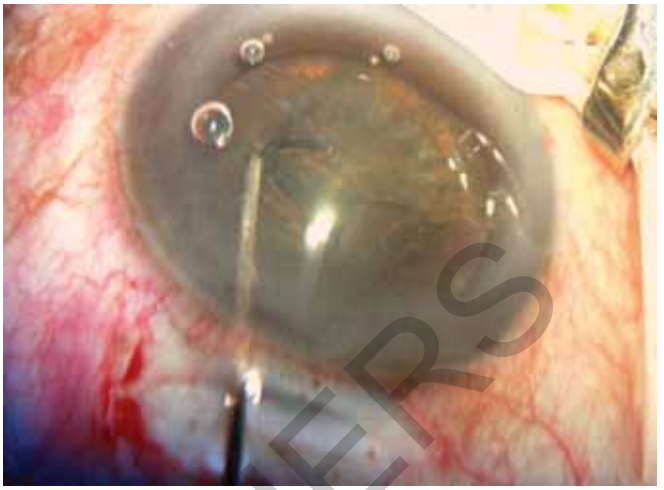


Fig. 10.5: Hydrodissection of the lens nucleus.

Prolapsing the Nucleus into the Anterior Chamber

Oftentimes when hydrodissection is performed, one pole of the nucleus will prolapse into the anterior chamber along with the fluid wave. At the sight of this prolapse, further hydrodissection can be stopped and under the cover of an adequate amount of viscoelastics, the remainder of the nucleus can be delivered by rotating the prolapsed pole with a Sinskey hook. If the nucleus does not prolapse with hydrodissection alone, then a combination of careful fluid infusion and lens rotation using a Simcoe cannula or a viscoelastic cannula can be used.

Prolapsing the Nucleus: Particular Techniques for Specific Types of Cataract

Mature cortical cataracts: White cataracts can be managed by doing a capsulorhexis after staining the capsule with 0.1 mL of 0.06% trypan blue dye. The nucleus can be levered out of the bag using a Sinskey hook, often without hydroprocedures, if the cortical attachments to the nucleus are loose. It is also worthwhile to debulk the cortical matter using a Simcoe cannula prior to prolapsing the nucleus. The capsular staining helps in performing the difficult step of nucleus prolapse through an intact capsulorhexis, as the dye-stained capsular rim is distinctly visible throughout the surgery. A Sinskey hook is first used to retract the stained capsulorhexis, then to engage the equator of the nucleus, and to lever one pole outside the capsular bag, after which the rest of the nucleus is rotated

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into the anterior chamber. During this maneuver, any compromise to the capsular bag can be detected easily, and relaxing incisions can be made at any point of the process.[2]

Hypermature Cataracts and Phacolytic Glaucoma

With this technique, after staining the capsule with trypan blue, a small nick is made in the anterior capsule using a bent 26-G needle mounted on a syringe, and the liquid cortex is aspirated. The capsular bag is inflated with viscoelastic, and the capsulorhexis is completed using Utrata Capsulorhexis Forceps or equivalent. A Sinskey hook is then used to lever one pole of the nucleus outside the capsular bag, and the rest of the nucleus is then rotated out into the anterior chamber.[3]

Hard brown/black cataracts: In these cases, the safest technique will be to perform a can-opener or triangular capsulotomy and prolapse the nucleus, as described earlier. If the surgeon is keen to perform a capsulorhexis, it is safer to stain the capsule and perform a larger capsulorhexis (6.0–7.5 mm) followed by a less forceful hydrodissection. As the capsule is stained, it will be easy to retract the capsule and lever out a part of the nucleus with a Sinskey hook (as described earlier). The nucleus is then gently rotated out, watching the movement of the capsular bag throughout the procedure. If the capsular bag seems to be compromised, a few relaxing incisions in the capsule can avoid intracapsular extraction of the nucleus. Alternatively, a bimanual technique can be tried, which is described later.

Small pupils: In patients with small pupils, one can resort to procedures, such as stretch pupilloplasty, using Kuglen hooks or make sphincterotomies. This allows greater visualization for performing capsulotomy and hydrodissection and makes easing the nucleus into the anterior chamber a much safer maneuver. In certain high-risk cases, such as pseudoexfoliation with a small rigid pupil and an associated hard nucleus, it would be prudent to go in for a small sector iridectomy or a "keyhole" iridectomy. If the small pupil is pliable, an alternative and more aesthetically pleasing, bimanual technique is possible. This technique is useful if one has failed to prolapse the nucleus by the mechanical method, or in cases of small pupils with hard cataract.

Bimanual technique: In cases with zonular compromise, a bimanual prolapse technique is used: in this technique, a cyclodialysis spatula and a Sinskey hook are used for the prolapse. The nucleus is retracted to one side (temporal in the right eye or nasal in the left eye, assuming a superior position) with a Sinskey hook through the sclerocorneal tunnel (Fig. 10.6). Following this, the spatula is introduced through the side port incision and placed under the nucleus. Using the spatula as a fulcrum, the nucleus is rotated with the Sinskey hook out of the capsular bag. With proper use of this technique, the cyclodialysis spatula absorbs the rotational forces, minimizing stress on the zonules.[4]

Subluxated cataracts: The MSICS can be done in selected cases of subluxated cataracts wherein the pupil is well dilated, and the nucleus is not very dense. Here also, staining of the capsule with trypan blue facilitates the capsulorhexis, helps with implanting a capsular tension ring (CTR), and aids safe prolapsing of the nucleus. After assessing the extent of subluxation and the density of nucleus, the capsule is stained, and the capsulorhexis is performed. This is followed by cortical-cleaving hydrodissection and manual insertion of the CTR through the paracentesis. The nucleus is then hydrodelineated, and irrigation is continued until one pole of the nucleus

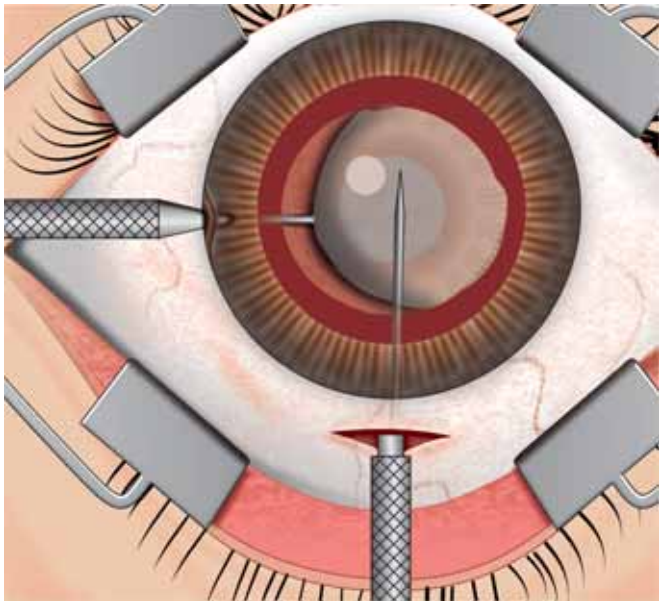


Fig. 10.6: Bimanual nuclear prolapsed technique.

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prolapses out of the capsular bag. The rest of the nucleus is wheeled into the anterior chamber using a Sinskey hook.[5]

Extracting the Nucleus

Once the nucleus is prolapsed into the anterior chamber, it can be extracted through the tunnel by one of the following techniques:

- Irrigating vectis technique
- Phacosandwich technique
- Phacofracture technique
- Modified Blumenthal technique
- Fishhook technique
- Simcoe technique.

Each will be discussed here in turn.

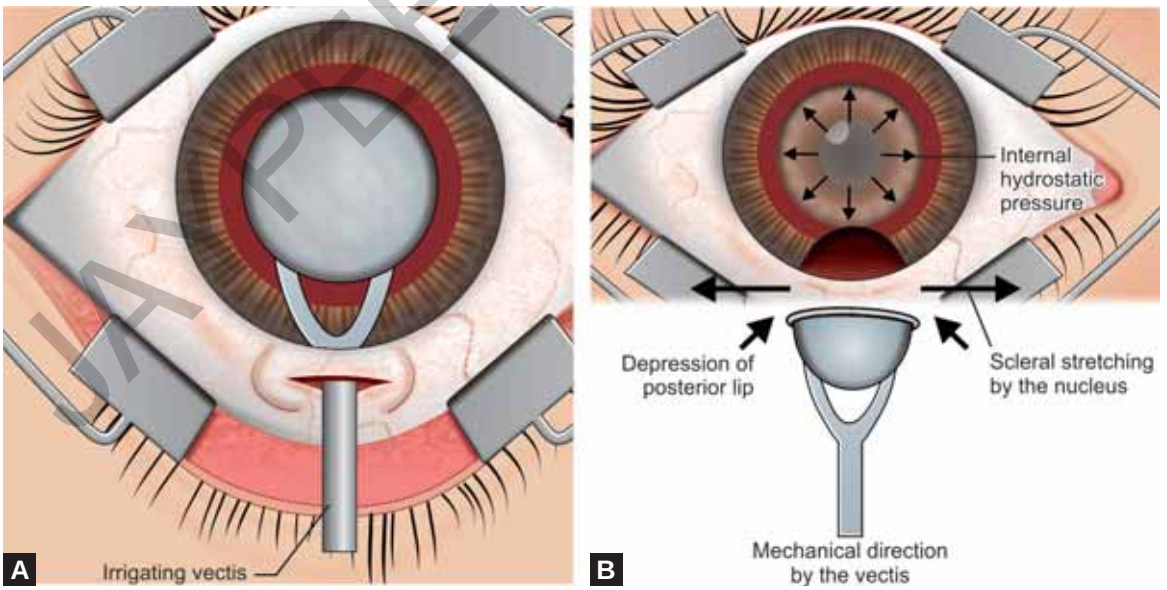
Irrigating Vectis Technique

This technique makes use of a combination of mechanical and hydrostatic forces to extract the nucleus. An irrigating vectis is, of course, necessary for this procedure (Figs. 10.7A and B). This vectis is 8 mm long and 4 mm wide, and has an anterior and a posterior surface. The anterior surface has a slight concavity and has two ends, with the anterior end bearing three small irrigating ports, each 0.3 mm in size. The posterior end is continuous with the main body of the vectis and is attached to a syringe containing lactated Ringer's solution or BSS.

After the nucleus is prolapsed into the anterior chamber, viscoelastics are liberally injected, first above and then below the nucleus. The upper layer shields the endothelium, whereas the lower layer pushes the posterior capsule and iris diaphragm posteriorly. This maneuver creates adequate space in the anterior chamber for atraumatic nuclear delivery.

A good superior rectus bridle suture is necessary for the success of the next step. To perform, the bridle suture is first held loosely in the left hand. After checking the patency of the ports, the vectis is then inserted under the nucleus with the anterior surface facing up. If it is an immature cataract, one will be able to see the margins of the vectis under the nucleus in place. It is extremely important to visualize the tip of the vectis lying anterior to the iris, for if iris tissue is pinched between the lens nucleus and the vectis, a large (or complete) iridodialysis may result upon attempted removal of the nucleus.

As the superior rectus bridle suture is pulled tight, the irrigating vectis is slowly withdrawn without irrigating, until the superior pole of the nucleus is engaged in the tunnel. Gentle irrigation is then started, and the vectis



Figs. 10.7A and B: Nucleus extraction using the irrigating vectis technique.

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is slowly withdrawn while pressing down gently on the posterior lip of the sclerocorneal tunnel. The force of irrigation must be reduced when the maximum diameter of the nucleus just crosses the inner lip of the tunnel. This decreases the likelihood of forcefully expelling the nucleus from the anterior chamber. A high-pressure evacuation of the lens from the anterior chamber can result in sudden anterior chamber decompression, shallowing of anterior chamber, and extrusion of ocular contents, including lens capsule and vitreous.

Of note, if the wound is placed temporally, a pull on the nasal conjunctiva by the surgical assistant can aid in nucleus extraction, as the bridle effect of the lateral rectus is usually not sufficient.

Potential complications of nucleus extraction with an irrigating vectis and their causes are listed in Table 10.2.

Phacosandwich Technique

In this technique, a Sinskey hook is used in addition to the vectis. The key requirement is that the anterior chamber is adequately filled with viscoelastics. Once the vectis is placed beneath the nucleus, the Sinskey hook is carefully introduced and placed on the top of the nucleus, effectively "sandwiching" it between the vectis and the Sinskey hook. The tip of the Sinskey hook is placed beyond the central portion of the lens, enabling a more secure grip on the nucleus with this two-handed technique. With the Sinskey hook in the dominant hand and the vectis in the other, the nucleus is "sandwiched" and extracted. While extracting the nucleus, the assistant should pull the superior rectus suture and simultaneously pull the globe inferiorly by grasping the conjunctiva at the 6 o'clock position near the limbus with toothed forceps. The outer portion of the nucleus, the epinucleus, and a portion of the cortex will be sheared off in this technique and can be removed with the irrigating vectis immediately after nucleus delivery (Figs. 10.8A and B).

Phacofracture Technique

This is the technique of manual nuclear fragmentation for removing a large nucleus through a small incision. A bisector or trisector can be used instead of a Sinskey hook, which is used to cleave its way through the nuclear substance. Steady, constant pressure on the bisector or the trisector, combined with the posterior pressure of gently lifting with the vectis, will split the nucleus. The split nuclear fragments can then be removed one at a time using the irrigating vectis.

Modified Blumenthal Technique

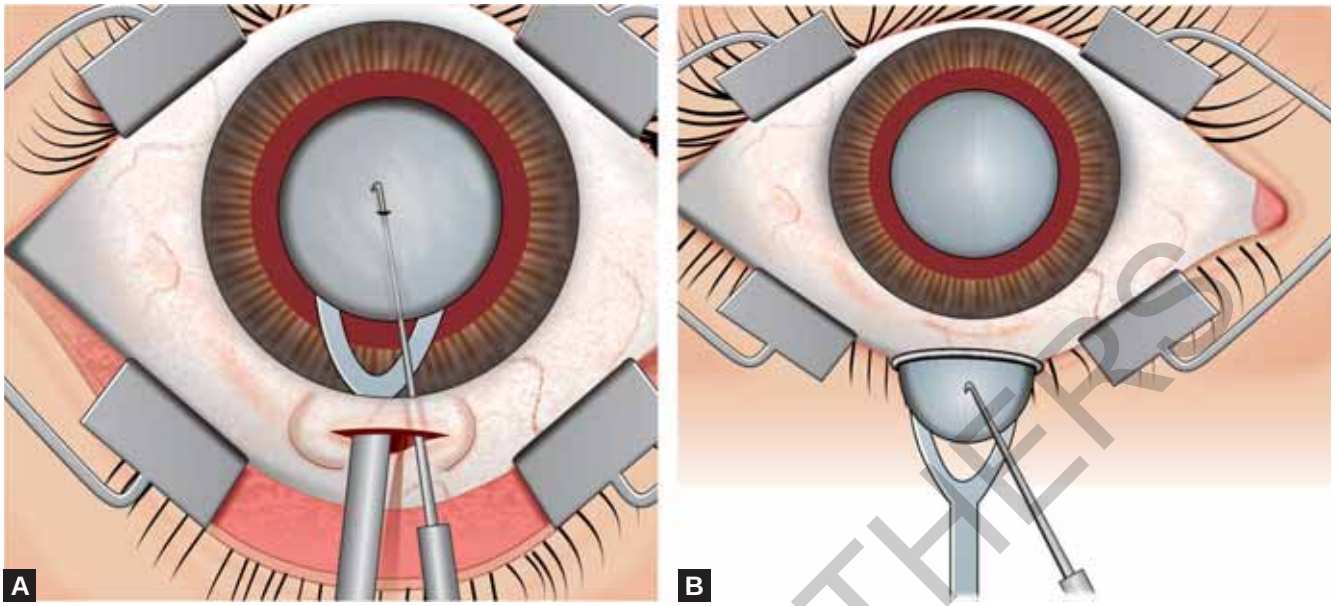
This technique uses an "anterior chamber maintainer" (ACM) throughout the procedure. An ACM is a hollow tube with a 0.9-mm outer diameter and a 0.65-mm inner diameter. The tube of the ACM is attached to a bottle of BSS, suspended 50–60 cm above the patient's eye.

Two small beveled entries are made in the cornea; the first is 1.5 mm long, placed between the 5 and 7 o'clock position (assuming a superior wound position), for inserting the ACM. The second port is 1 mm wide, placed at the 11 o'clock position, for the entry of various instruments. The fluid flow from the ACM is stopped only during the capsulotomy. After a good hydrodissection, the nucleus is prolapsed into the anterior chamber. The freed

Table 10.2: Potential complications of nucleus extraction with an irrigating vectis and their causes.

Potential complications	*Causes*
Corneal endothelial damage	Misjudged nuclear size leading to disproportion between nucleus and wound size. Inadequate use of viscoelastics. Improper technique in handling the vectis. Iatrogenic: Surgeon's ego leading to repeated attempts at forceful extraction
Trapped nucleus	Improper bridle suture. Misjudged nuclear size. Improperly designed vectis, i.e. not having sufficient concavity. Poor technique
Iris trauma/iris stretching/iridodialysis	Premature entry causing iris to be washed out through the weak site. Premature injection of fluid. Vectis incarceration of the iris opposite the sclerocorneal tunnel. Vectis not pressed down sufficiently on the posterior scleral lip
Posterior capsular rent with vitreous loss	Sharp edges of the vectis. Forceful extrusion of the nucleus. Enlargement of a preexisting zonular dialysis caused while prolapsing the nucleus

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Figs. 10.8A and B: Nucleus extraction using the phacosandwich technique.

nucleus, extremely mobile in a deep anterior chamber, is ready for being propelled out by the hydropressure generated by an ACM system.

A plastic glide 3–4 mm wide, 0.3 mm thick, and 3 cm long is subsequently inserted under the nucleus, one-third to one-half width nucleus distance. The bottle height is then raised to 60–70 cm above the patient's head, and slight pressure is applied over the lens glide on the scleral side. Intermittent pressure then propels the nucleus out of the sclerocorneal tunnel. Finally, a few more taps should enable the epinucleus and cortex to easily flow out of the anterior chamber.

If the nucleus is not engaging the inner lip of the tunnel despite the full volume of ACM flow, the reasons may be as follows:

- A tunnel that is small, irregular, or incomplete
- Improperly fashioned or leaky side ports
- Premature entry of the tunnel
- Vitreous in the anterior chamber.

Fishhook Technique

In this technique, a 30-gauge disposable needle is bent in the form of a fishhook and used in the nucleus extraction. After a thorough hydrodissection or hydrodelineation, the anterior chamber is filled with viscoelastic, and only the superior pole of the nucleus is brought into the anterior chamber. Viscoelastic is injected in front of and behind the nucleus again to protect the surrounding structures.

The 30-gauge "fishhook" needle is then advanced into the anterior chamber with a sideways tilt to prevent endothelial injury. It is then maneuvered behind the nucleus to hook the undersurface of the lens. At this point, viscoelastic can be reinjected if there is any difficulty in traversing the fishhook. Once the nucleus is hooked, it is delivered out of the eye by applying slight downward pressure on the posterior lip of the tunnel. The nucleus is thus delivered without performing extensive maneuvers in the anterior chamber.

Simcoe Technique

The Simcoe technique uses the same principles as the Blumenthal technique, combining mechanical and hydrostatic forces to allow extraction of the nucleus. After delivery of the lens into the anterior chamber and injection of viscoelastic anterior and posterior to the lens, the sclera or Tenon's capsule is grasped with 0.12 toothed forceps, and the globe is rotated away from the surgeon. The Simcoe is introduced into the anterior chamber through the sclerocorneal tunnel and is centered posterior to the lens and anterior to the iris. The irrigation is then turned on. The tip of the cannula should be visualized distal to the nucleus. The hydrostatic forces will bring the nucleus to the internal incision. Once the nucleus engages

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in the tunnel, slight downward pressure is applied to the external lip of the wound using the cannula while slowly withdrawing the cannula at the same time. Upon nuclear delivery, the Simcoe can be used immediately for cortical cleanup.

Performing the Epinucleus Removal, Cortex Aspiration, and IOL Implantation

After the extraction of the endonucleus from the anterior chamber, a mixture of epinucleus and viscoelastic materials remains in the anterior chamber. It is easier to remove this mixture with the help of an irrigating vectis, although either of the following two methods can be used:

- The epinucleus can be flipped out of the bag by introducing the Simcoe cannula under the anterior capsular rim and lifting out the epinucleus into the anterior chamber. The prolapsed epinucleus can then be extracted by depressing the inferior scleral lip with the Simcoe cannula and pulling the superior rectus bridle suture at the same time.
- The epinucleus can also be manipulated by doing viscodissection. Viscoelastic is injected under the capsular rim, between the capsule and the cortex, to lift this material out of the bag and into the anterior chamber, where it can be extracted through the sclerocorneal tunnel. The remainder of the cortical matter can then be aspirated using a Simcoe cannula.

The IOL is then placed through the tunnel into the intact capsular bag. As the size of the wound is above 6 mm, it is preferable to place a rigid poly(methyl methacrylate) IOL with a 6-mm optic, especially in the setting of a "can-opener" capsulotomy. In the case where a capsulorhexis has been performed, then the option of implanting a foldable lens into the bag is available.

Smooth placement of the IOL is imperative to prevent anterior chamber collapse, iris trauma, and zonular dehiscence. If there is vitreous loss or prior zonular dehiscence, this is even more critical. Viscoelastic should be used to inflate the capsular bag, and a small amount should be injected over the subincisional iris, effectively creating a "viscoelastic ramp" for passage of the IOL and preventing inadvertent iris trauma or prolapse. (In straightforward cases, some experienced surgeons use air instead of viscoelastic to maintain the anterior chamber.)

The IOL is then inserted through the sclerocorneal tunnel in a two-step maneuver: using the nontoothed forceps, the leading haptic and optic are inserted, assuring that the leading haptic begins to enter the capsular bag. At this point, the surgeon's other hand can use forceps to stabilize the wound and prevent retraction of the IOL from out of the anterior chamber. Then, the trailing haptic is grasped by the nontoothed forceps and pushed toward the left aspect of the anterior chamber, rotating the leading haptic and optic fully into the capsular bag and allowing placement of the trailing haptic safely after. Any remaining viscoelastic can then be removed with the Simcoe cannula, and the wound can be tested for stability.

In select cases, the IOL may be strategically placed earlier in the procedure. For example, for cases of hypermature or morgagnian cataracts in which the capsular bag is extremely weak and collapsible, the IOL can be inserted pre-emptively between the nucleus and the posterior capsule, where it serves as a makeshift CTR. This allows for safe removal of the hypermature nucleus from a stabilized capsular bag, without subsequent tearing of the zonules or vitreous loss.

Assuring Wound Closure

The anterior chamber is reformed by injecting BSS through the side port incision, or through the tunnel if no side port has been created. If the wound is constructed properly, a watertight closure is observed, and no sutures are necessary. One should be able to press down moderately on the central cornea without noting wound distortion or collapse of the anterior chamber.

After watertight closure is ensured, the conjunctiva should be placed to cover the external scleral incision. This can be performed on both superior and temporal incisions using cautery. Alternatively, the conjunctiva can be closed using a single interrupted suture.

OUTCOMES: PHACOEMULSIFICATION VERSUS MSICS

As discussed earlier, phacoemulsification is considered the gold standard for cataract extraction in the developed nations. But, undoubtedly, phacoemulsification is disadvantaged (particularly in the developing world setting) by being significantly more expensive than intracapsular cataract extraction, ECCE, or MSICS. Still,

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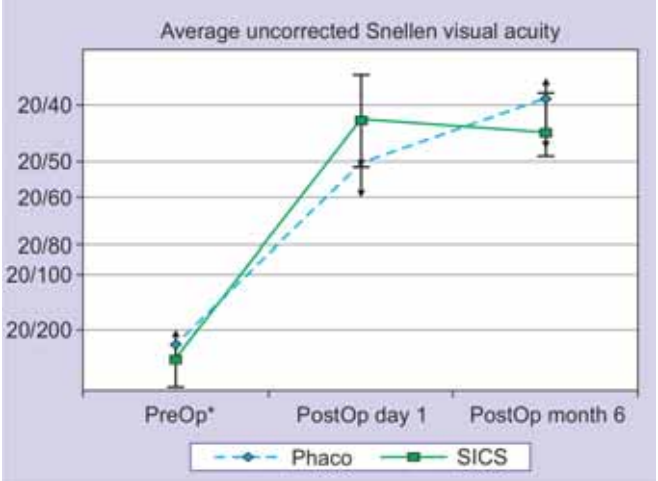


Fig. 10.9: Mean uncorrected visual acuity for the phacoemulsification (Phaco; dashed line) and manual sutureless small-incision extracapsular cataract surgery groups. Vision recorded at preoperative testing (PreOp) and postoperative (PostOp) day 1 and month 6. Error bars denote 95% confidence interval.

**Source*: Ruit S, Tabin G, Chang D, et al. Am J Ophthalmol. 2007;143(1):32-38.e2.

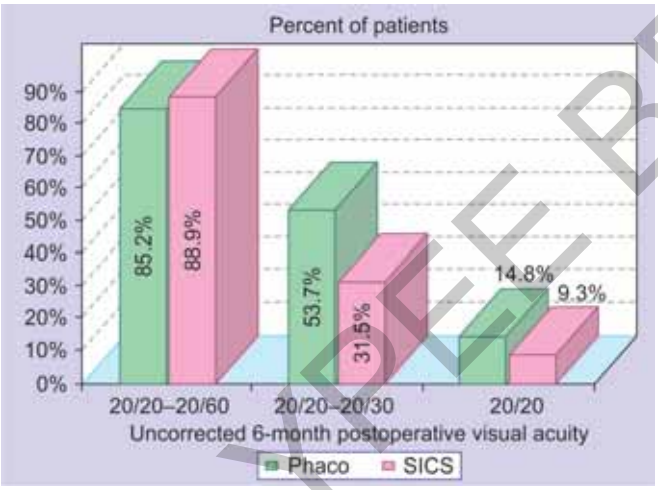


Fig. 10.10: Uncorrected visual acuity by functional level at 6 months after operation. Stratified into groups with visual acuity of 20/20, better than or equal to 20/30, and better than or equal to 20/60 in the phacoemulsification group (Phaco; green) versus the manual sutureless small-incision extracapsular cataract surgery (SICS; pink) group.

Source: Ruit S, Tabin G, Chang D, et al. Am J Ophthalmol. 2007;143(1): 32-38.e2.

cost aside, how do outcomes with phacoemulsification compare with MSICS?

Three randomized controlled studies have measured and compared patient outcomes in phacoemulsification and MSICS in the developing world.[6-8] All these studies have reported similar uncorrected visual acuity (UCVA) and BCVA ≥20/60 at 6 weeks (two studies) and 6 months (one study) postoperatively. A recent randomized prospective study from Nepal evaluated 6-month outcomes of 108 patients randomized to phacoemulsification or MSICS for the treatment of advanced cataracts (average VA ≤20/300). The two techniques demonstrated equal rates of UCVA ≥20/60 and BCVA ≥20/60 at 6 months (Figs. 10.9 and 10.10). In the Nepal study setting, phacoemulsification was less efficient, requiring 15.5 minutes on average for completion compared with 9 minutes for MSICS. In addition, complication rates, including endophthalmitis rates, were shown to be similar between the two procedures.

Thus, in summary, the BCVA and UCVA ≥20/60 at 6 months after surgery were similar between the phacoemulsification and MSICS groups. However, MSICS was more efficient, more economical, and resulted in faster visual rehabilitation compared with phacoemulsification in treating advanced cataracts in the developing world.

CONCLUSION

The MSICS technique provides a low-cost, highly efficient surgical option for the developing world, with outcomes comparable with the most advanced surgical techniques used throughout the developed world. The high speed and low cost with which the surgery can be performed, even in the setting of very mature cataracts, make this technique ideal for decreasing the burden of cataract blindness in the developing world.

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