*The following 2 topics - Hydroprocedures and Nucleus Phacoemulsification were presented by **Dr. Shabbir Hussain** on 28-07-2002 at IMA Hall. The meeting was sponsored by **Novartis** Pharma.*

Hydroprocedures

Hydroprocedures comprises of :-

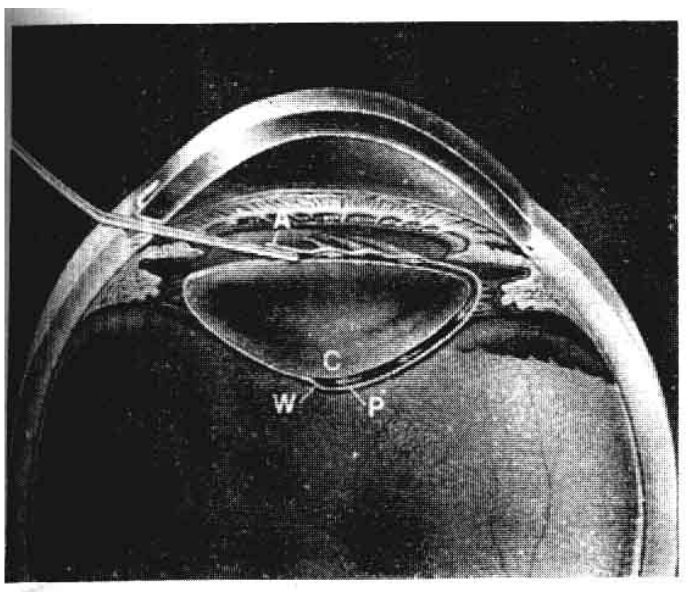
1. Hydrodissection
2. Hydrodelineation

In both irrigating , fluid is injected through a cannula into various anatomical layers of cataractous lens

Hydrodissection

Infusion fluid is injected exactly between the anterior capsule and the cortex , so that the fluid wave dissects all around the capsular bag and separates it from the entire lens nucleus ,epinucleus and cortex.

This helps nucleus rotation and manipulation during nucleus emulsification



Hydrodissection of the lens—cross section view. The cross-section view shows the 30 gauge cannula placed through the capsulotomy (A) and under the anterior lens capsule. Fluid is infused (arrows) to separate the capsule from cortex. A Hirschman/Fine "wave" (W) is seen at the point where the fluid separates the posterior capsule (P) from the cortex (C). Technique as modified by Drews. (Courtesy Allergan India)

Technique :-

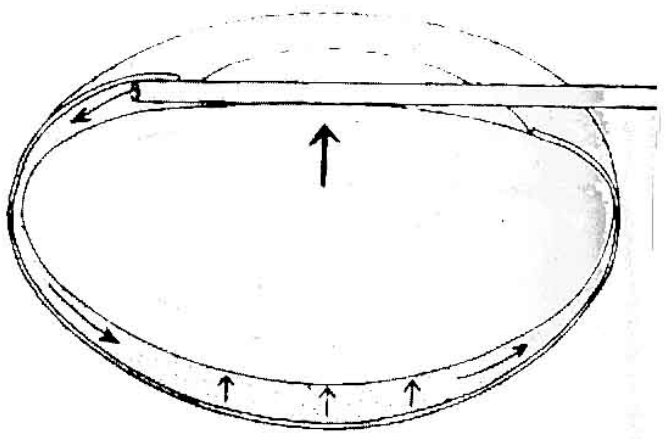
1. Hydrodissection cannula which is blunt tipped , is mounted on a syringe and

is guided along the subcapsular plane.

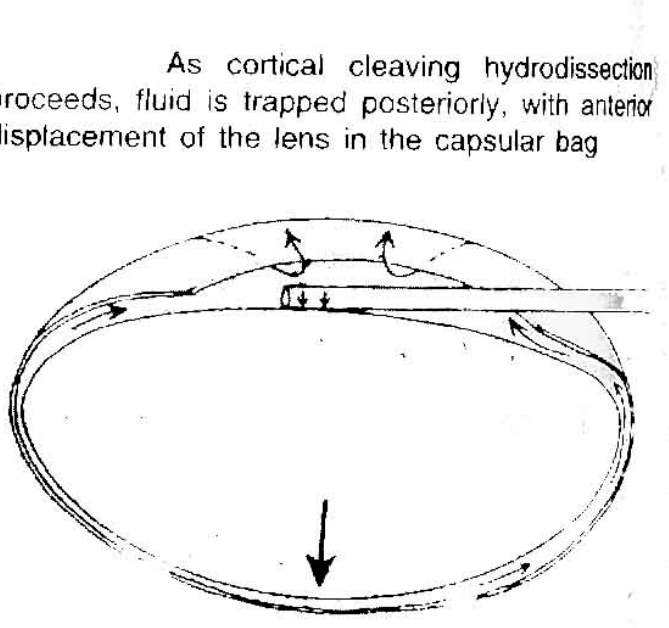
2. The capsule is lifted and small amount of fluid injected along the subcapsular

area at 6 o'clock position and in different quadrants.

1. Indications that the hydrodissection has occurred is shallowing of anterior chamber signifying entrapped fluid in subcapsular layer of the lens at one pole. A gentle tap in the shallow part results in completion of the hydrodissection with associated chamber deepening.



As cortical cleaving hydrodissection proceeds, fluid is trapped posteriorly, with anterior displacement of the lens in the capsular bag



The posteriorly loculated fluid is decompressed by downward pressure on the lens with the cannula. The trapped fluid then advances around the equator, releasing equatorial cortical capsular adhesions

2. Free rotation of the nucleus suggests that successful hydrodissection has been performed .

Importance :-

Hydrodissection is performed for the followability.

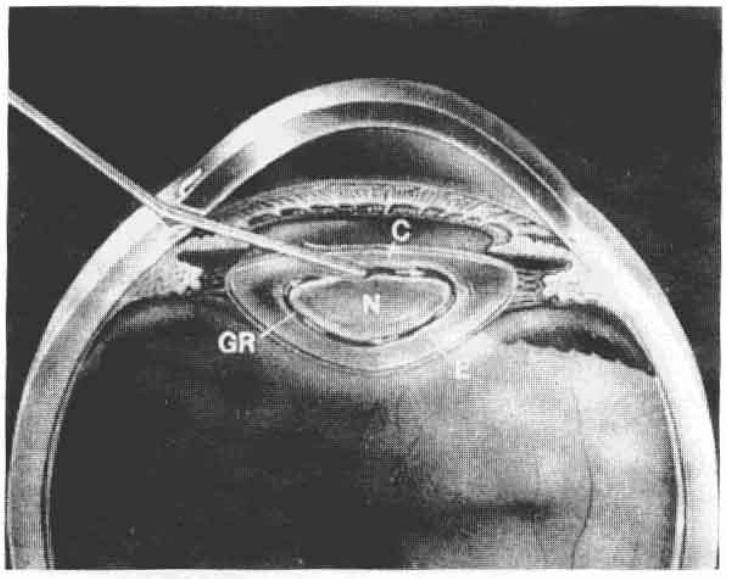
It separates the nucleus from capsular bag so that it will be free to rotate within the bag .

Allowing each sequential piece of the nucleus to be rotated into the best position for removal.

Hydrodelineation

Infusion fluid is injected between epinucleus and nucleus . This fluid wave appears as a golden ring under the microscope.

The Posterior epinucleus created by hydrodelineation acts as a cushion safe guarding to a certain extent the posterior capsule during nucleus emulsification apart from debulking the nucleus.



Hydrodelineation of nucleus and epinucleus—cross section view. A larger cannula is advanced beneath the cortex (C) and infusion is started to separate the nucleus (N) from the epinucleus (E). Arrows show the flow of fluid. The demarcation of the nuclear core and epinucleus is seen clinically as the "golden ring" (GR). Technique as modified by Drews. (Courtesy Allergan India)

Technique:

1. A small guage 26-30 G cannula is attached to the syringe with BSS.
2. It is passed into the nucleus at the edge of the capsulorhexis until it meets resistance ,the point of resistance is where the soft outer nucleus ends and the firm inner nucleus begins .
3. At the point of resistance ,the cannula is pulled back a fraction of a mm and fluid is injected .The fluid passes into the body of the cataract and creates a cleavage plane, usually identified by the appearance of a golden ring around the inner nucleus.

Importance :-

Hydrodelineation is performed for safety .

Once the firm inner nucleus is separated from the softer outer nucleus , we gain significant margin of safety ,the firm nucleus could be emulsified within a thick cushion of soft outer nucleus.

Nucleus Emulsification

The management of the nucleus is the fundamental step in phacoemulsification surgery and number of innovative techniques have been developed.

The basic steps of the processes, involved in Phacoemulsification are :-

1. Sculpting
2. Nuclear segmentation
3. Nuclear rotation
4. Nuclear fragment removal

Endocapsular Phacoemulsification can be divided into the following four categories :-

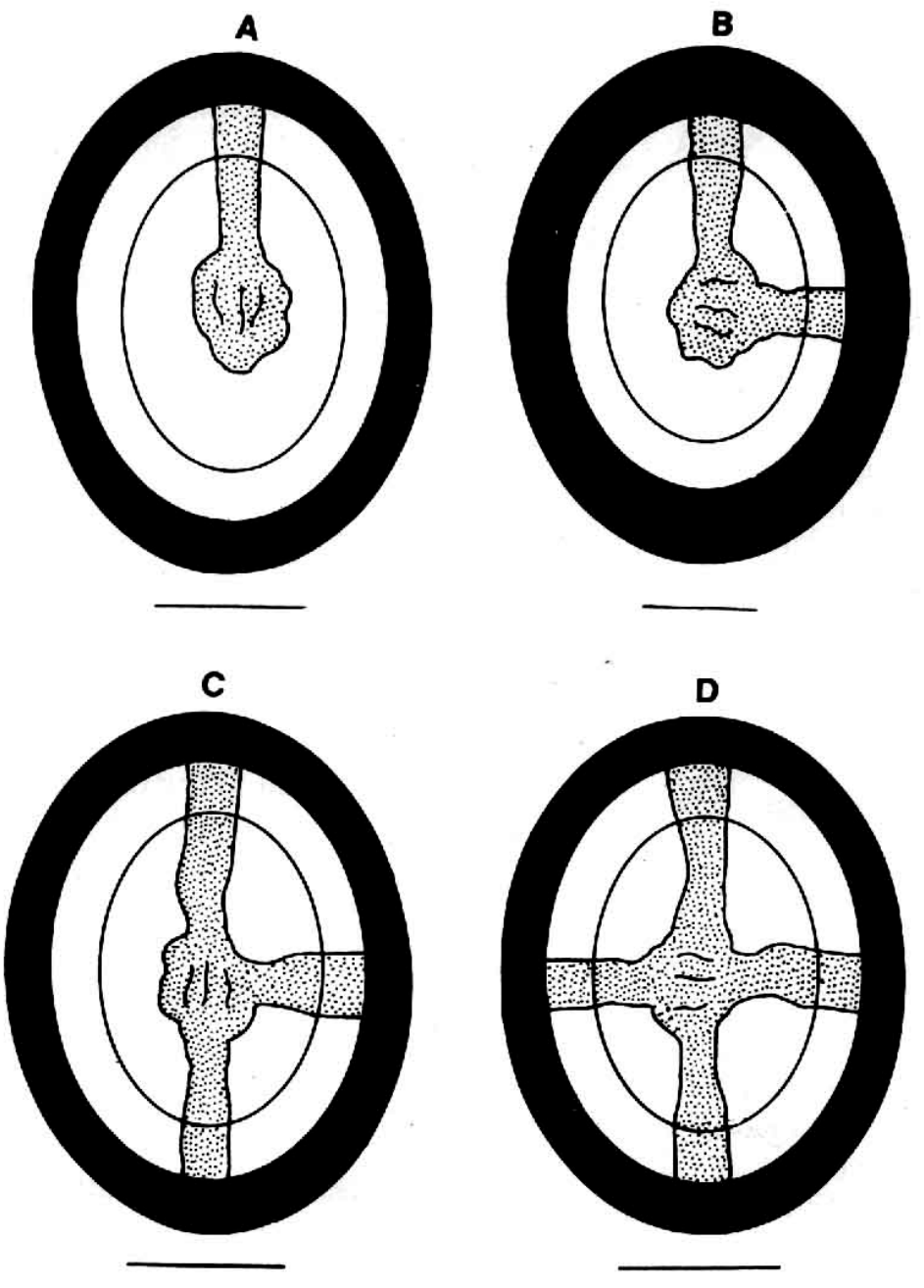
1. Phacoemulsification without nucleus cleavage
2. Phacoemulsification with nucleus cleavage
3. Phacoemulsification with nucleus cracking
4. Intercapsular Phacoemulsification

Here I will be restricting myself to emulsification technique with nucleus cracking

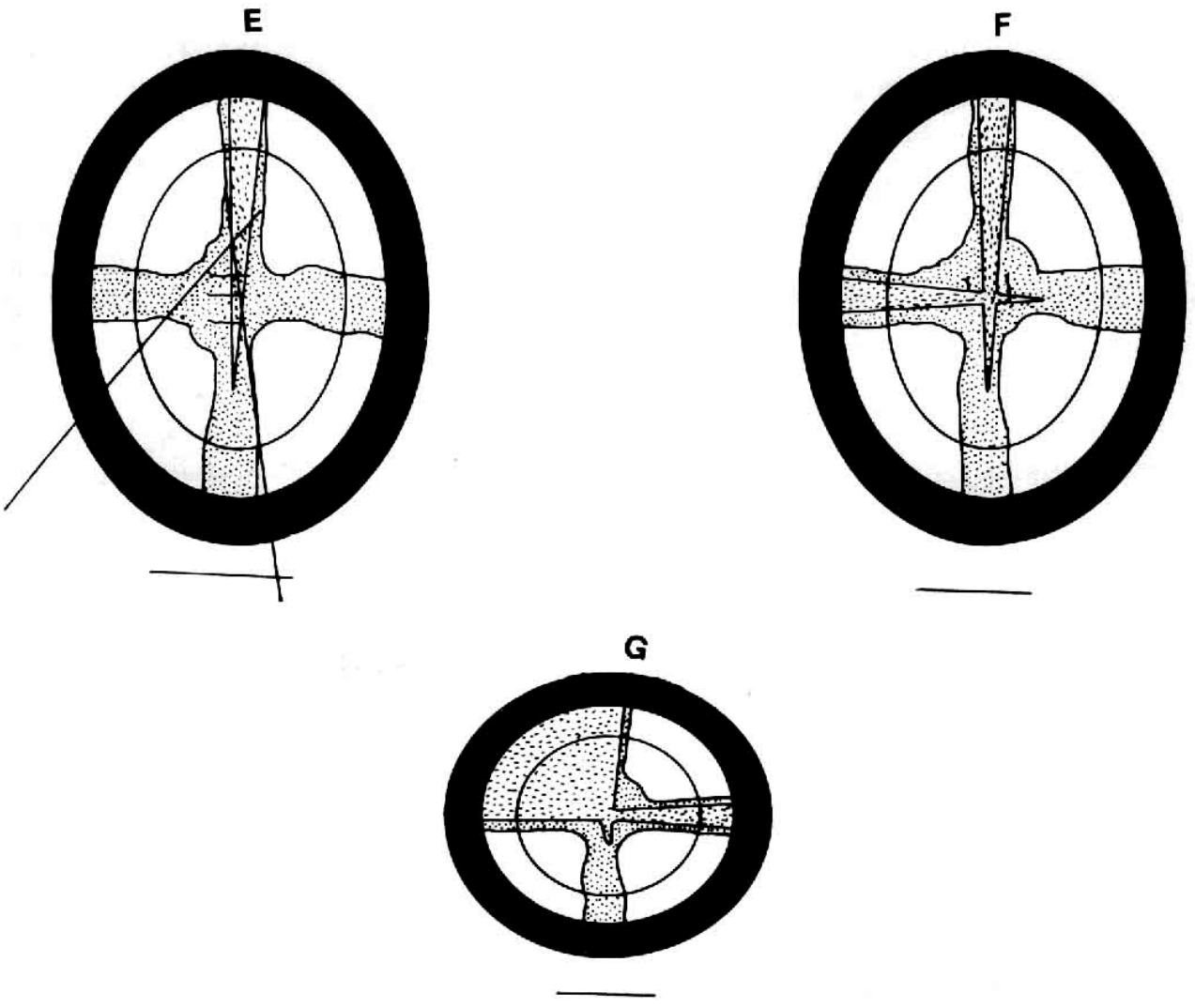
The main principle of this technique is to mechanically reduce the size of the nucleus in shortest possible time, with the least use of phaco energy and minimal surgical trauma to adjacent structure.

Various cracking techniques are :_

1. Four quadrant cracking

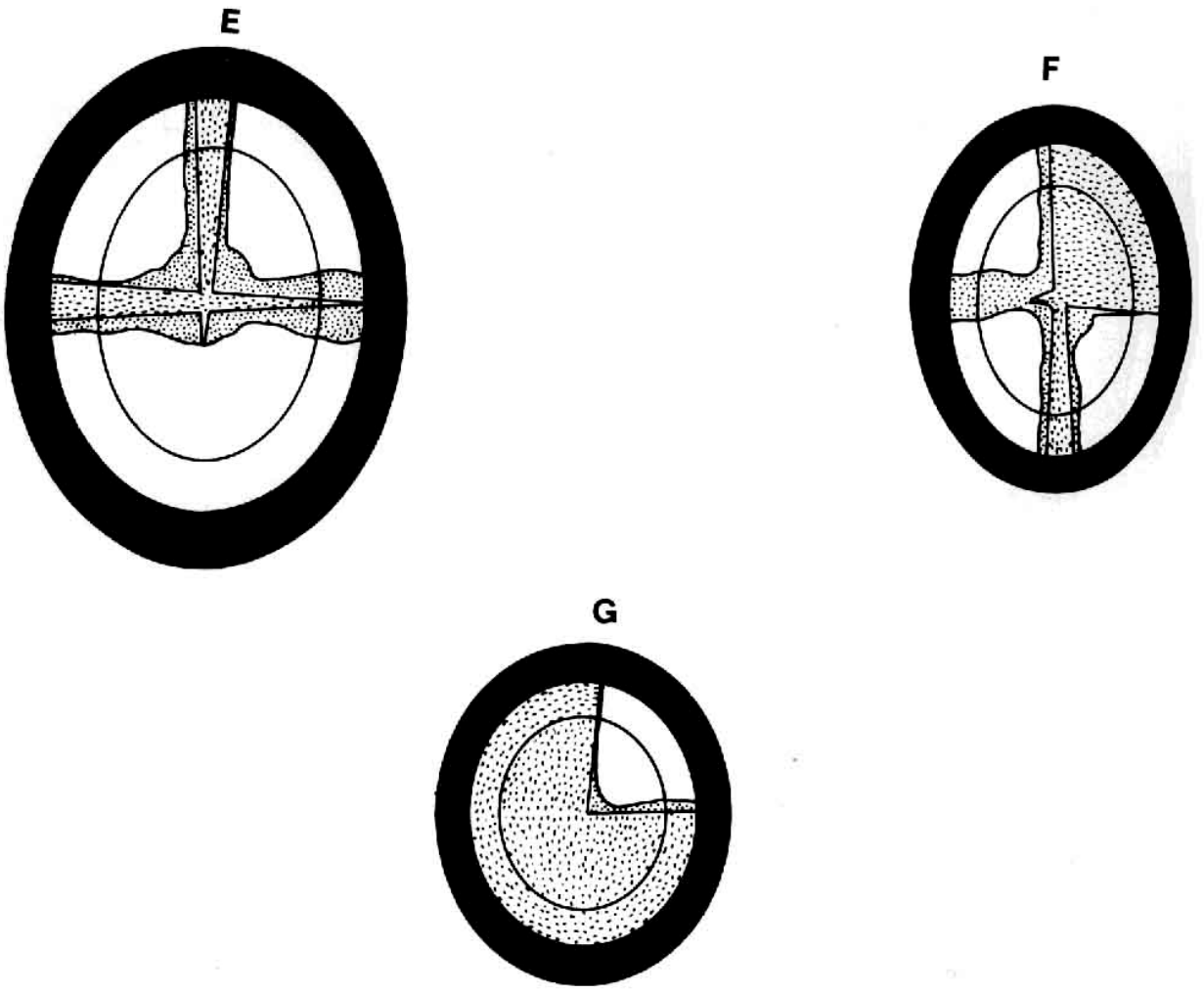


A to D: Four quadrant cracking: (A) Creation of a central trench inferiorly; (B) Rotation of the nucleus through 90° and formation of the second trench; (C) Completion of the third trench; (D) Formation of the fourth and the final trench and completion of the second trench and formation of a cross in the center of the nucleus



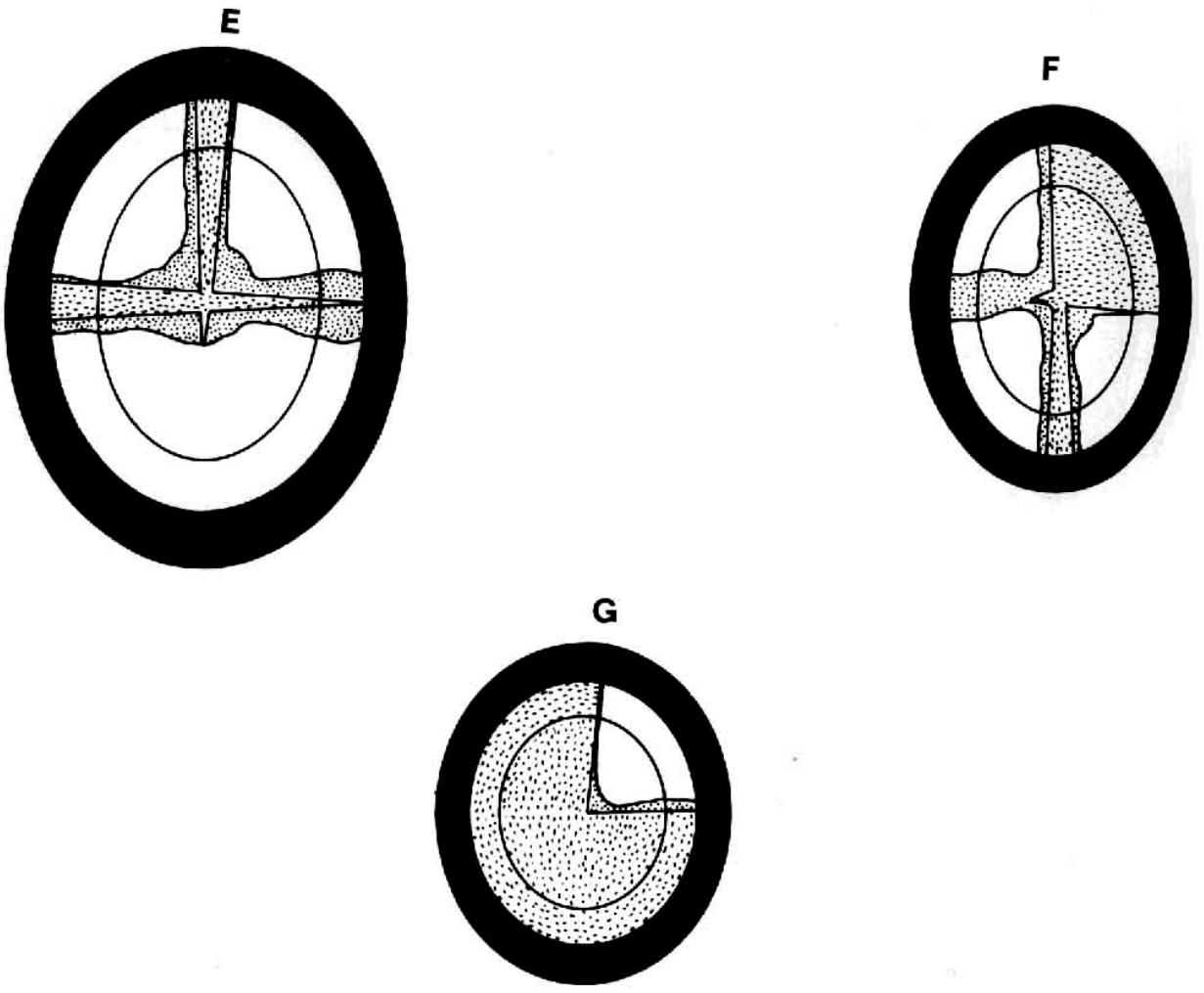
E to G: Four quadrant cracking: (E) Cracking of the nucleus into quadrants using a cross-action; (F) Creation of the second crack isolating one quadrant; (G) Emulsification of the first quadrant

2. Fractional 2 : 4 phaco



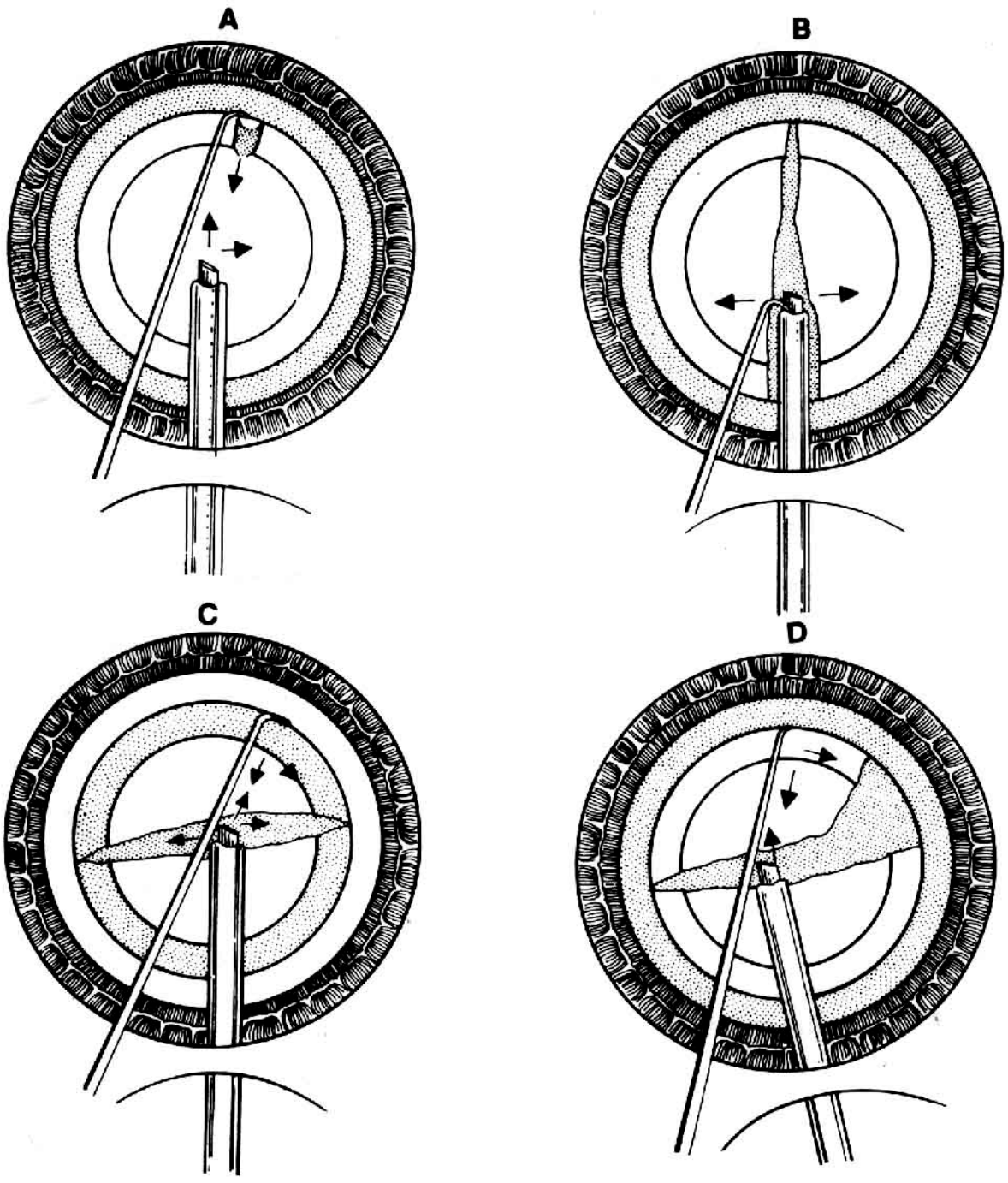
E to G: Fractional 2:4 phaco: (E) Splitting of the inferior half into quadrants; and (F) Removal of the first quadrant using the safety zone principle. (G) Removal of three quadrants completed

3. Crater divide & conquer



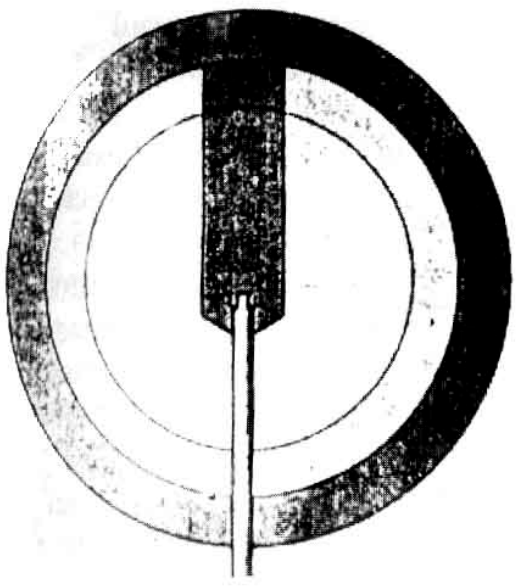
E to G: Fractional 2:4 phaco: (E) Splitting of the inferior half into quadrants; and (F) Removal of the first quadrant using the safety zone principle. (G) Removal of three quadrants completed

4. Phaco chop

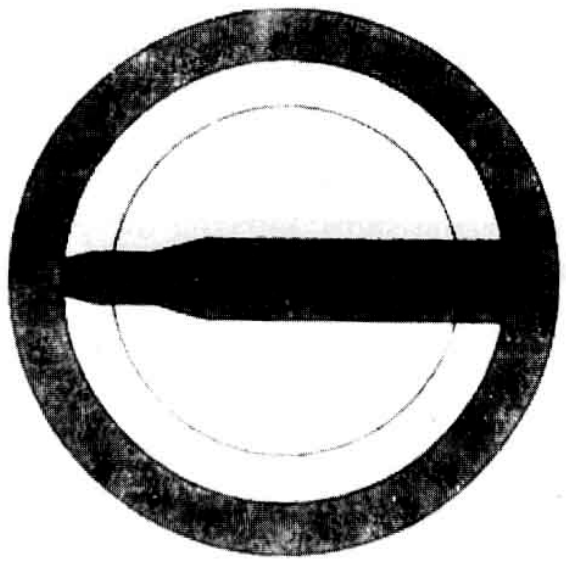


(A) Showing the placement of the phaco probe and the chop. (B) Showing the movement of the probe and chopping of the nucleus into two halve. (C) Demonstrating chopping of one half into smaller pieces. (D) Demonstrating emulsification of the nucleus fragments

5. Phaco Stop and chop



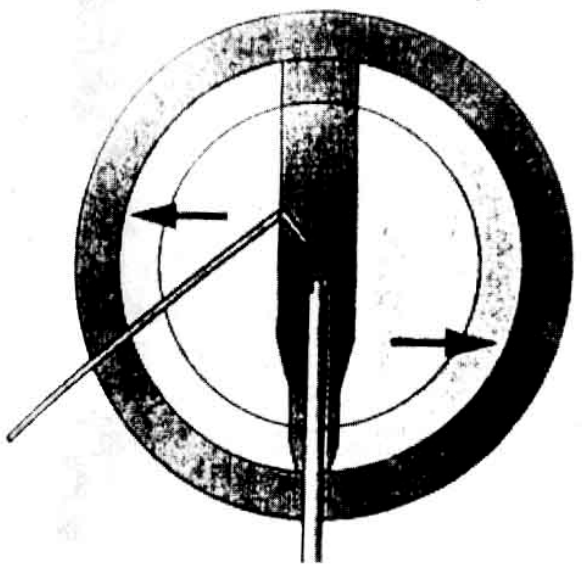
Stop and chop technique of Koch: Creation of a groove by the phaco tip



The nucleus rotated 90° in preparation for the first chop

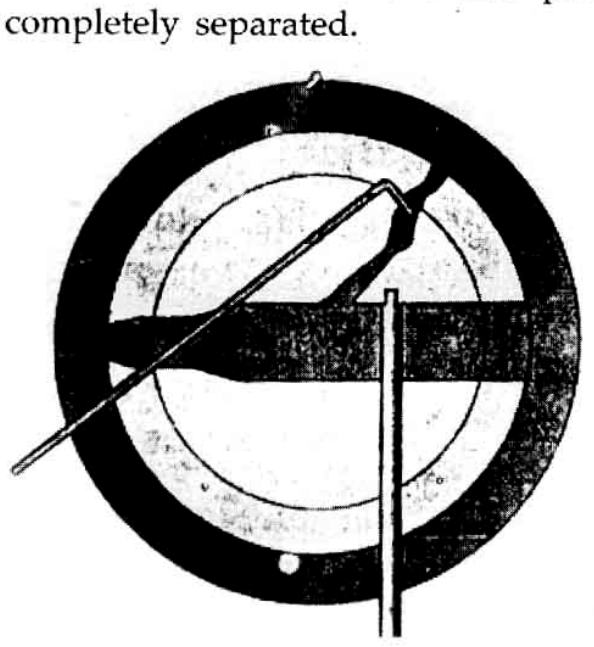
- The nucleus is then broken into two halves (Fig 11.2) with the help of the phaco tip and the chopper. It is important that the posterior plate be completely separated.The separation of the nucleus into two hemisections is the most crucial step of this technique as it provides free segments which can be manipulated and cracked with the chopper.

- The phaco tip is buried into the inferior half of the nucleus about one-third the distance from the right hand side and is held there with aspiration only. The chopper is than pulled toward the phaco tip, thereby deeply grooving the nucleus (Fig 11.4). When it reaches the phaco tip, the chopper and tip are separated, this action splits the nuclear rim so that one nuclear piece is completely separated.

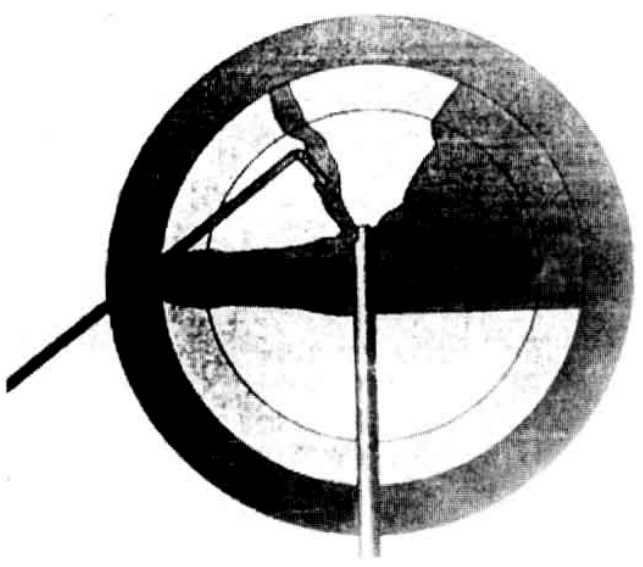


Cracking into two halves

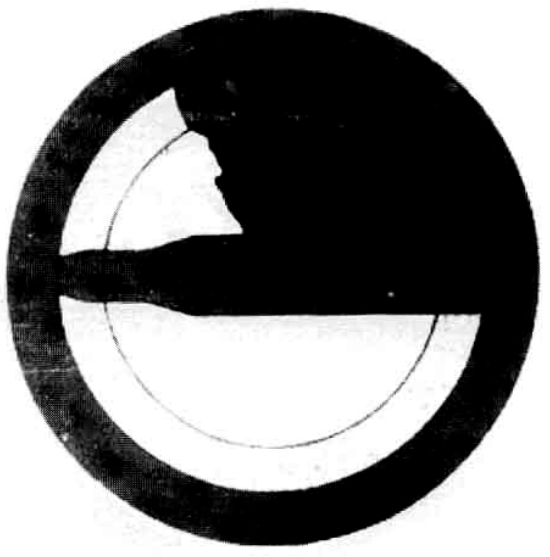
The two hemisections are then rotated 90° so that we get two nuclear halves, one superior and one inferior (Fig 11.3).



The chopper is buried into the nucleus at the junction of right 1/3 and left 2/3. It is then pulled towards the phaco tip, chopping a third of the inferior half



A second chop is made



Central one-third piece is emulsified

The superior half is then manipulated with the chopper and brought inferiorly. It is then chopped and emulsified in a similar fashion.