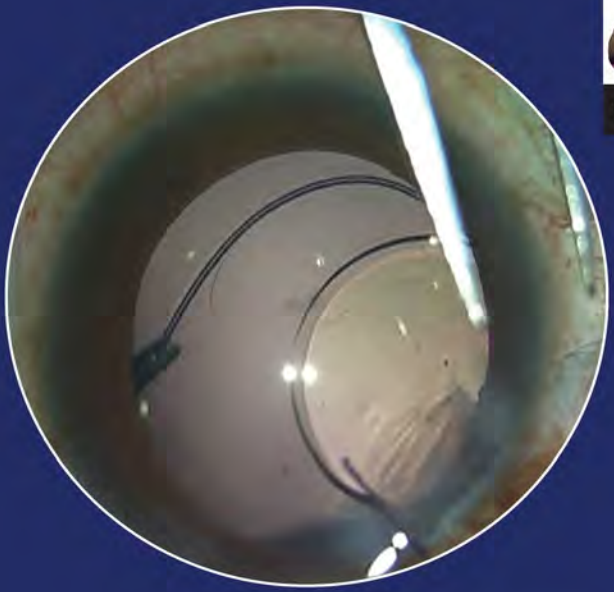
Jaypee Gold Standard Mini Atlas Series®

PHACOEMULSIFICATION

SECOND EDITION



Editors
Amar Agarwal
Priya Narang

Foreword
Steven Safran

JAYPEE GOLD STANDARD® MINI ATLAS SERIES

JAYPEE

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SECTION 4

Microincision Cataract Surgery
(Phakonit and Microphakonit)

Amar Agarwal
Priya Narang

CLEAR CORNEAL INCISION MADE WITH A SPECIAL KNIFE (MST, USA)

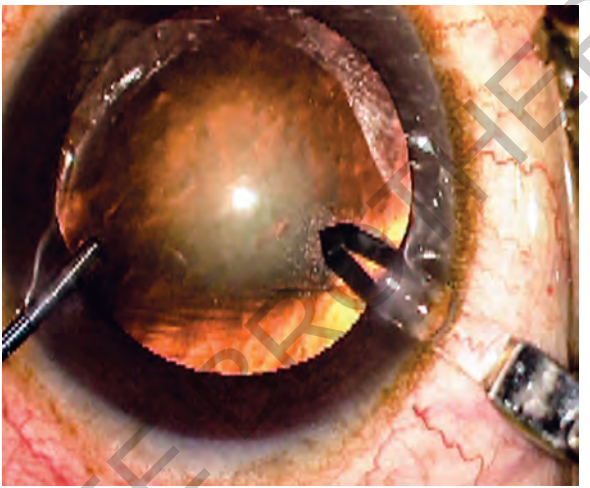

Fig. 4.1 Clear corneal incision framed with a special keratome designed by MST, USA. The globe stabilization rod helps to stabilize the eye during the surgery. Note the left hand has a globe stabilization rod to stabilize the eye. (Geuder, germany). This knife can frame an incision from sub 1 mm to 1.2 mm

On 15th August 1998, the author (Amar Agarwal) performed the first 1 mm cataract surgery by ***PHAKONIT*** technique. The term '***PHAKONIT'*** designates phaco (PHAKO) being done with a needle (N) opening via an incision (I) and with the phako tip

(T). It is also known as Phako being done with a Needle Incision Technology. In this the cataract was removed through a bimanual phaco technique and it was performed without any anesthesia. The first live surgery in the world of Phakonit was performed on August 22nd 1998 at Pune, India by the author (Amar Agarwal) at the Phaco and Refractive surgery conference.

The point of concern with this technique was to find an IOL, which would pass through such a small incision. Eventually on 2nd October 2001 the author (Amar Agarwal) performed a case of Phakonit with the implantation of a Rollable IOL. The lens used was a special lens from ThinOptx that worked on Fresnel principle and was designed by Wayne Callahan from USA. The first such ultrathin lens was implanted by Jairo Hoyos from Spain that was later modified by the author (Amar Agarwal) into a special 5 mm optic rollable IOL.

A 26 G needle attached to a 1 mL syringe filled with viscoelastic is taken and pierced in the eye in the area where the side port incision has to be framed. The viscoelastic is then injected inside the eye. This distends the eye so that the clear corneal incision can be made. A special knife can be used for this purpose. Note in the Figure 4.1 the left hand holds a globe stabilization rod (Geuder, Germany). This helps to stabilize the eye while creating the clear corneal incision. The special knife is held in the dominant hand and it helps to create an incision of either sub 1 mm or 1.2 mm depending on the diameter of the knife chosen by the surgeon. If the surgeon choses a sub 1 mm knife then a 21 gauge irrigating chopper and a 0.8 mm phaco needle is the preferred choice.

CAPSULORHEXIS INITIATED WITH A NEEDLE

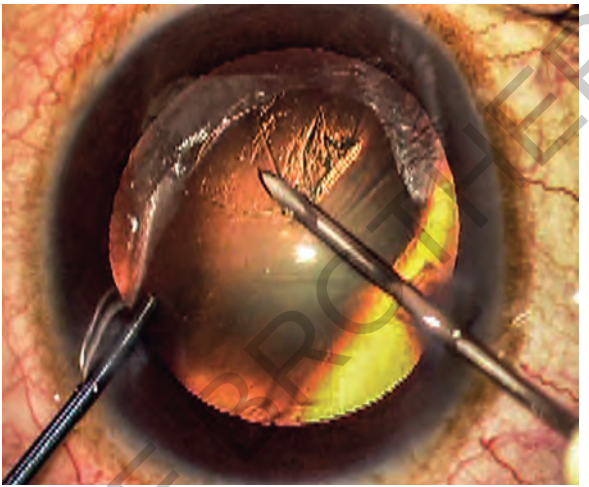

Fig. 4.2 Capsulorhexis initiated with a needle

Capsulorhexis is performed either with a 26 G needle (Fig. 4.2) or with a capsulorhexis forceps through the corneal incision and the choice depends entirely on the surgeon's preference. In pediatric and young patients it is preferable to do rhexis with a forceps as it offers better control over the edges of the flap created. In young patients, the surgeon should intend to create a rhexis of around 5 mm initially as it often tends to run in the periphery due to increased posterior pressure and elasticity of the capsule.

While performing the rhexis, it is important to start the rhexis from the center and move the needle to the right and then downward. This is important, as the concepts have changed and it is better to remember it as superior, inferior, right or left. If the surgeon happens to start the rhexis from the center and move towards the left then the weakest point of the rhexis is generally where it ends. In other words, the point where the surgeon tends to lose the rhexis is near its completion. So the surgeon will have an incomplete rhexis on the left-hand side either inferiorly or superiorly. As, the phaco probe is always moved down and to the left so with every stroke of movement with the phaco probe the rhexis gets extended posteriorly creating a posterior capsular rupture. Alternatively, if the surgeon performs the rhexis from the center and move to the right and pushes the flap inferiorly then in a case of incomplete rhexis it will be near the end of the rhexis and it will be located superiorly and to the right. Any incomplete rhexis can extend and create a posterior capsular tear but in the latter scenario, the chances of survival are better. This is because we are moving the phaco probe down and to the left, but the rhexis is incomplete up and to the right.

MST RHEXIS FORCEPS USED TO PERFORM THE RHEXIS IN A MATURE CATARACT

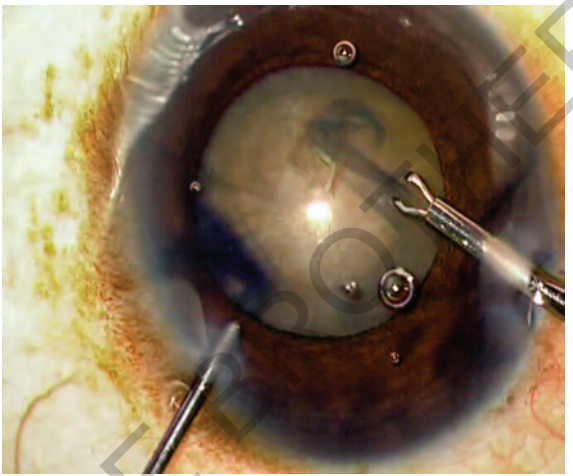

Fig. 4.3 MST capsulorhexis forceps used to perform the capsulorhexis in a mature cataract. Trypan blue stains the anterior capsule for better visualization. Note the trypan blue staining the anterior capsule

In the left hand a straight rod is held to stabilize the eye. This is known as the Globe stabilization rod. The advantage of this is that the movements of the eye can be controlled as the surgeon performs either a 'Topical' or a 'No anesthesia' cataract surgery. Microsurgical Technology (USA) has designed an excellent capsulorhexis forceps for Phakonit (Fig. 4.3) that passes through a 1 mm incision. Surgeons comfortable with a forceps can use this special forceps during Phakonit surgery.

DESIGNS OF AGARWAL IRRIGATING CHOPPERS

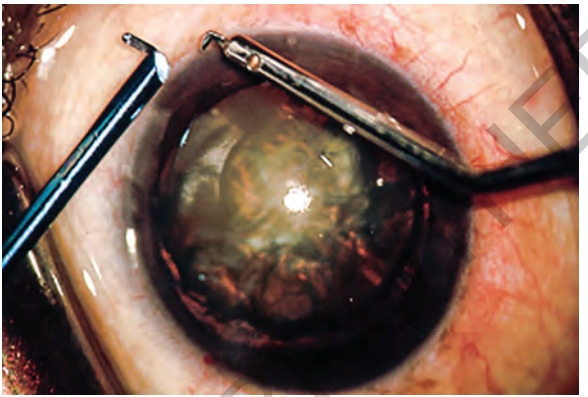

Fig. 4.4 Designs of Agarwal irrigating choppers. The one on the left has an end opening for fluid (microsurgical technology). The one on the right has openings on the either sides (Geuder–Germany)

Two designs of irrigating choppers that are designed are designated in the picture. On the left is the 'Agarwal irrigating chopper' made by the MST (Microsurgical Technology) company that is incorporated in the Duet system (Fig. 4.4). The irrigating chopper on the right is made by Geuder, Germany.

Notice in the right figure the opening for the fluid is end opening, whereas the one on the left the chopper has two openings on the sides. Depending on the convenience of the surgeon, the surgeon can decide upon the design of irrigating chopper to be used.

PHAKONIT IRRIGATING CHOPPER AND PHAKO PROBE WITHOUT THE SLEEVE INSIDE THE EYE

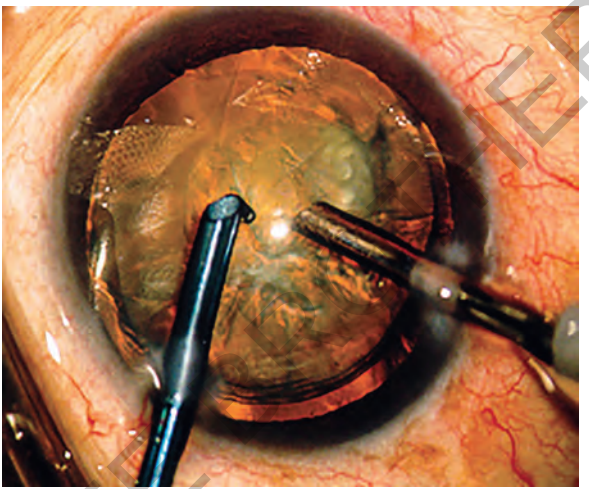

Fig. 4.5 Phakonit irrigating chopper and phaco probe without the sleeve inside the eye

The procedure of Phakonit (Fig. 4.5) can be performed with any phaco machine. The usual parameters set are:

Power-50% phaco power: Start in the continuous mode and once chopping has been done then shift to the pulse mode.

Suction-100 mm of Hg: The surgeon should use an air pump or an antichamber collapser to eliminate surge.

Flow rate: 20–24 mL/min.

Phaco needle: If the surgeon uses a 0.8 mm phaco needle with a 21 gauge irrigating chopper then sub 1 mm cataract surgery is eventually achieved.

Continuous irrigation over corneal incision is preferred as it negates the possibility of a corneal burn.

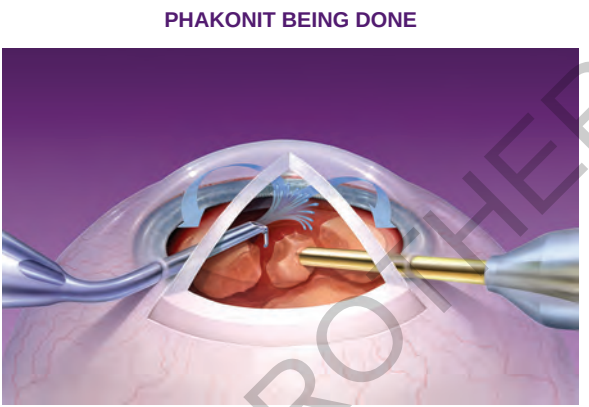

Fig. 4.6 Phakonit being performed. Notice the irrigating chopper with an end opening
(*Courtesy:* Larry Laks, MST, USA)

This is a specially designed irrigating chopper (Fig. 4.6) to facilitate the procedure of 'Phakonit'.

BIMANUAL IRRIGATION ASPIRATION COMPLETED

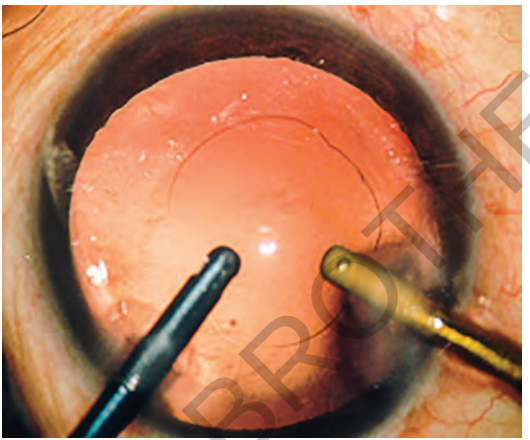

Fig. 4.7 Irrigation aspiration completed. Cortical wash-up done with the bimanual irrigation aspiration technique

Following irrigation-aspiration (Fig. 4.7), the surgeon can inject vancomycin inside the eye at the end of the surgery to prevent endophthalmitis. For this the intraoperative protocol is:

- 250 mg vial of vancomycin is taken to be dissolved in 25 mL of Ringer lactate (RL) or balanced salt solution (BSS)
- This will give a concentration of 1 mg in 0.1 mL
- At the end of the surgery, insert 0.1 mL of vancomycin containing 1 mg into the capsular bag behind the IOL. If need be additional BSS/RL can be injected into the eye to make the eye firm.

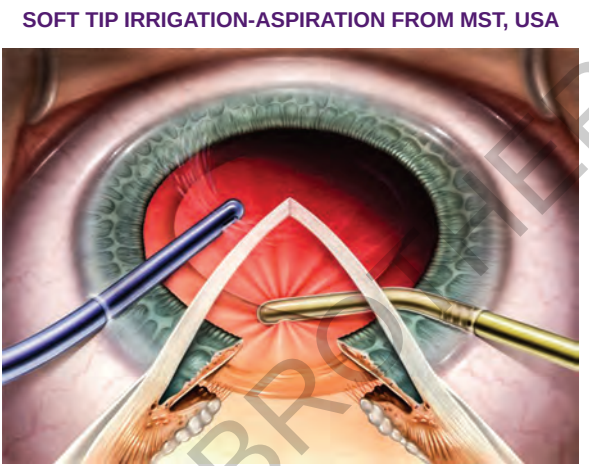

Fig. 4.8 Soft tip irrigation aspiration (*Courtesy:* Larry Laks-MST)

Microsurgical Technology (USA) has designed a soft tip I/A (Fig. 4.8) that is very safe for the posterior capsule.

THINOPTX ROLLER CUM INJECTOR INSERTING THE IOL IN THE CAPSULAR BAG

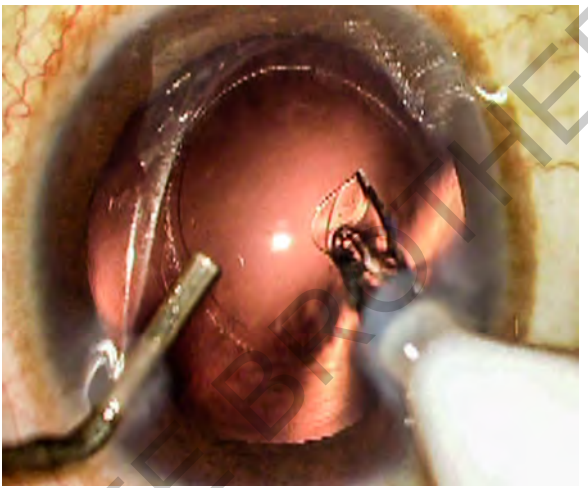

Fig. 4.9 ThinOptx roller cum injector inserting the IOL in the capsular bag

ThinOptx have made a special injector that not only rolls the lens but also inserts the lens (Fig. 4.9). This avoids the need to use our fingers for rolling the lens. In the figure a special injector injecting the IOL in the capsular bag is noticed. The tip of the nozzle is kept at the edge of the incision.

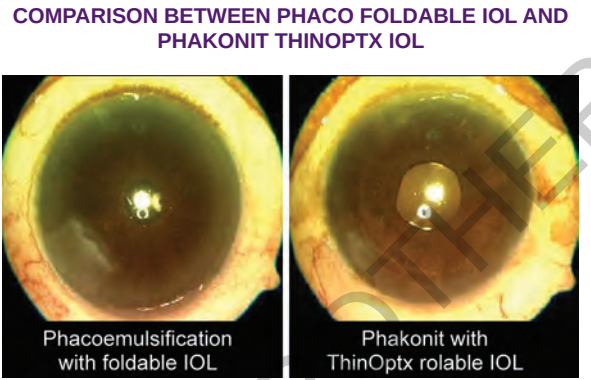

Fig. 4.10 An illustrative photograph showing the comparison between phaco foldable IOL and phakonit ThinOptx IOL. The figure on the left shows a case of phako with a foldable iol and the figure on the right shows phakonit with a ThinOptx rollable IOL

ThinOptx the company that manufactures these lenses has patented technology that allows the manufacture of lenses with plus or minus 30 diopters of correction on the thickness of 100 microns. The ThinOptx technology developed by Wayne Callahan, Scott Callahan and Joe Callahan is not limited to material choice, but is achieved instead of an evolutionary optic and unprecedented nano-scale manufacturing process. The lens is made from off-the-shelf hydrophilic material, which is similar to several IOL materials already on the market (Fig. 4.10). The key to the ThinOptx lens is the optic design and nano-precision

manufacturing. The basic advantage of this lens is that they are Ultra-Thin lenses. One of the authors (Amar Agarwal) modified this lens to make a special 5 mm optic rollable IOL.

The Acrylic IOL is manufactured by the AcriTec company in Berlin, Germany. This lens is a sterile foldable intraocular lens made of hydrophobic acrylate. The intraocular lens consists of highly purified biocompatible hydrophobic acrylate with chemically bonded UV-absorber. It is a single piece foldable IOL like a plate-haptic IOL. The lens is sterilized by autoclaving. The lens comes in a sterile vial, filled with water and wrapped in a sterile pouch.

MICROPHAKONIT

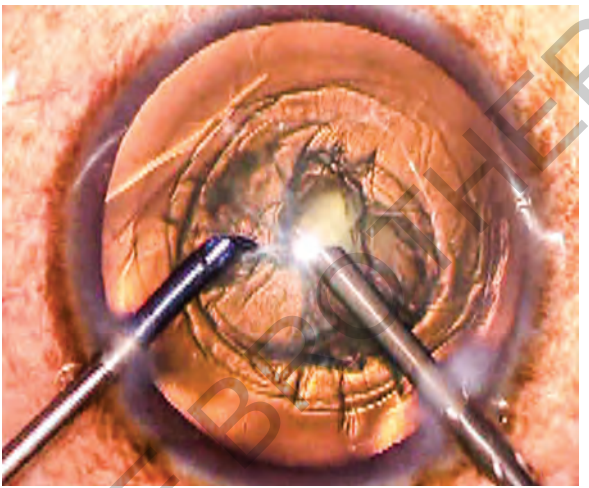

Fig. 4.11 In microphakonit, 0.7 mm irrigating chopper and 0.7 mm phaco tip without the sleeve is seen inside the eye. The assistant continuously irrigates the phaco probe area to prevent corneal burns

On May 21st 2005, for the first time a 0.7 mm phaco needle tip with a 0.7 mm irrigating chopper was used by the authors (Am A) to remove cataracts through the smallest incision possible as of now. This is called microphakonit (Fig. 4.11).

Lary Laks from MST, made a special 0.7 mm phaco needle for microphakonit.

The inner diameter of the phaco tip regulates the flow rate/perceived efficiency. In order to increase the allowed aspiration flow rate from what a standard 0.7 mm tip would be, MST (Larry Laks) made the walls thinner, thus increasing the inner diameter. This would facilitate better speed at low diameter. With the utilization of gas forced infusion the system would work very well.

MICROPHAKONIT COMPLETED. THE NUCLEUS HAS BEEN REMOVED

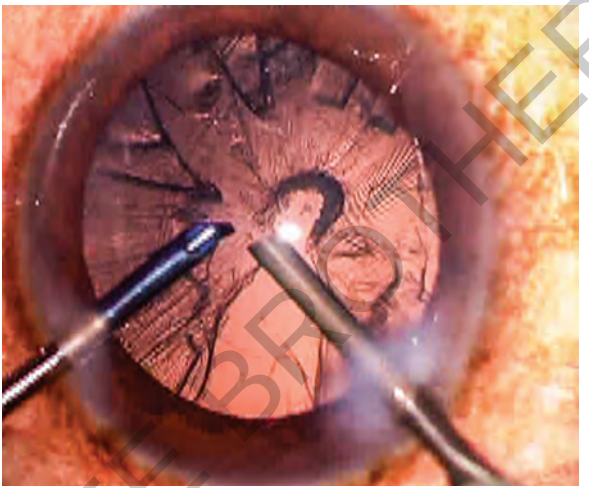

Fig. 4.12 Microphakonit is completed and the nucleus is completely emulsified

An end-opening irrigating chopper is preferred as the bore of the irrigating chopper is smaller (Fig. 4.12) and the amount of fluid effusing out of it would be less and so an end-opening chopper would maintain the fluidics better. With the additional back up of gas forced infusion, the amount of fluid entering and exiting into the anterior chamber can be balanced.

The problem encountered in phakonit was the destabilization of the anterior chamber during surgery. It was solved to a certain extent by using an 18-gauge irrigating chopper. Eventually, Dr Sunita Agarwal suggested the use of an antichamber collapser, which injects air into the infusion bottle. This pushes more fluid into the eye through the irrigating chopper and also prevents surge.

BIMANUAL IRRIGATION-ASPIRATION WITH THE 0.7 mm SET

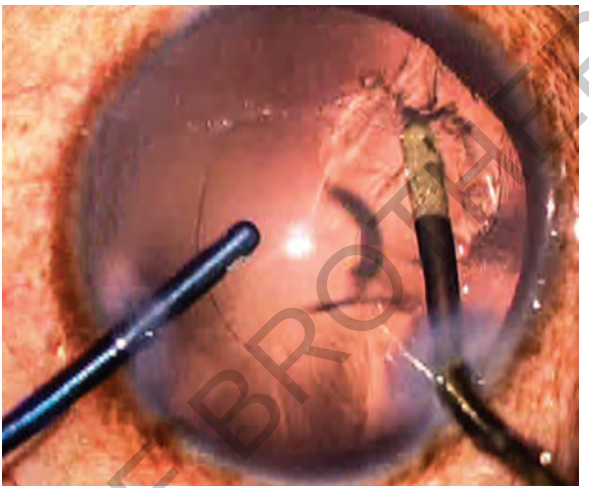

Fig. 4.13 Bimanual irrigation-aspiration with 0.7 mm set

Bimanual irrigation-aspiration is done with the bimanual irrigation-aspiration instruments (Fig. 4.13) designed by Microsurgical Technology (USA). The previous set we used was the 0.9 mm set. With microphakonit it is necessary to use a 0.7 mm bimanual I/A set so that after the nucleus removal there is no need to enlarge the incision.

BIMANUAL IRRIGATION-ASPIRATION COMPLETED

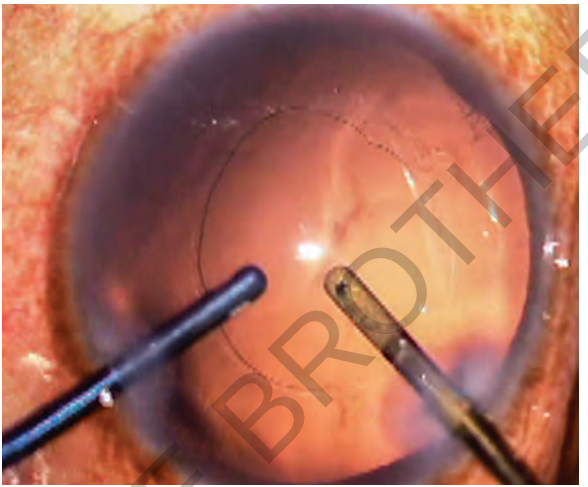

Fig. 4.14 Bimanual irrigation-aspiration is completed

With microphakonit a 0.7 mm set is used for the cataract. At present this is the smallest size available for a cataract surgery (Fig. 4.14). With further evolution over a period of time, better instruments and designs can be achieved.

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