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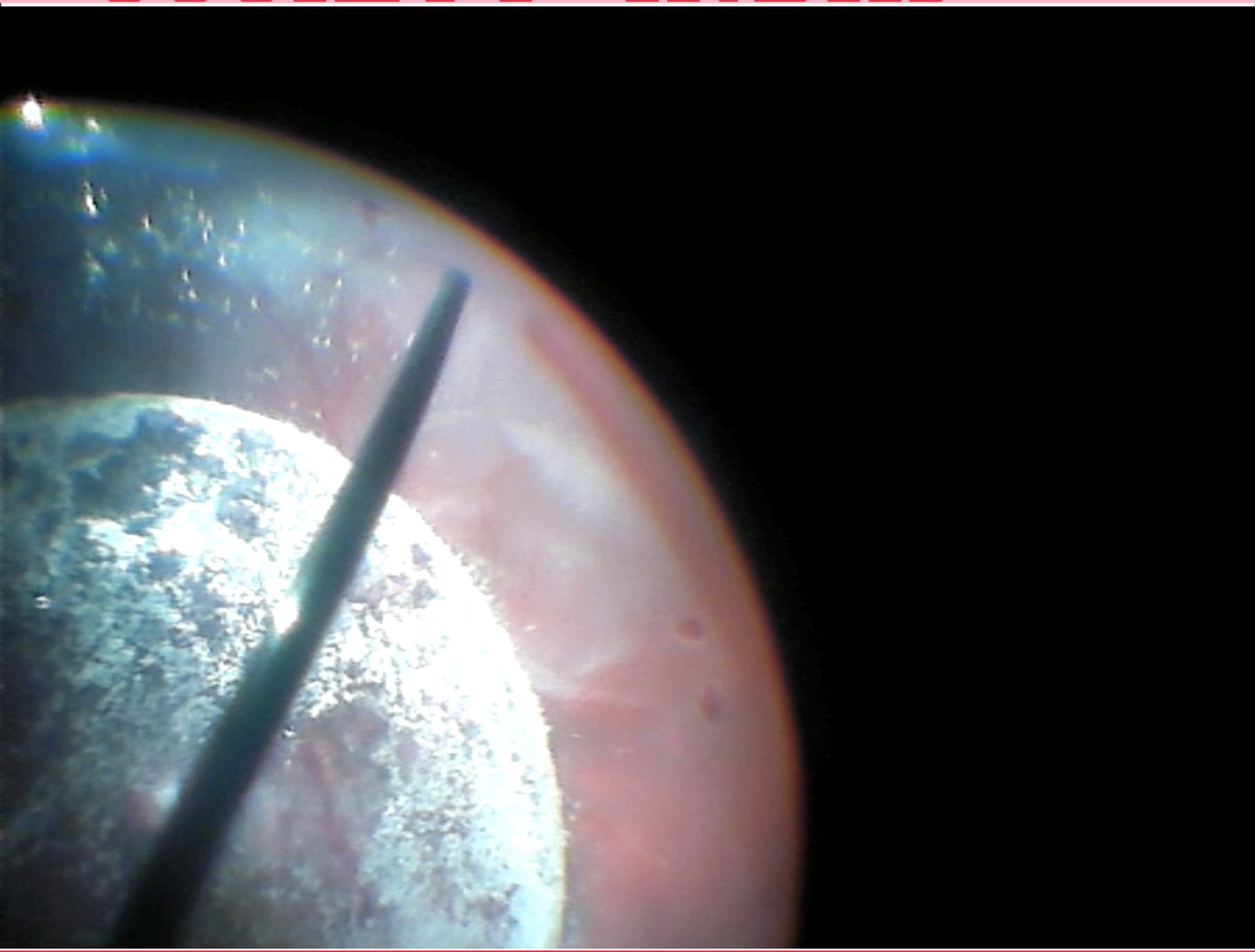
September 2025

Vitreo Retinal Society - India

The Official Newsletter of the

VITREORETINAL SOCIETY-INDIA



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GUIDELINES:
MANUSCRIPT SUBMISSION FOR VRSI NEWSLETTER

Original Articles :

These include randomized controlled trials, interventional studies, studies of screening and diagnostic test, outcome studies, cost effectiveness analyses case-control series, and surveys with high response rate. The text of original articles amounting to up to 3000 works (excluding Abstract, References and Tables) should be divided into sections with the headings: Abstract, Key-words, Introduction, Material and Methods, Results, Discussion, References, Tables and Figure legends.

Case Reports / Challenging Case / Innovations / Instruments / Techniques:

New, interesting, challenging, rare cases, innovations, instruments and techniques can be reported. They should be unique and providing learning point for the readers.

Manuscripts with clinical significance or implications will be given priority. These communications could be of up to 1000 words (excluding Abstract and References) and should have the following headings : Abstract (unstructured), Key-words,

Introduction, Case, Discussion, Reference, Tables and Legends in that order. The manuscript could be supported with up to 10 references. Case Reports could be authored by up to four authors.

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COVER PAGE IMAGE– THE VITREORETINAL COSMOS

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An image capture during retinal re-attachment surgery wherein the combination of perfluorocarbon liquid, triamcinolone acetonide crystals and the vitrector created a surreal depiction of the retinal surgeons Odyssey into the vitreoretinal cosmos

TIPS FOR PATIENT AND SURGEON COMFORT DURING VR SURGERY

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Vitreoretinal surgery is a demanding profession—both in terms of skill and physical stamina. While the average cataract surgery takes just around 10 minutes, a typical vitreoretinal procedure can last anywhere from 45 minutes to several hours, depending on the complexity. In the operating room (OR), we navigate multiple foot pedals—for the vitrectomy machine, operating table, laser, and cryo-all while performing delicate microsurgery. Add to that long clinic hours wearing an indirect ophthalmoscope and bending over slit lamps, and it becomes clear that the physical demands of this specialty are considerable.

Not surprisingly, VR surgeons are particularly vulnerable to work-related musculoskeletal disorders, with Indian studies reporting prevalence rates exceeding 70%. Alarmingly, only 28% of ophthalmologists surveyed had ever received ergonomic training. [1-3]

Thus, ensuring comfort for both surgeon and patient is critical to maintaining surgical precision and minimizing long-term physical stress.

Before Entering the OR: Strengthen and Prepare Your Body

Ergonomic preparation begins outside the operating room. Regular exercise-especially routines that focus on core, back, and neck muscle strength—can significantly reduce fatigue and musculoskeletal discomfort. Yoga helps improve posture awareness, spinal alignment, and flexibility, while aerobic activities such as 30 minutes of brisk walking several times a week can build stamina and improve circulation. This helps create a more resilient body that is better equipped to handle long surgical hours.

Before You Begin the Surgery

Raise the bed to a comfortable height before administering the block—this allows you to maintain an upright posture and avoids unnecessary forward leaning over the patient, which can strain your lower back and shoulders.

This brief moment is also an ideal opportunity to begin aligning the patient's head, microscope, and seating so that minimal adjustments are needed once the case begins.[4]

Positioning the Patient's Head

Proper patient head positioning is key to minimizing neck strain for the surgeon and optimizing the microscope view. The patient's head should be centered and stable, with slight chin-up positioning to avoid deep neck flexion. A well-positioned head minimizes the need for the surgeon to tilt or hunch to compensate for a poor angle.

If the patient's head shifts during surgery, avoid contorting your own posture to compensate — instead, reposition the head. Chasing the patient's movement with your body leads to awkward angles, muscle fatigue, and long-term strain.

Microscope, Chair, and Foot Pedal Positioning

Before you begin, adjust the chair and microscope to maintain a neutral spinal posture—with your back straight, shoulders relaxed, and elbows bent at around 90 degrees. Your seat height should allow your feet to rest flat on the floor, knees bent at 90 degrees, and thighs parallel to the ground.

Place all foot pedals (vitrectomy machine, laser, cryo, etc.) within easy reach without overextending your legs or twisting at the hips. If possible, fix or mark pedal positions to avoid constant readjustments between cases. [4,5] It is important to place floor markings for the microscope and digital screens to prevent displacement and, in turn, avoid affecting the surgeon's view.Ensure symmetrical leg positioning to avoid hip torque during long procedures. This can be done by putting a towel below the foot pedals to ensure similar height.

Avoiding Contact Stress and Cumulative Strain

Prolonged pressure on nerves, tendons, or vessels—especially from leaning your wrists, forearms, or elbows on hard, unpadded surfaces—can lead to tingling, numbness, or repetitive strain injuries. To reduce this use padded armrests or wrist support. Keep palms, wrists and forearms in a straight line, roughly parallel to the floor.[4]

Incorporate Microbreaks During Surgery

Even during long, demanding cases, brief pauses—known as microbreaks—can go a long way in reducing physical fatigue. For instance, after completing a key step such as core vitrectomy or laser, lean back from the microscope, gently shrug your shoulders, stretch your neck, or reset your sitting posture. These movements take only a few seconds but help release muscle tension and improve circulation.[6]

Invest in the OR Setup That Supports You

Surgeon chairs should offer adjustable lumbar-supported backrests, motorized height control (ideally foot-operated to maintain sterility), and smooth, lockable casters to promote proper posture and effortless repositioning throughout surgery. Microscope eyepiece extenders help maintain a more upright head and neck position by increasing the working distance, reducing strain during prolonged procedures.[7] One of the most impactful innovations in recent years has been the adoption of heads-up 3D digital visualization systems. By enabling a neutral, upright posture, these systems significantly minimize physical fatigue—especially during lengthy vitreoretinal surgeries.[8]

Patient Comfort During VR Surgery

Ensuring patient comfort during vitreoretinal surgery not only improves cooperation but also helps prevent intraoperative movement. For head support, use a soft gel cushion or contoured foam to cradle the occiput gently—avoid hard donut rings, especially in patients under local anesthesia, as they can cause discomfort or pressure points.

Allowing the patient to slightly flex the knees or placing towel rolls under the knees can help reduce lower back discomfort. Ensure adequate anaesthesia and sedation, especially during long procedures.

Ophthalmology ORs are typically quite cold, so it's important to keep the patient warm using layered blankets or intermittent hot air blowers.

Finally, offer verbal reassurance and emotional support, especially for awake patients, to reduce anxiety and promote cooperation throughout the surgery.

In conclusion, optimizing ergonomics and patient comfort during vitreoretinal surgery is not a luxury—it is a necessity.

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CLEARING THE SURGICAL VIEW: ANTI-FOGGING STRATEGIES

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Non-contact wide-angle viewing systems (WAVS) are often used in vitreoretinal surgery to provide superior visualization of posterior segment. Tools like the Resight 700 (Carl Zeiss Meditec) and EIBOS system (Möller-Wedel) have improved the surgeon’s capability to execute delicate procedures over a large surgical field. Intraoperative lens fogging still remains a persistent problem.

Why fogging happens

Fogging occurs when water vapor condenses on a surface that is cooler than the surrounding humid air in operating rooms where temperature, draping, and irrigation create a microenvironment prone to condensation. During vitrectomy, this phenomenon often affects the undersurface of the non-contact lens, which hovers just above the cornea. Condensation distorts the fundus view and disrupts workflow, threatening to compromise surgical safety.

During peripheral vitrectomy, the problem becomes very troublesome. The risk of fogging increases as the objective lens is positioned closer to the corneal surface for enhancing the field. Increasing the distance to prevent fog, on the other hand, decreases the field of view, which is sometimes a bad trade-off while operating on the far periphery.

Contributing factors

A number of intra-operative circumstances can make fogging of non-contact lenses worse. These include fluid pooling at the medial canthus, especially when the patient's head is tilted or after sub-Tenon's anesthesia; deep-set eyes and flat nasal bridges, which lets the exhaled air to reach the lens; and inappropriate draping techniques that do not adequately seal the surgical field.

Cool operating room conditions also make it more likely that the lens temperature may go below the dew point, which encourages condensation. In these situations, fogging could happen in as little as two to three minutes, which is frequently too quick for surgical manoeuvres involving the periphery. For this reason, maintaining a stable and clear surgical view requires the development of effective and practical anti-fogging techniques.

Strategies in practice

Several practical methods have been explored by surgeons around the world, with varying levels of success:

1. Warm saline soaking

This is arguably the most popular and straightforward method. Before surgery, the lens' temperature can be raised above the dew point by soaking it in saline that has been heated to around 50°C. Theoretically, this offers a window of up to four or five minutes without fog. However, the effect is transient, especially when proximal lens positioning is used for peripheral shaving.[1,2] As a result, although useful as a supplement, it might not be sufficient for prolonged surgeries.

2. Viscoelastic coating on the cornea

A stable tear film is produced and the frequency of corneal irrigation is decreased when ophthalmic viscosurgical devices (OVDs) are applied to the corneal surface. This lowers the vapor pressure surrounding the lens. Although this technique can be helpful in certain situations, it cannot stop fogging when condensation is caused by other elements, such as pooled fluid or exhaled air.

3. Active airflow devices

Several airflow-based techniques have shown promise:

- **Kusaka et al.**[3] developed a compact, vacuum-assisted chamber mounted directly on the Resight lens. This draws humid air away from the lens-cornea interface. Fog clears rapidly (within 10 seconds) by this method. However, some inherent limitations of this device include bulky design and occasional interference with instruments in deep-set or highly myopic eyes.
- **De Marinis et al.**[4] proposed a simplified version using a standard suction tube, taped to the inferotemporal area of the drape and connected to a wall vacuum source. This setup creates a steady airflow that prevents condensation efficiently. The use of a large-bore suction tube improves humidity clearance, and the materials are readily available in most ORs—making this a practical solution for many vitreoretinal units.
- **Uwaydat et al.**[5] described a creative adaptation using a 14 French urethral catheter. The tip is trimmed and placed near the medial canthus, connected to wall suction. This generates localized air movement and clears moisture effectively using readily available tools.
- **Kucukevcilioglu et al.**[6] took a different approach with a handheld fan mounted on a nebulizer arm aimed at the lens-cornea gap. This provides immediate defogging. However, concerns about maintaining sterility associated with non-filtered airflow must be borne in mind. To address this, HEPA filters, laminar airflow systems, or UV-sterilized air could theoretically be used, although not all ORs are equipped for this.

Chemical anti-fog agents

FRED Anti-Fog Solution

The colorless, water-based anti-fogging solution FRED (Covidien) has 2% surfactant and 15% isopropyl alcohol. Instead of forming vision-obscuring droplets, it causes moisture to spread out into a uniform film by reducing the surface tension of water. Using the included sponge, it can be carefully applied to the underside of the non-contact lens. In practice, there has never been any documented epithelial toxicity from sporadic lens contact with the methylcellulose-protected corneal surface.[7]

ULTRASTOP Pro Med. solution

Warm saline or ULTRASTOP anti-fog solution were used to treat lenses in a comparative study conducted by Myungho Seo et al.[2] There was no central lens condensation in any of the trials, and the anti-fog group displayed noticeably less fogging at 3 and 5 minutes. These results highlight the efficacy of these formulations in enabling a clear operating field.

Take-home message

Non-contact WAVS lens fogging during vitrectomy is still a frequent but manageable issue. Current research and real-world experience indicate that anti-fog products such as FRED or ULTRASTOP work best.

Mounted or homemade suction-based airflow devices are useful instruments. While it has a limited duration, warm saline soaking can be utilized as an adjuvant.

To reduce the issue of fogging, proper drape, patient placement, and corneal preparation are still crucial.

The best results are from combining several tactics, such as mechanical, thermal, and chemical. With continued innovation and greater awareness, achieving a consistently clear surgical view is increasingly within reach.

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AVOIDING LENS TOUCH AND IATROGENIC RETINAL BREAKS IN MODERN VITRECTOMY

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Introduction: Elevating Surgical Safety in the Era of Microincision Vitrectomy

Vitrectomy has evolved remarkably since its introduction by Robert Machemer in the early 1970s.[1] The evolution of small-gauge, high-speed vitrectomy systems coupled with advanced wide-angle visualization and bimanual illumination have redefined the safety landscape of vitreoretinal surgery. Yet, the risks of accidental lens touch and iatrogenic retinal breaks remain ever-present.[2] This article reviews key techniques and considerations for reducing preventable issues in vitrectomy.

Foundational Concepts

No vitreoretinal surgery begins at the draping table; it is conceived in the clinic, on the preoperative screen, and in the mind's eye of the surgeon.

<u>Know Your Machine: Optimizing Settings and Gauge Choice in Vitrectomy</u>

Vacuum and cut rate: Traction is the main threat in vitrectomy. Use higher vacuum (~350-600 mmHg) for efficient core removal, PVD induction and remove anterior hyaloid behind the lens[3] (Video 1). Near the retina or vitreous base, switch to lower vacuum with a high cut rate (5000-20000 cpm) as excess vacuum at the periphery may pull retina towards the cutter. Faster cutting reduces vitreous bite size and turbulence, thus minimizing traction and iatrogenic breaks

Gauge selection: Smaller gauges (23G, 25G and 27G) improve access near the retina and lens, especially in deep-set or long eyes. They enhance manoeuvrability, reduce instrument-lens contact, and lessen traction on vitreoretinal interfaces. However, greater flexibility can cause bowing, risking lens touch. A combined approach-sturdier 23G cannula with flexible 25G cutter balances control and precision.[4]

Ergonomics: The Silent Pillar of Precision

Optimal ergonomics form the foundation of sustained precision in vitreoretinal surgery.[5] Maintain a 90-degree elbow angle with full forearm support on armrests, along with relaxed foot placement on the pedals. Adopting a neutral spine position, adjusting chair and table height, and using ergonomic equipment such as heads-up 3D visualization[6,7] systems helps minimize neck, back, and shoulder strain, thereby reducing fatigue and musculoskeletal strain.

Visualization Techniques

- Wide angle viewing systems like BIOM and Resight reduce the need for anterior manoeuvres to visualize periphery, thus reducing the risk of lens touch and iatrogenic break.
- Scleral indentation by assistant or self with Chandelier illumination, increase peripheral visualization. Begin vitrectomy in the mid vitreous cavity, then indent to view the peripheral retina, and finally advance the cutter to periphery under direct visualization to reduce risk of lens and retinal injury. (Video 2)
- Use iris hooks or pharmacologic pupil dilatation in case of small pupil. Do not fish blindly near the lens.
- Advance the instrument under direct visualization and keep the tip centred in mid vitreous cavity before initiating vitrectomy or moving to another port. Avoid blind sweeping movements inside. Be ready to pause and reposition in

case of accidental movement by the patient.

Avoiding lens injury during vitrectomy

Preoperative Considerations

Lens Anatomy: The lens is a biconvex structure with the posterior capsule bulging into the anterior vitreous cavity, making Berger's space narrow.[8] Appreciating lens anatomy is essential, as this close proximity increases the risk of accidental lens touch. Preoperative A-scan biometry aids in assessing lens position and axial length.

Age and Refractive Status: Younger patients have larger lenses with a narrower anterior vitreous cavity.[9] High hyperopes possess relatively larger lenses compared to globe size, creating a higher risk zone. Conversely, high myopes have longer eyes with a slightly safer anterior vitreous cavity, allowing more posterior placement of ports[10,11].

Surgical approach

Sclerotomy Placement: The Gateway and Its Geometry

- Place sclerotomies 3.5 to 4 mm posterior to limbus depending on age and lens vault, to minimize anterior intrusion. Slightly anterior in children depending on the age,[12] 0.5mm anterior in high hyperopia and 0.5mm posterior in high myopia.[10,11]
- Entry is made in an oblique fashion, starting tangentially to the sclera and then directed inward towards mid vitreous cavity. Avoid perpendicular entry as this risk the lens. A standardized "stop and slide" technique[12] pausing

trocar insertion until the cannula abuts the sclera, then sliding cannula over trocar has eliminated lens trauma in infant ROP surgery series and shows promise in phakic adult eyes.

- In deep-set eyes, shifting the nasal sclerotomy half a clock hour toward 12 o'clock enhances surgical access to membrane/ILM peeling.
- Infusion canula should be fixed with tip directed towards mid vitreous cavity and not horizontally so as to prevent lens touch, especially during fluid air exchange

Avoid Midline Crossover

Crossing instruments anterior to the lens equator increases the risk of lens touch. Use quadrant-specific access (Video 1). The *twist technique* pivoting the cutter tip toward the periphery by wrist rotation allows nasal and superior quadrant access without switching hands, reducing crossover .

Rotate the Globe, Not the Instruments

Rotate or indent the globe to bring the target into view instead of tilting instruments forward toward the lens (Video 3).

Posterior-to-Anterior Approach

Clear the central vitreous and induce PVD before moving anteriorly. Early vitreous base dissection increases traction and risk of lens touch.

Avoiding iatrogenic retinal breaks

Preoperative assessment

Planning begins with imaging: Case mapping through OCT, B-scan, and fundus imaging reveal retinal topography and guide the plane of dissection. The vitreous base represents a critical high-risk zone, with increased vulnerability in eyes exhibiting peripheral lattice degeneration and avascular retina.[13]

Lens Status Stratification: Phakic eyes, especially younger patients with tight posterior hyaloid or proliferative vitreoretinopathy have a 3.7% incidence of lens touch during PPV.[14] Peripheral spoke-like cataracts can significantly compromise intraoperative visualization. In such cases, consider primary or combined phaco vitrectomy. However, if proceeding with intraocular lens implantation, it is imperative to assess the cornea immediate postoperatively; notable epithelial or stromal edema can obscure the surgical field leading to inadvertent breaks.

Other preop considerations:

- Avoid sclerotomy ports in areas of anterior retinal fold or retinal incarceration which may be seen in cases of trauma, uveitic eyes, retinopathy of prematurity, familial exudative vitreoretinopathy etc.
- Surgeon may need to position on temporal or nasal side accordingly.
- In cases of choroidal detachments, use of 6 mm cannula and drainage of suprachoroidal fluid or haemorrhage by partial thickness entry, reduces the risk of iatrogenic peripheral retinal breaks and suprachoroidal infusion cannula placement.[15]

Surgical approach

Controlled Posterior Vitreous Detachment (PVD) Induction

PVD induction is a major contributor to intraoperative retinal breaks, particularly due to traction exerted on the peripheral retina. Begin PVD induction at optic disc margin in the nasal quadrant, using cutter or extrusion cannula, under high magnification. Apply controlled suction (~350-600 mm Hg), to engage the posterior hyaloid avoiding premature upward lifting. Gently glide the cutter to detach the posterior hyaloid from the disc margin, then sweep toward the inferonasal quadrant. This peeling motion minimizes traction and reduces the risk of retinal trauma (Video 4).

Triamcinolone-Assisted Visualization

Use small amount of **diluted triamcinolone** to lightly stain the vitreous. Inject gently away from the optic disc and posterior pole to highlight the posterior cortical vitreous. Remove the stained vitreous first, ensuring the retina remains visible and instrument depth is carefully assessed, thereby reducing inadvertent retinal contact.

Safe Peripheral Hyaloid Separation

Ensure that the tissue being elevated is the true cortical vitreous and not a vitreoschisis plane, proceeding in small increments with a “cut-and-advance” approach rather than a single continuous peel.[16] Near the vitreous base, avoid aggressive traction lift.

The vitreous cortex adherent to the lattice can often be shaved using a high cut rate and low vacuum and avoid forceful separation. Circumferential dissection around the lattice is safer than centripetal pulls (Video 5).

Chandelier Illumination and the Art of Bimanuality

Independent intraocular illumination frees the non-dominant hand for dynamic tasks such as scleral depression, bimanual peeling, or peripheral shaving. This approach enhances safety by allowing one hand to stabilize tissue while the other performs active manoeuvres minimizing inadvertent cutter or light pipe contact with retina.[17]

Understanding Dissection Planes in Vitrectomy

- In diabetic TRD or PVR, accurate identification of the dissection plane (second membrane) is critical to avoid iatrogenic breaks. Fibrovascular membranes can be removed by segmentation, which divides membranes into smaller islands, or by delamination, which separates them layer by layer to expose the true vitreoretinal plane[18]. Segmentation is favoured in broad, dense membranes with firm adhesions and delamination for thin membranes with clear plane for dissection and both are complimentary (Video 6).
- Apply visco-dissection, bimanual method and perfluorocarbon liquids as a retinal stabilizer for safer membrane dissection.
- Microscope-integrated OCT provides real-time cross-sectional imaging to delineate planes and detect occult traction. In over 50% of complex PDR cases, its use altered surgical strategy and prevented complications.[7,19]

Prevent Laser-Induced Breaks: Maintain probe-retina distance, titrate energy for light, uniform burns, and use curved/angled probes within the entry quadrant. Avoid overpowering or poor angling, especially superiorly in phakic eyes.

***Synchronize Workflow*:** Ensure smooth coordination between surgeon and assistant to maintain stable ergonomics and instrument control.

Conclusion

Advances in vitrectomy have brought unparalleled precision, yet the smallest lapse can turn technology into liability. Preventing lens touch and iatrogenic retinal breaks demands equal parts technology, technique, and foresight. It is about anticipating challenges before they appear -knowing the planes, respecting tissue behaviour and optimal visualization. With these in harmony, surgeons can navigate even the most complex cases with safety and confidence.

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TECHNIQUES FOR POSTERIOR VITREOUS DETACHMENT (PVD) INDUCTION

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The introduction of pars plana vitrectomy (PPV) by Robert Machemer was a landmark event in the vitreoretinal surgeries, prompting Edward Norton to famously describe it as the "atomic bomb" of the retinal surgery.[1] Since its inception, PPV has undergone remarkable evolution and is now an indispensable tool for the management of all vitreoretinal cases, particularly the complex ones. Among the various steps of modern vitreoretinal surgery, the induction of a *complete and safe* posterior vitreous detachment (PVD) is the most crucial determinant of the surgical success.

PVD induction involves two key components:

1. **Visualization** – Staining and identification of the barely visible posterior vitreous cortex
2. **Separation** – Controlled detachment of the posterior hyaloid from the underlying retina

Visualization and Staining Agents

Multiple agents have been used to stain the posterior hyaloid face. The most commonly used and easily available agent is Triamcinolone Acetonide (TA) at 40 mg/mL. It may be used as such or diluted in a ratio of 1:2 or 1:3 as per personal preference.[2] TA particles become trapped within the collagen fibrils of the vitreous, producing positive staining. Once stained and visible, the posterior hyaloid and residual cortical vitreous can be removed more easily. In addition to enhancing visualization, intraoperative TA injection has been hypothesized to reduce the risk of postoperative proliferative vitreoretinopathy (PVR). Although preservative-free TA is considered relatively safe, possible complications include postoperative intraocular pressure (IOP) elevation and subretinal migration—especially in cases with large posterior tears and eye with breaks in colobomatous area.

Other staining options include autologous blood and vital dyes such as indocyanine green (ICG), trypan blue, sodium fluorescein, and bromophenol blue (BBG).[2] These hydrophilic dyes penetrate the vitreous gel to varying extents and stain it. Chen et al. described a technique of ICG-assisted ILM peeling for PVD induction in cases where conventional methods fail, attributing this to ICG's ability to penetrate the vitreous.[3] In this technique, 0.25% ICG is applied under air for 10 seconds to stain the ILM. A limited ILM peel is then performed until the posterior hyaloid rim is elevated, after which suction with the vitrectomy probe completes the PVD. Haritoglou described the use of 0.2% BBG for delineating the peripheral vitreous during RD surgery.[4] After PVD induction, the globe was filled with perfluorocarbon liquid (PFCL) to stabilize the retina and compartmentalize the vitreous cavity into anterior and posterior segments. Following fluid–air exchange, dye is applied to stain the peripheral vitreous. Compartmentalization of the dye, in this technique, minimizes dilution, subretinal migration, and lens capsule staining.

PVD Induction Techniques

The various PVD induction methods can be broadly grouped into aspirational, non-aspirational, and combined techniques.

Han et al. first described PVD induction by incising the posterior hyaloid with a knife blade.[5] Kelly and Wendel performed PVD induction using active suction via a silicone-tipped needle.[6] Over time, high-vacuum aspiration at the nasal margin of the optic disc has become the most widely used approach. The advent of modern, small-gauge vitrectomy systems has greatly enhanced surgical safety and efficiency. However, a notable drawback of smaller 23- and 25-gauge instrumentation is the reduced mechanical grip of the vitreous ports on the posterior hyaloid due to the smaller inner diameter (Poiseuille's law).[7]

Conventionally, the tip of a vitrectomy probe is used to engage the posterior hyaloid at the margin of the optic disc, employing a vacuum of up to 650 mm Hg. Once fully engaged, the PVD is lifted tangentially in all directions, preferentially starting on the nasal side (Figure 1). Although mostly successful, this technique can fail in cases of dense adhesion.

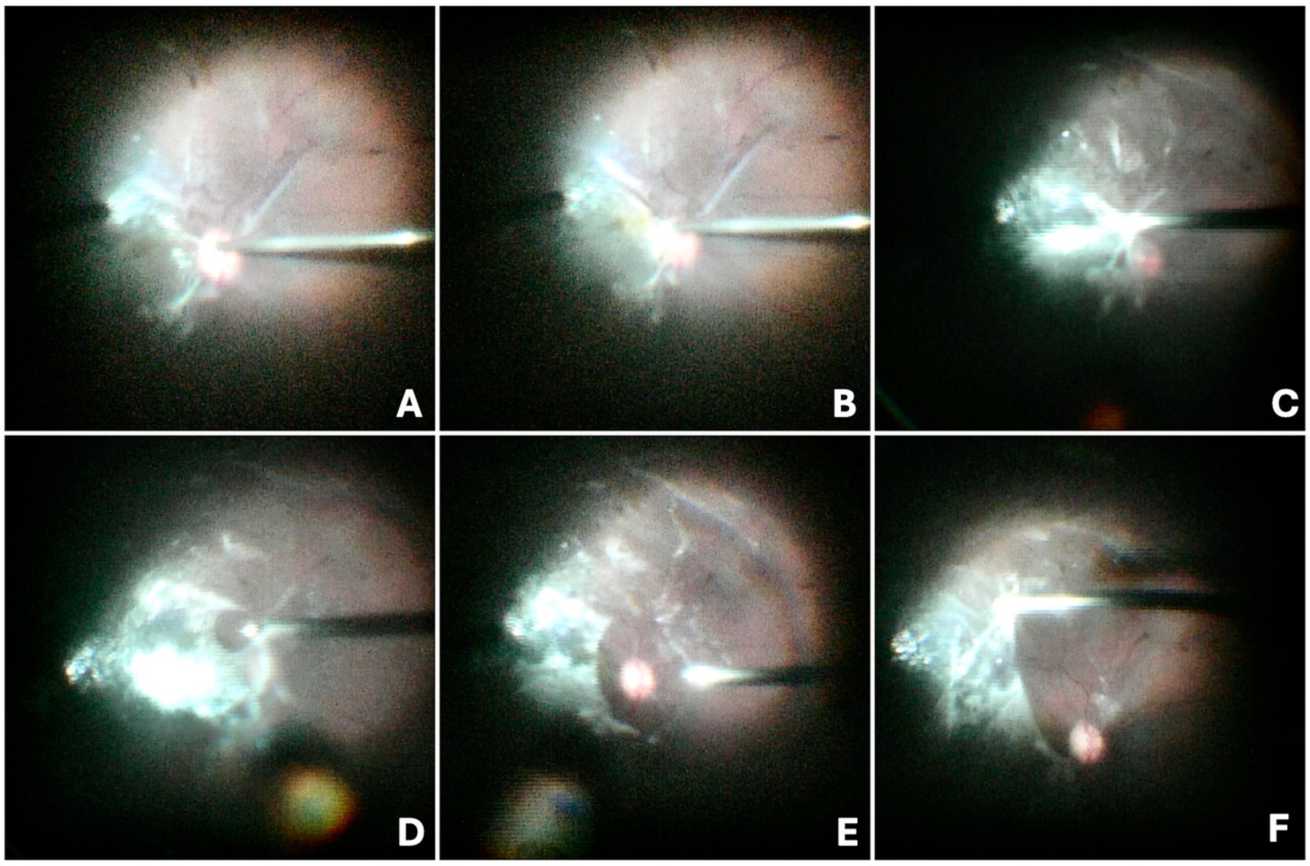

Figure 1 :Triamcinolone acetonide-assisted PVD induction using a vitrectomy probe. (A) The probe is placed at the disc margin. (B) Engagement of the posterior hyaloid at the disc margin. (C) Lifting of the posterior hyaloid. (D–E) Appearance of a Weiss ring. (F) Extension of the PVD in various directions.

Caporossi et al. introduced the Kaminari Kagura, or "lightning bolt," technique in which, instead of tangential lifting, the posterior hyaloid is engaged with the vitrectomy probe and elevated in a zig-zag fashion along any of the major arcades.[7] Once adequately engaged, the probe is lifted vertically to complete the detachment. This method, according to the authors, enhances probe-hyaloid coupling, overcoming the limitations of small-gauge probes.

Non-aspirational techniques for PVD induction use instruments such as a nylon-tipped adjustable brush (Peyman et al.), MVR blade (Desai et al.), 25-gauge micropick with active aspiration (Ellabban et al.), bent end of a 25-gauge needle (Garg et al.), diamond-dusted membrane scraper (DDMS), Finesse MaxGrip membrane flex loop, ILM forceps and handmade polypropylene loop with barbed edges (Feng et al.).[8-12] (Figure 2,3,4) These instruments are especially useful in cases with dense vitreoretinal adhesions, such as pediatric VR surgeries, and in patients with vitreoschisis and cortical remnants—such as high myopia, hereditary vitreoretinopathies, and proliferative retinopathies. However, while using these mechanical instruments, one should be wary of iatrogenic retinal damage, which are visible as retinal hemorrhages, focal whitening, and retinal tears. Compared to DDMS, flexible loops have been hypothesized to cause fewer retinal alterations and have been adapted for pediatric PVD induction. Linda et al. described its use in pediatric cases for PVD induction by performing six radial movements around the disc, whereas Patel et al. applied 4–6 perifoveal radial strips (1500 µm long, starting 500 µm from the fovea) to lift the hyaloid at the macula.[13,14]

The combined technique uses both mechanical scraping and active suction. Ellabban et al. modified a 25-gauge needle (bent to 45°) to enable both active suction and sharp dissection.[10] Another instrument, the Bapaye aspiration scraper—a 32 mm long, 25-gauge curved stainless steel cannula with a diamond-dusted round tip—combines aspirational and non-aspirational mechanisms.[15]

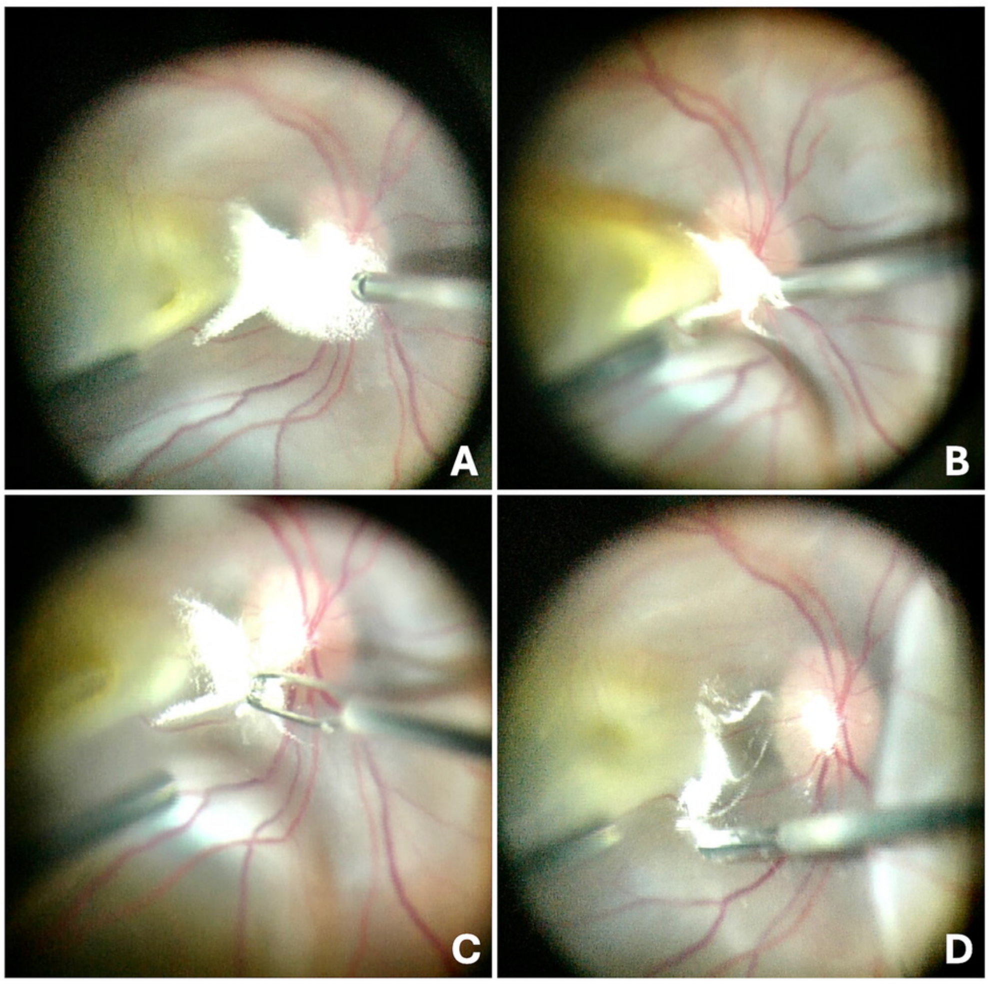

Figure 2: Use of a non-aspirational technique in cases of bullous RD. (A–B) PVD induction with a vitrectomy probe. Note how the RD becomes more bullous (B) when suction is applied, which may lead to entrapment of the mobile underlying retina in the vitrectomy probe and the formation of an iatrogenic break at the posterior pole. (C–D) Use of ILM forceps does not significantly alter the RD configuration, as no active suction is applied. Note the successful PVD induction and the reduction in retinal height.

A "fourth spectrum" has evolved, which uses fluid or PFCL to facilitate separation of the posterior hyaloid. Vitreous hydrodissection using a flute needle was proposed by Guo et al., in which they injected BSS underneath the posterior hyaloid, about 1 disc diameter above the fovea, to achieve separation in two pediatric cases.[16] The **"Mega Weiss ring" technique**, published by Babu et al. in 2019, involves creating a large defect in the posterior cortical vitreous under a PFCL bubble using a DDMS.[17] The edges of the posterior hyaloid are lifted using ILM forceps, allowing the PFCL bubble to migrate into the plane between the retina and the posterior hyaloid. This PFCL bubble migration helps peripheral PVD extension without damaging the underlying retina. A modification proposed by Aziz et al. actively pushes PFCL through the hole in the posterior hyaloid to achieve vitreo-dissection, similar to hydrodissection in cataract surgery. This was found advantageous in advanced preretinal proliferation, traumatic, and long-standing cases.[18] In 2015, Almedia et al. described the multiplanar dissection technique, in which PFCL and TA were used to create three distinct planes: an anterior BSS plane, a peripheral TA-stained vitreous plane, and a posterior PFCL plane.[19] They proposed that the mobile nature of TA crystals in PFCL and BSS—versus their adhesion to vitreous gel—combined with PFCL's retinal stabilization, accentuates visualization of the TA-stained vitreous compartmentalized in the anterior periphery.

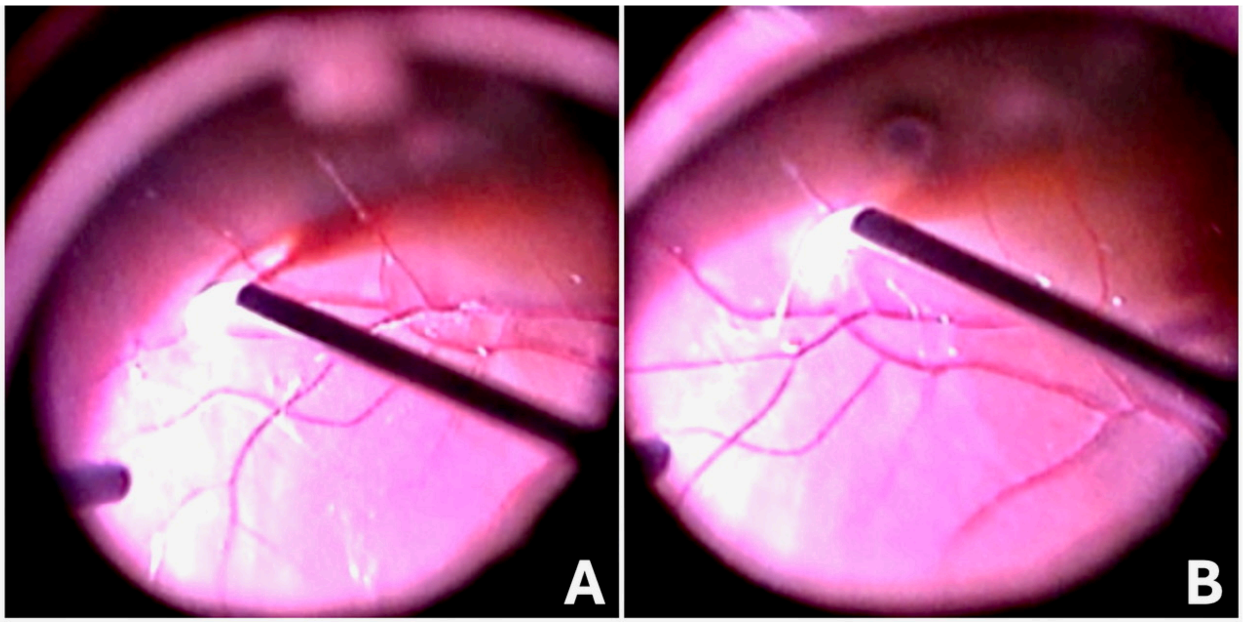

Figure 3: Use of DDMS for removal of remnant vitreous cortex. (A) Triamcinolone acetonide-stained cortical vitreous disengaged using a brushing movement of the DDMS over the retinal surface. (B) Formation of a thick, rolled-out edge by this repetitive manoeuvres, which can then be lifted easily using aspirational or non-aspirational techniques.

In some cases, lifting the hyaloid from the epipapillary area is challenging. Initiating detachment at the perifoveal region can be advantageous due to steepening of the inner retinal contour, vitreous stretching, and the presence of the posterior precortical vitreous pocket (PCVP). Otani et al. used a soft-tipped cannula to create a break at the margin of the PCVP, enlarging it into an oval defect before lifting the hyaloid.[20] Takeuchi et al. used a DDMS to make a temporal hole in the PCVP for the similar goal.[21]

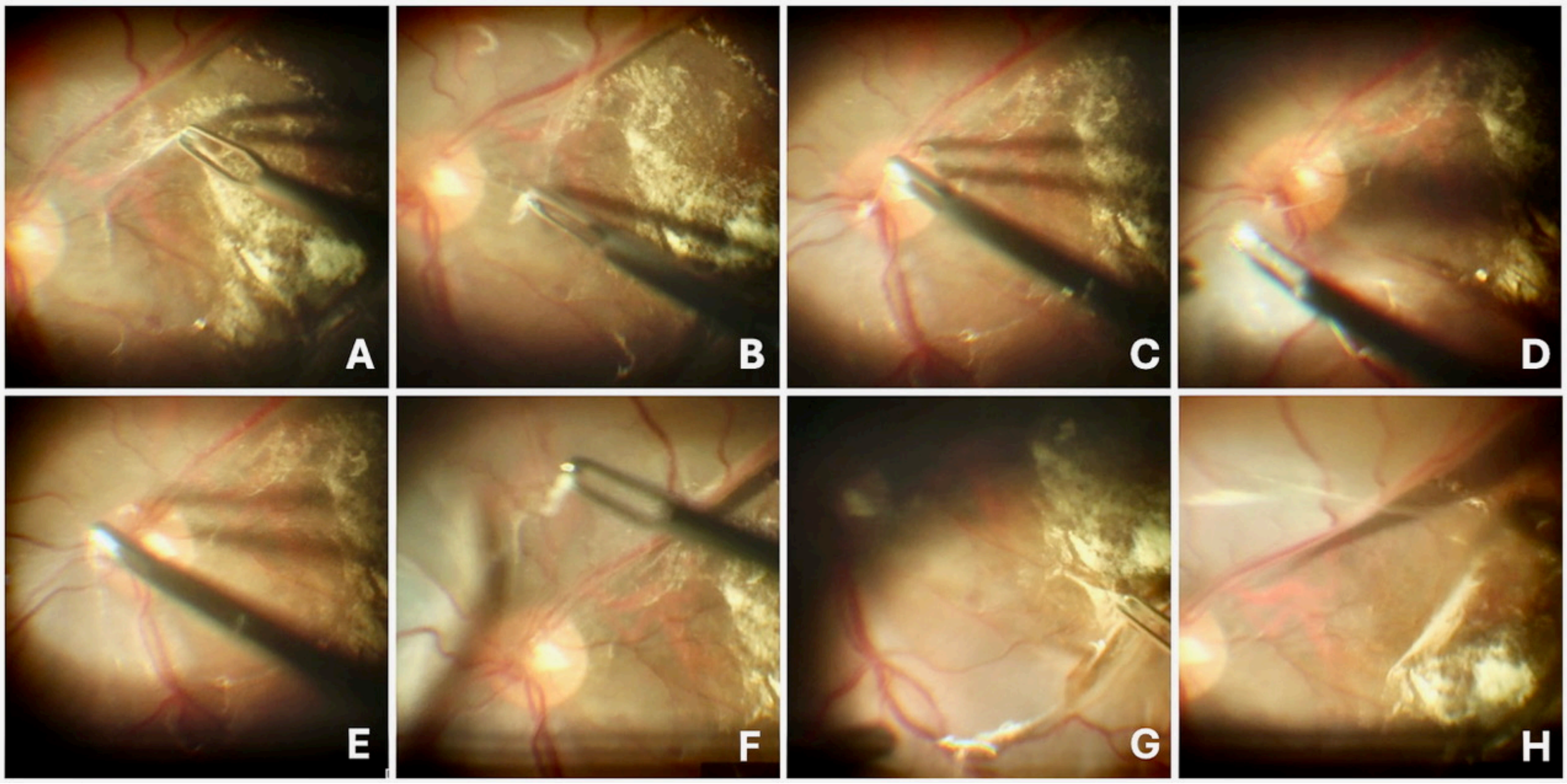

Figure 4: PVD induction at the macular area in a case of post-traumatic RD with multiple posterior pole breaks. (A) Creation of a hole in the posterior hyaloid at the macular area using ILM forceps. (B) Extension of the nasal edge towards the disc. (C–D) Lifting of the PVD from the disc. (E–H) Extension of the PVD in all directions.

The use of diathermy to induce PVD was described by Vander et al. in 1992, where diathermy was applied briefly adjacent to the nasal margin of the optic disc about 0.5–1.5 mm above the retinal surface. This caused posterior hyaloid contracture, increasing its visibility and potentially creating a hole in it. The PVD could then be lifted by passing the diathermy probe itself or a vitrectomy cutter underneath. A modification by Marco et al. used a combined flute needle with bipolar diathermy. Suction was applied just above the superotemporal vascular arcade, followed by diathermy, resulting in two key benefits: appearance of small bubbles at the flute tip—which increased posterior hyaloid and cortical gel visibility—and formation of a hole in the posterior hyaloid for extending the vitreous detachment.

Assessing Completeness of PVD Induction

A major challenge after PVD induction is determining whether it was complete. A repeat injection of triamcinolone can help identify posterior cortical remnants.

Signs of incomplete PVD include:

- Persistent posterior hyaloid staining with TA.
- *Fish-strike* sign: abrupt bending of a soft-tip cannula upon engaging residual vitreous.
- Minimal vitreous aspiration during core vitrectomy.
- Immobility of the detached retina.
- Lack of central retinal artery pulsation under high infusion pressure due to aspirating probe occlusion by vitreous.
- Dual blue staining patterns:
    - **Blue lake** – uniform concave dye distribution, indicating complete PVD
    - **Blue jelly** – patchy staining, suggesting incomplete separation and guiding further induction.

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INTERESTING VIDEO- PVD SUCTION

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Aravind eye hospital, Puducherry

Successful posterior vitreous detachment induction is a crucial step in Vitreo-Retinal surgeries. In this video we discuss a mnemonic for PVD induction: "**PVD SUCTION".** It walks you through the mental checklist for a safe and controlled detachment.

Link for the video

ATRAUMATIC ILM PEELING

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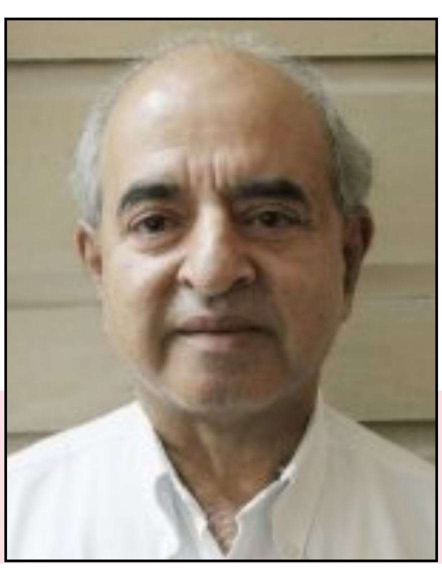

Dr Yog Raj Sharma

Formerly at Dr. R.P. Center, AIIMS, New Delhi India

There are a lot of tips available for successful ILM peeling. This includes planning "peel strategy" before-hand, pinch and peel technique, restaining or pause for blanching to find ILM edge, and peeling circumferentially.

While it's difficult to peel ILM absolutely atraumatically, there are a lot of improvisations that help in minimizing the trauma.

Visualization and inventory

Good visualization, adequate illumination and sharp forceps are foremost; If you see better, you peel safer. Maintaining optics of microscope and viewing system, orientation of patient's eye by head and globe rotation and clearing ocular media are important steps to achieve optimal visualization before starting. Replacing viscoelastic over cornea with fluid also enhances the view. Illumination can be adjusted by altering the distance of light pipe from macula. Aim is to use minimum illumination that allows adequate visualization. It's advisable not to direct light towards fovea or stay closer to fovea for prolonged duration. Choice of viewing system depends on surgeon's preferences, media clarity and axial length of eye. Non-contact green lens from Re-Sight system is very handy for macular peeling in emmetropic eyes if media clarity is good, it's quick and assistant independent. Sutured or self-stabilizing contact lenses provide an excellent view of macula with better depth perception. They have other advantages like obviating the need for an image inverter (lesser optics means better view), no obstruction to ILM forceps (advantage for long eyes) and not affected by fogging. Because they are in close proximity to cornea, they offer a stable field of view with minimum adjustments in microscope.

Initiation

Peeling initiation by raising ILM flap is most important step. Surgeon needs to plan his peeling beforehand. This includes decision to spare the fovea or peel across fovea and the need for fashioning a single layer or multilayer ILM flaps.

Goals of peeling vary depending upon the indication, while for macular holes (FTMH) aim is to relieve tangential traction and place an ILM flap to cover it, sub-ILM hemorrhage just needs de-roofing, peeling in retinal detachment can address a star fold in vicinity and so on. Discussion on specific situations that warrant different peeling strategies is beyond the scope but consistent plan helps surgeon in achieving surgical goals. Most surgeons prefer to use an ILM forceps with fine sharp grasping surface akin to sharkskin. This allows them initiate peeling by “pinch” technique and avoid traumatic instruments like diamond-dusted scrapper to raise the flap. Pinch technique mandates lifting ILM and superficial retina briefly and releasing it so that ILM becomes loose. ILM is gently indented with open blades of ILM forceps, followed by pinch to lift it. Planning also includes the site where you will initiate (Figure-1). It’s recommended to start inferiorly close to a retinal vein, acknowledging that the trauma to NFL from “PINCH” would result in a superior scotoma and also that ILM is easier to pinch and peel near blood vessel (Figure-2).

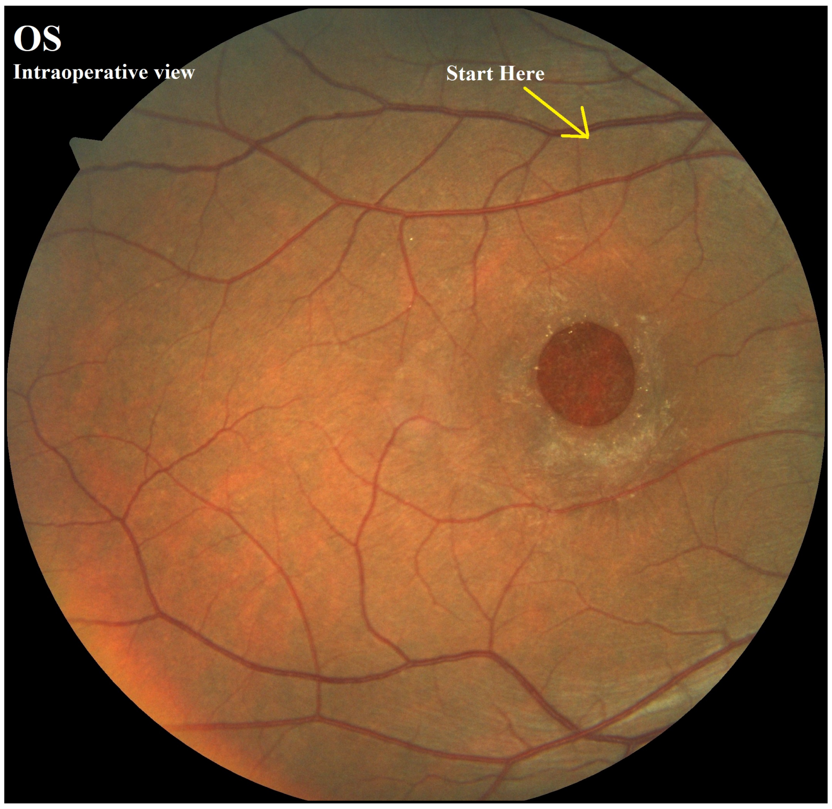

Figure 1: Staring point

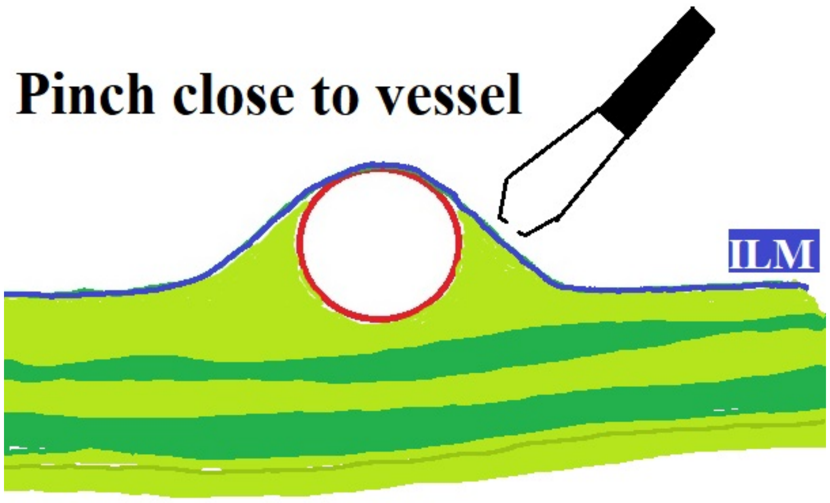

Figure 2: Pinch close to vessel

Surgeon should also consider the comfortable hand position while choosing the starting point. Video-1 shows "pinch and peel" technique and how to create predictable ILM flaps for FTMHs.

Controlling the size and direction of peeling

A recent publication reported that beginners are more likely to make repeated attempts to grasp ILM resulting in higher forceps induced damage to inner retinal layers.[1]

Learning the techniques for peeling large ILM flaps with minimum re-grasps is desirable. Video-2 shows one such "D-plan". In this technique, we start with creating a long strip of ILM and then peeling circumferentially from one end of the strip and imagining that the fulcrum of our centripetal movement is the other end of strip. In case a strong adhesion to fovea is encountered, the peeling plan is modified by holding the ILM close to fovea and applying a centrifugal force directed outwards. This allows a longer peel without avulsing the fovea.

Creating ILM flaps

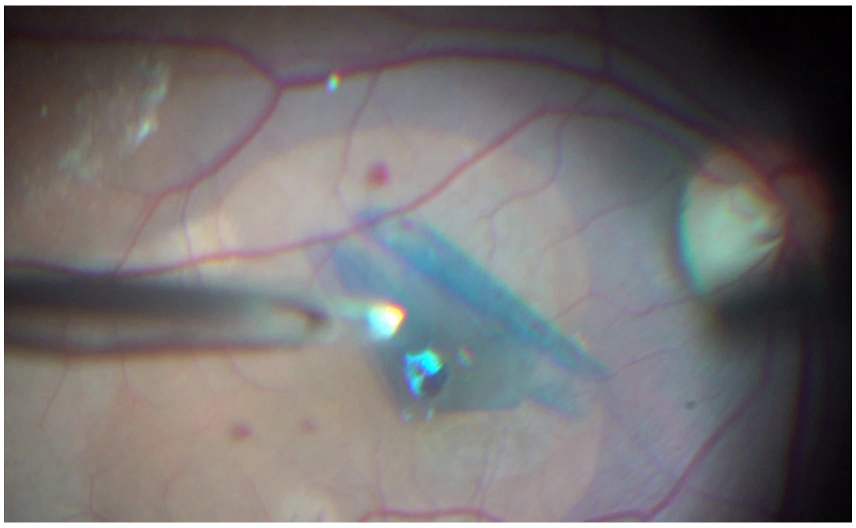

Figure 3: ILM flaps

Creating ILM flaps involves more careful planning and extra caution while handling the flap during the final phase of fluid-air exchange. Because ILM flap has a tendency to migrate towards disc, it is advantageous to leave hinge close to temporal edge of FTMH (Figure-3).

Other modifications include creating multiple small flaps and placing over FTMH. In this technique, peeling is done towards center and aim is to leave multiple hinges near the edge of FTMH.

Fovea sparing peels

There can be two strategies for sparing fovea; one is to create multiple flaps hinged close to fovea followed by trimming and second is to peel in arcs around the fovea and thereby leaving a small island of ILM on fovea. Video-3 demonstrates second approach in a case with optic pit maculopathy.

Peeling over friable retina

Peeling ILM in cases with vasoproliferative retinal diseases can be more challenging because of multiple reasons; retina is often avascular and easy to tear, ILM is firmly adherent and media clarity can get compromised by bleeding. Few modifications that can help; start from better perfused area (Figure-4), proceed in smaller steps (Figure-5), change the site of peel if you encounter strong adhesions, do not hesitate to leave few islands of ILM over extremely friable retina (Figure-6). Re-staining often helps in better visualization. Avoid using any scrappers or loops over ischemic retina. Learn to identify the “Retinal Drag” where retina tends to drag with the ILM when we are peeling it (Figure-7). That’s the first sign that retina could tear if proceed further. At this point, one can slow down or leave ILM and approach from different direction. Video-4 shows ILM peel in a case with RVO.

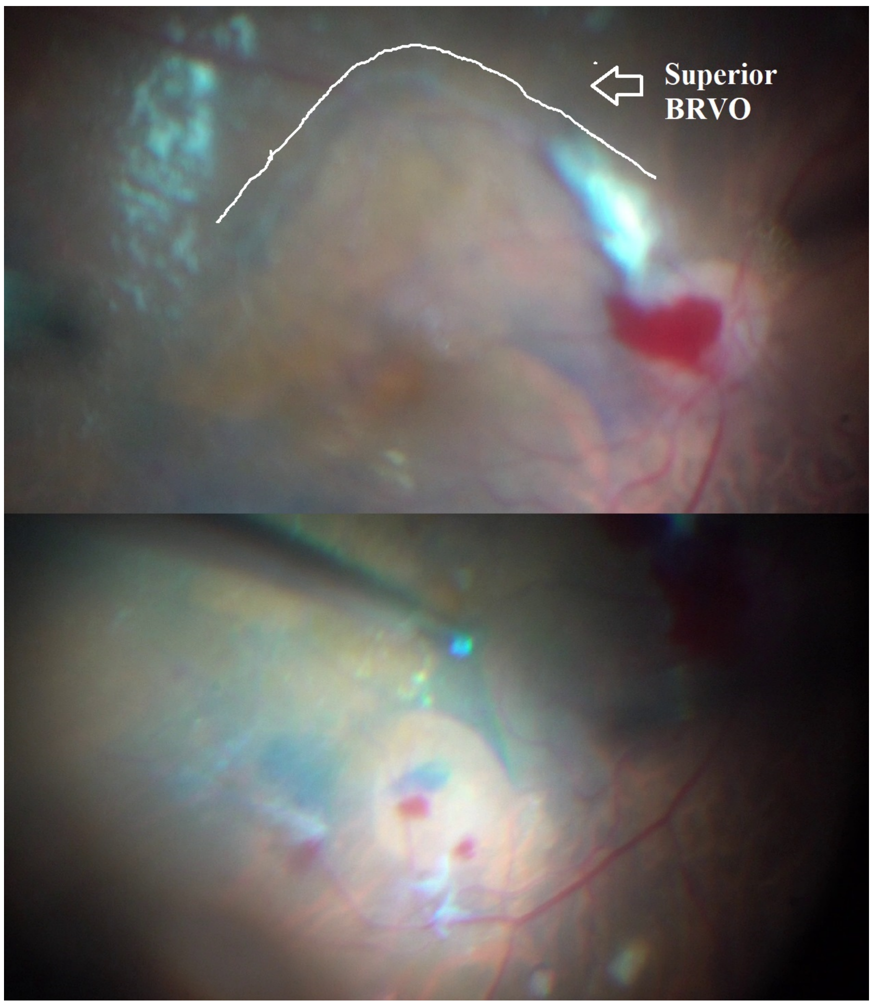

Figure 4: ILM peel in superior branch retinal vein occlusion

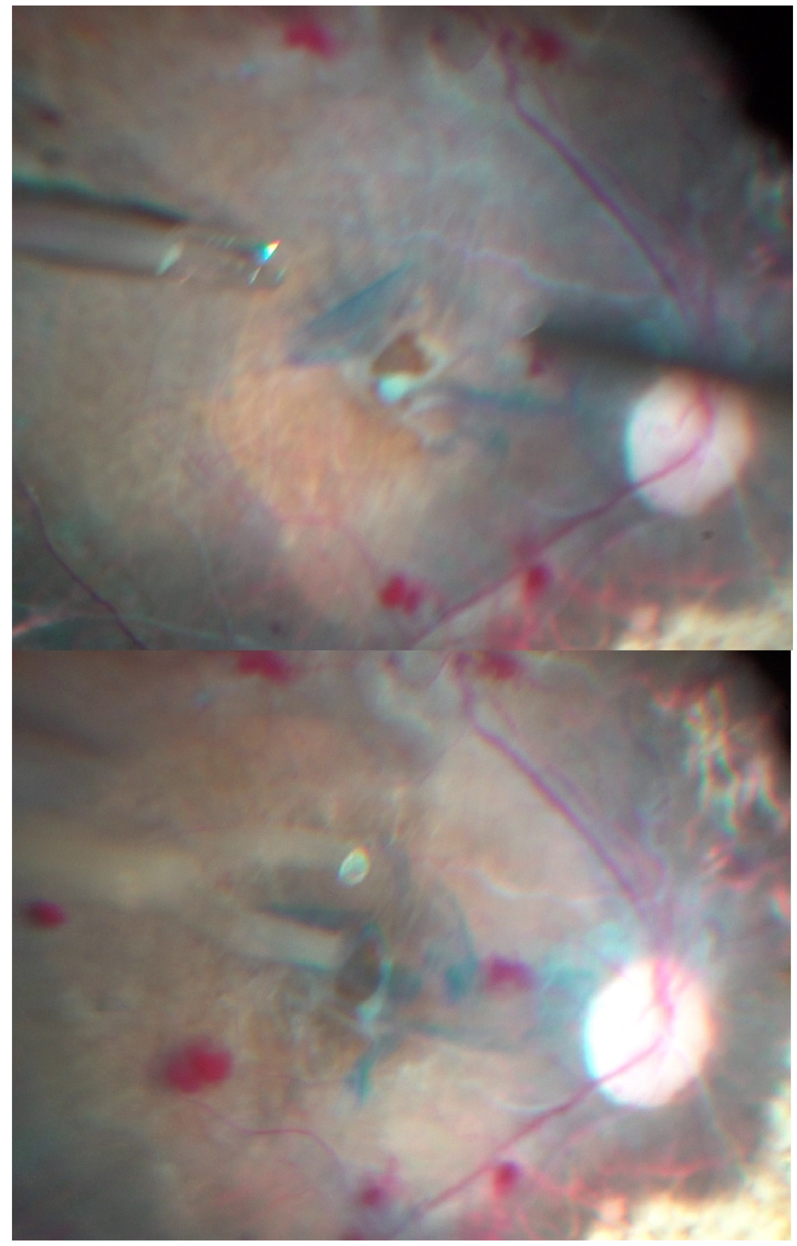

Figure 6: Careful peeling in extremely friable retina

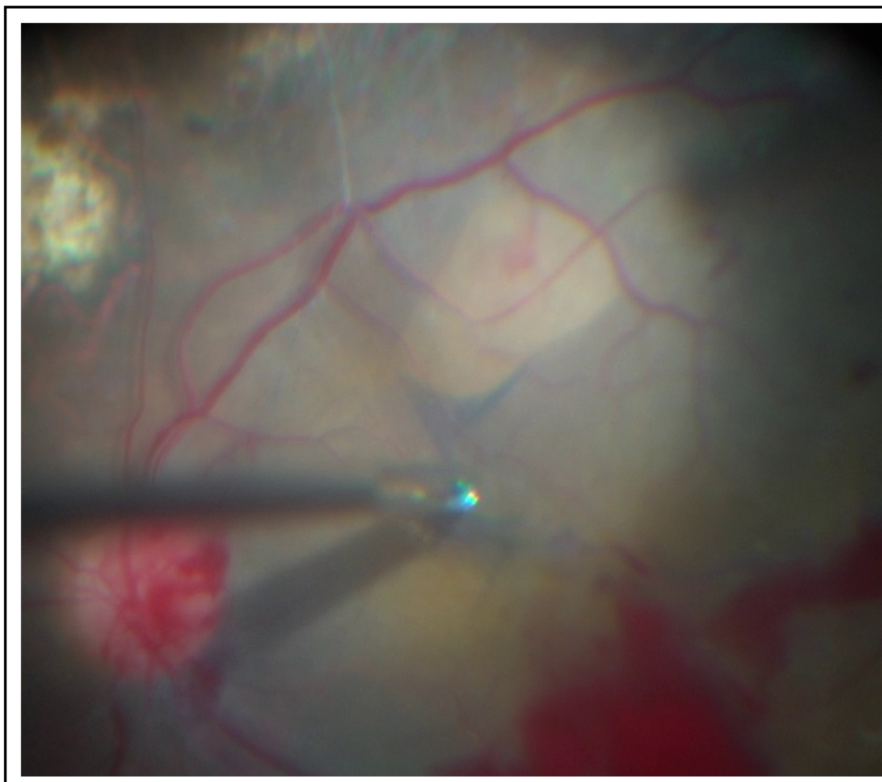

Figure 5: Peeling in small steps

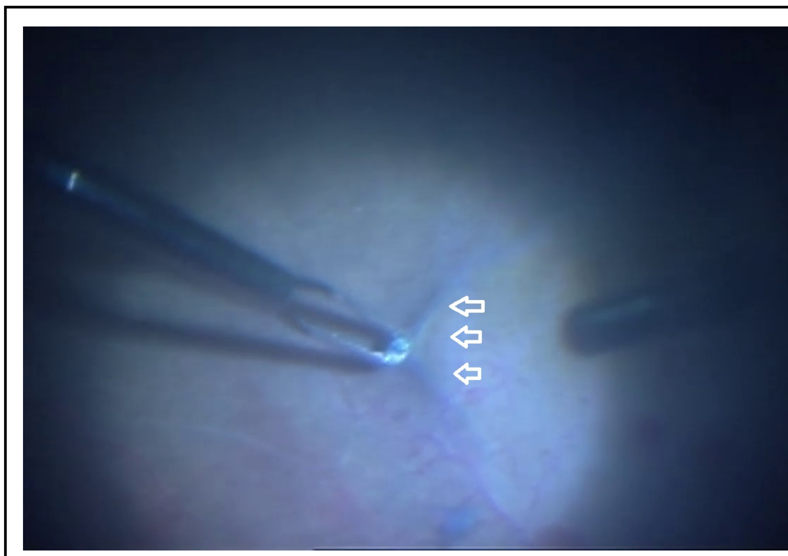

Figure 7: Retinal dragging

ILM peeling in detached retina

ILM peeling can be done without PFO in most eyes with RRD. Basic principles of peeling including pinch technique and peeling a long strip are same (Figure-8). Peeling in bullous RDs can sometimes be challenging due to retinal mobility. Mobile retina requires repeated re-focusing and does not offer any counter-traction (Figure-9,10). Draining the subretinal fluid (SRF) before initiating the

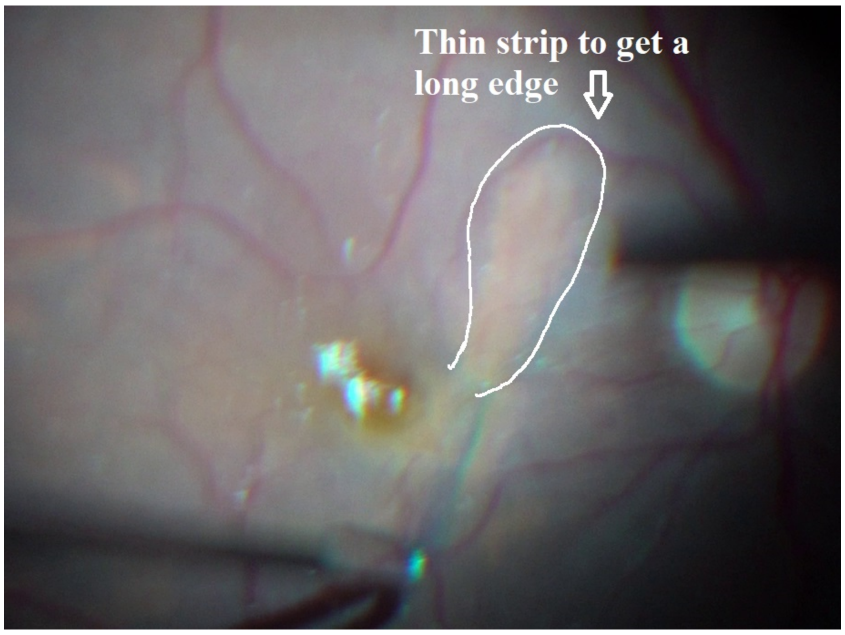

Figure 8: Thin strip of ILM

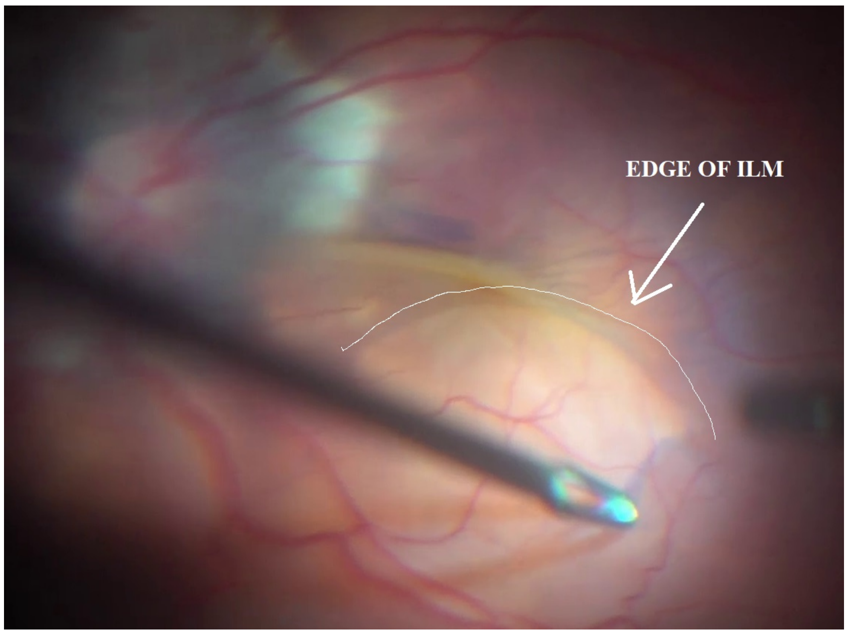

Figure 9: ILM peeling in RD

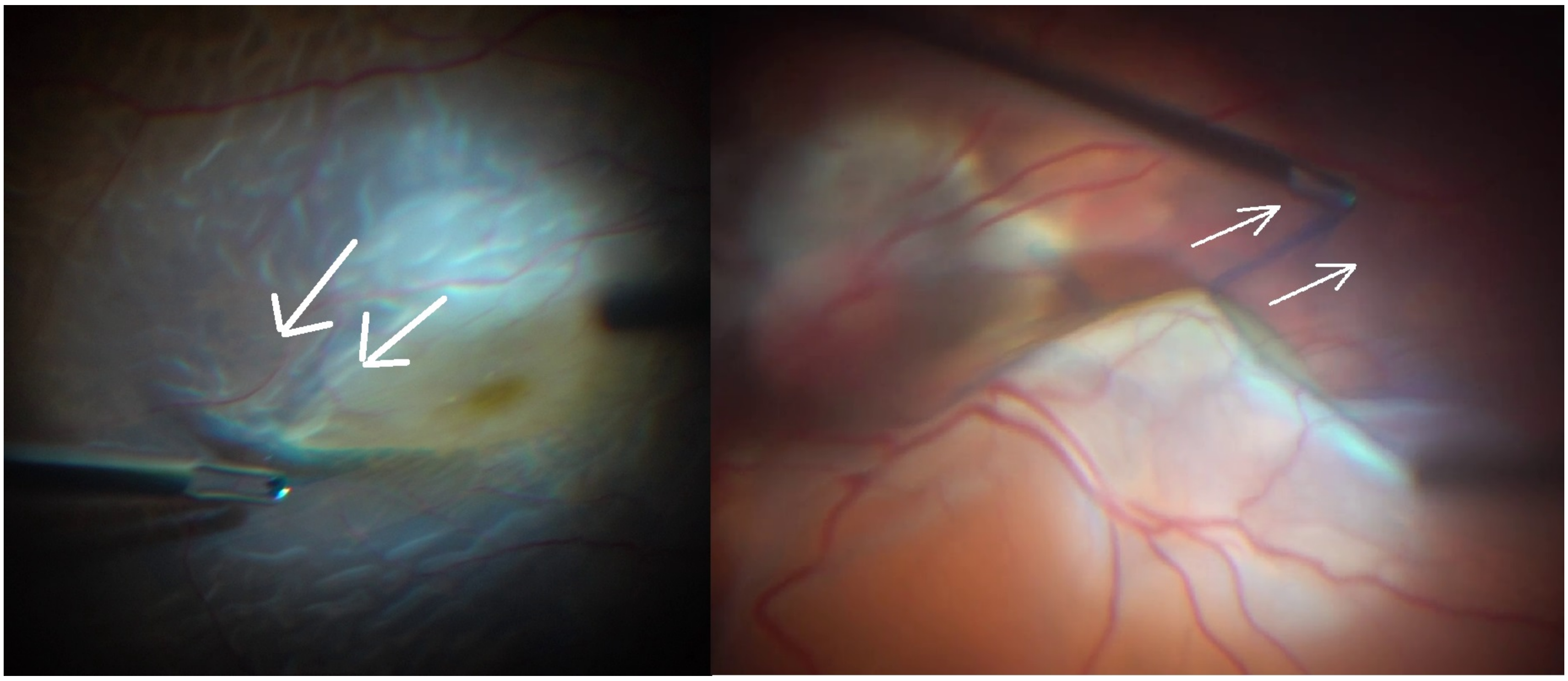

Figure 10: Retina pulled towards forceps

peel is helpful. Internal drainage can be repeated to flatten macula if SRF re-accumulates. Starting peel nasally gives you counter-traction but one should avoid starting peeling close to disc where axons of NFL converge because even a smaller injury here will result in a bigger scotoma. Video-5 shows steps for peeling ILM in an eye with RRD and video-6 in an eye with RRD and ERM.

ILM peeling in RRD with FTMH

Peeling ILM in these cases is different because one has to fashion flaps also. One can create a large temporal flap before injecting PFO and then manipulate this flap under PFO during fluid air exchange. Another modification is to create a drainage retinotomy to prevent flap dislodgement during fluid air exchange. Video-7 shows ILM peel in RRD with FTMH.

Conclusion

Peeling ILM atraumatically encompasses planning beforehand, ensuring good visualization and staining, peeling slowly in steps, re-staining if required and modifying plan if strong adhesion is encountered.

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MASTERING BIMANUAL VITREORETINAL SURGERY

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Introduction:

The standard three-port vitrectomy involves using one port for infusion, usually fixed in inferotemporal quadrant, one port for passive illumination, and the third port for an active instrument, such as a vitreous cutter, scissors or forceps. Though both hands are being used, one hand largely remains inactive, yielding effectively only ***"uni-manual"*** surgery.

What is true ***"bimanual"*** surgery?

To use both hands actively to perform various surgical manoeuvres. Visualization is achieved either by direct microscope illumination or with chandelier illumination source through the fourth port or as an illuminated instrument/s (multifunctional instruments) while continuing with three port system.

Illumination systems:

During 20G era, bimanual surgery was being performed with assistant holding a regular endo-illuminator through a forth port. The advantage was that assistant could focus the light better at desired surgical area for excellent illumination. However, surgery was almost totally assistant dependent with occasional hindrance in globe rotation. With MIVS and availability of self-retaining chandelier illumination systems, the bimanual surgery becomes much easier and more and more surgeons are opting for bimanual techniques.

Currently, multiple chandelier systems with different sizes are available, 25G and 27G are being most popular. Both single or twin (dual) optical fibre chandelier systems are available in the market. (Table 1)

Techniques:

Decision regarding use of bimanual technique is generally taken during preoperative evaluation. 23/25/27G instruments can be used as per surgeons' discretion. Conventional 3 ports are made for the vitrectomy. Usually there is no need to change the location of the ports. Wide angle visualization system gives better view and orientation for easy surgical manoeuvring.

In eyes with anteriorly pulled retina, initial surgery can be performed under direct microscope illumination.

Table 1: Currently available chandelier/similar illumination systems

S.NO	Name of instrument	Type of instrument	Mode of fixation
1	Alcon 23G / 25G chandelier (Figure 2)	Chandelier	Trans scleral, 23/25G 4th port
2	Bausch & Lomb 27G/ 29G dual-chandelier	Naked fiber optics	Trans scleral, without cannula, usually placed at 6 and 12 O' clock meridian for uniform diffuse illumination
3	Bausch & Lomb 25G / 27G single-fiber chandelier	Naked fiber optic	Trans scleral 4th port, without cannula
4	Bausch & Lomb 23G / 25G single-fiber chandelier	chandelier	Trans scleral, 23/25G 4th port
5	Bausch & Lomb high-flow infusing chandelier	Combined Illumination and infusion	At infusion port, No need for 4th sclerotomy
6	25G/27G Eckardt Twin Light chandelier fibers	Chandelier	Trans scleral, at 6 and/or 12 O' clock meridian
7	DORC 23 / 25G chandelier	Chandelier	Trans scleral, 23/ 25G 4th port
8	DORC 27G dual-fiber chandelier	Naked fiber optic	Trans scleral, at 6 or 12 O' clock meridian
9	Synergetics 25G high flow infusion chandelier (Figure 3)	illuminated infusion	At infusion port
10	Synergetics 23G/ 25G chandelier (Figure 1)	Chandelier	Trans scleral, 23/25G 4th port
11	OFFISS (Optical Fiber Free Intravitreal Surgery System)	Illumination integrated into the microscope	

Chandelier illumination is the most commonly used illumination source for bimanual surgery. [1] It can be a standalone source fixed through the fourth sclerotomy (Fig 1, 2, video 1, video 2) or can be integrated with infusion cannula (Fig 3, video 3) or with one of the active instrument/s (multifunction instruments).

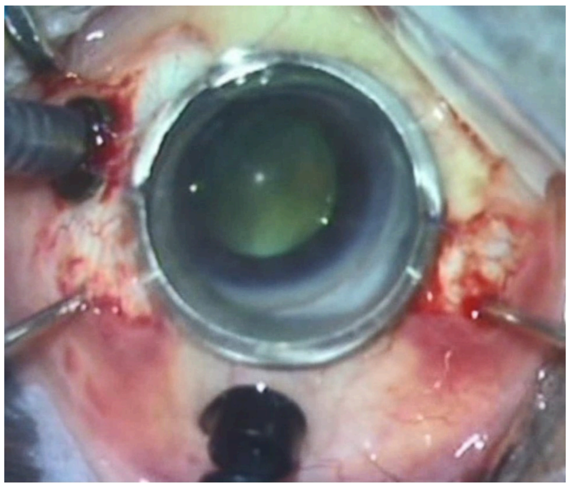

Figure 1: 20G bimanual vitrectomy with 25G chandelier (Synergetics) at 12 O'clock meridian

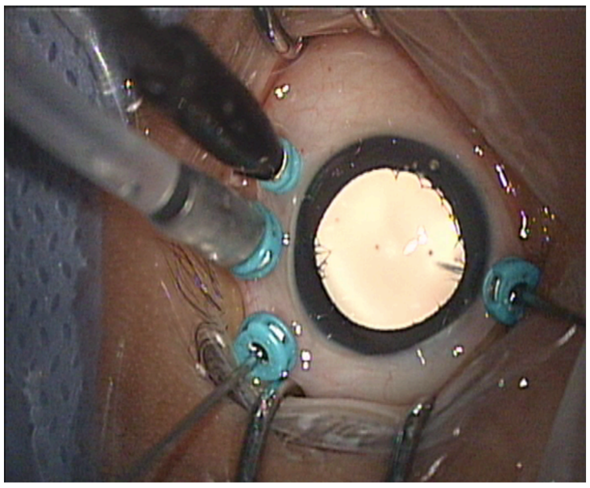

Figure 2: 25G bimanual vitrectomy, 25G Alcon chandelier placed in inferotemporal quadrant next to infusion cannula

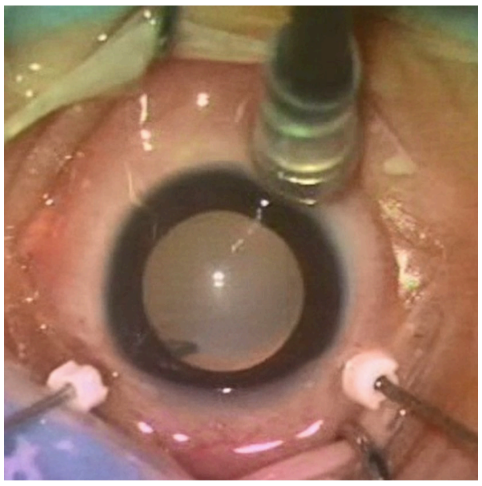

Figure 3: Stage 4 ROP, lens sparing vitrectomy, 25G combined infusion and illumination

The chandelier is designed to be self-retaining. It is inserted (with /without cannula) perpendicular to the sclera (and not angled/ stepped entry) directed towards posterior pole for diffuse illumination of fundus. Although most surgeons prefer to fix chandelier in infero-temporal quadrant (Fig 2, video 1) next to infusion cannula, to get the best possible illumination during surgery, meridian for placement of chandelier should be decided depending on pathoanatomy to be addressed and the meridian, in which dissection is initiated. **The aim is to get adequate illumination and to avoid shadow during membrane surgery.** If necessary, intraoperatively, assistant can nudge the chandelier direction to achieve optimal illumination in specific areas. More than one chandelier or twin/duel chandelier can be used for uniform diffuse illumination of entire vitreous cavity (video 4). Posteriorly directed chandelier also minimises glare during surgery. Shielding the illuminator under iris, gives excellent fundus visualization with almost no glare.

During bimanual surgery, typically one hand can be used to grasp, lift, fold or stabilise the mobile tissue to offer counter traction (usually forceps) for better delineation of surgical plane. The second hand is used to peel, cut or separate adhesions between retina and the membranes (cutter, scissors or forceps).

Common indications:

Bimanual surgery is usually reserved for complex vitreoretinal cases where there is anticipated extensive tissue manipulation and unimanual approach can be very challenging, time-consuming or insufficient. [1-4]

1. Diabetic tractional retinal detachments (TRD) with broad adherent fibrovascular proliferation (FVP) needing extensive membrane dissection- This is the commonest indication for bimanual surgery. (video 5)

2. Combined traction and rhegmatogenous retinal detachments (CRD)- With mobile retina, membrane surgery can be very challenging. Bimanual techniques offers counter traction for adequate traction relief and reattachment. (video 6)

3. Rhegmatogenous RD with severe proliferative vitreoretinopathy (PVR), especially anterior PVR and subretinal membranes- Two forceps can be used in two hands to dissect and separate the membranes off the retina. Occasionally a

shaft of one instrument can be used as fulcrum to peel large pre and subretinal membranes and bands. (**video 7**)

4. Select cases with giant retinal tear (GRT) with /without PVR- Useful during membrane peeling as retina is very mobile. Bimanual technique helps in direct perfluorocarbon fluid- silicone oil exchange.

5. Advanced Retinopathy of Prematurity (ROP) and paediatric RDs- Initial surgery, especially in stage 5 ROP, can be performed under direct microscope illumination. (**video 8**)

6. Retained lens matter / subluxated / dislocated crystalline lens

7. Dislocated IOL/ IOFB removal- Soft tipped cannula, forceps or magnet can be used to lift the FB off retina, to minimize the risk of iatrogenic retinal injury, and then transfer to another instrument to take out of the eye either through limbal section or through enlarged sclerotomy.

8. Complex trauma- Extensive tissue damage in these eyes can be better managed with bimanual techniques.

9. Induction of posterior vitreous detachment (PVD)- Bimanual technique using cutter or soft tip cannula in one hand and forceps or pick in other hand may help PVD induction in difficult situations such as paediatric or post inflammation RD, when vitreous is firmed adherent to mobile retina.

10. Control intraoperative bleeding – A back flush needle can be used in one hand to clear the blood over the bleeder and the other hand can immediately apply diathermy.

Advantages: [1-4]

1. Bimanual techniques enable precise, controlled and safer membrane dissection in more complex cases which were once considered inoperable.
2. When combined with wide angle visualization system, chandelier offers uniform diffuse illumination of large fundus area for better orientation during surgery.
3. Minimises / helps in better management of intraoperative complications
4. Reduced instrument exchanges, thereby reduced risk of sclerotomy associated complications and overall shortened surgery time
5. Improved overall anatomical and visual outcomes
6. Minimizes need for skilled assistant

Limitations: [1-4]

1. Need for additional sclerotomy
2. Needs ambidexterity and better coordination (learning curve)
3. Fixed location provides diffuse illumination but can sometimes be insufficient at specific area of the interest. Assistant may occasionally have to readjust the direction of the light.
4. Shadowing can potentially obstruct visibility of surgical field, especially with single fibre chandelier. It is necessary to plan surgical steps and placement of chandelier preoperatively, to avoid this. Twin fibre chandelier helps to minimize intraoperative shadowing.

5. May restrict mobility. Higher risk of iatrogenic trauma during globe rotation, as the fibre optic is projecting in vitreous cavity.

6. Glare, especially during fluid air exchange (FAX). Increased reflexes may compromise visibility. It is advisable to revert to conventional illumination system during FAX.

7. Needs brighter light source, increased risk of photo toxicity

8. Occasionally the chandelier tip can become very hot leading to thermal damage to ocular tissue.

9. Cost

To summarize:

Advances in instrumentation and illumination systems continue to enhance the efficacy and safety of the surgical approach. Whilst most of the vitreoretinal disorders can be managed by conventional three-port (unimanual) vitreoretinal surgery, bimanual surgery helps in managing complex vitreo-retinal conditions with reduced overall risk of complications, reduced surgery time with better final anatomical and functional outcome.

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INTERESTING IMAGE

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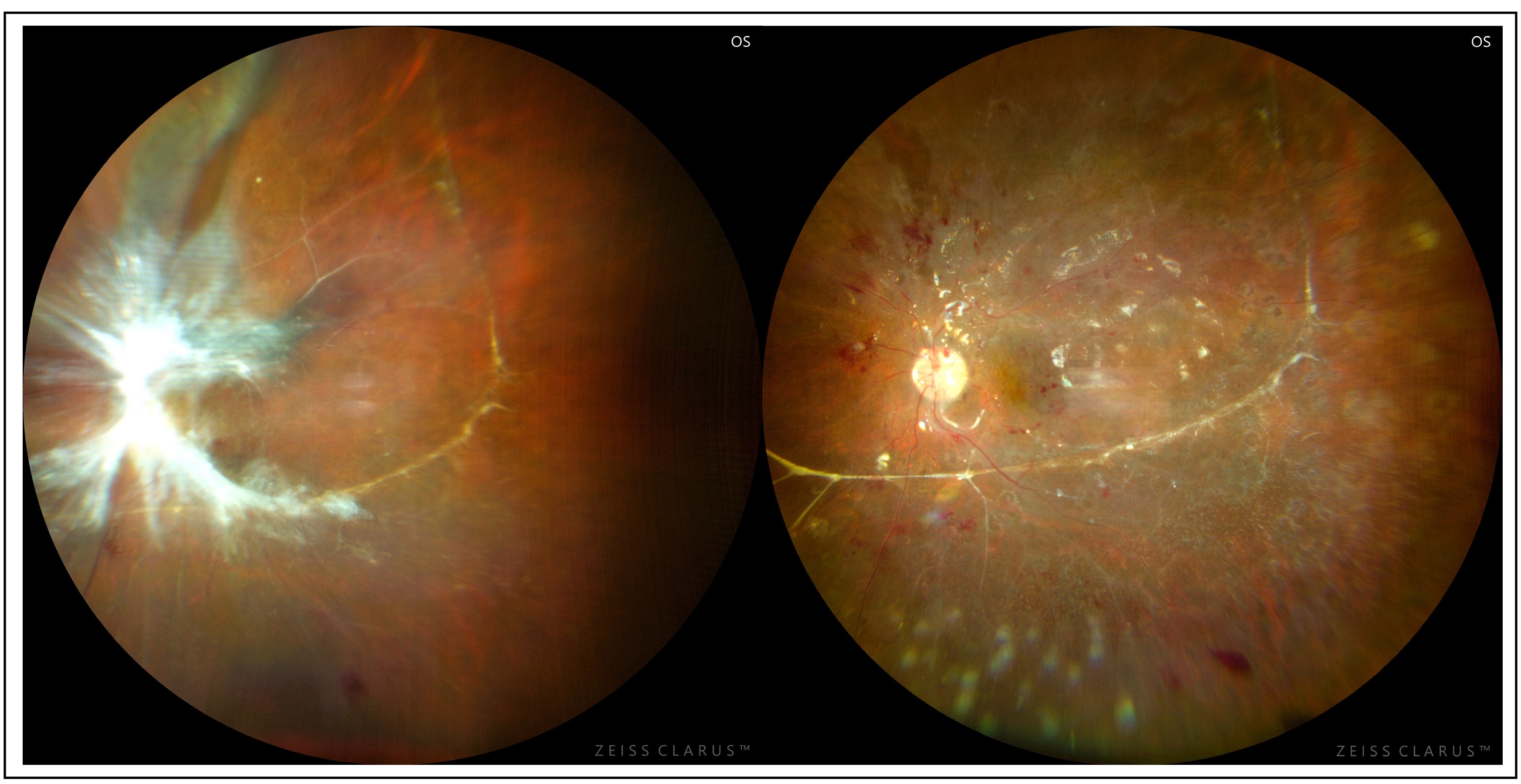
First image is a preoperative fundus photograph of left eye of a diabetic patient presenting with combined retinal detachment and end-stage retinopathy. Best corrected visual acuity (BCVA) was perception of hand movements close to face.

Patient underwent vitrectomy with silicone oil injection. Second image is postoperative fundus photograph.

BCVA improved to 6/60 after 2 weeks. Patient remains under follow-up.



RETINECTOMY- INDICATIONS AND TIPS FOR OPTIMUM RETINECTOMY

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Introduction

Retinectomy is a surgical procedure in which a portion of the peripheral retina is excised. Although micro-incision vitrectomy has advanced significantly, complex retinal detachments with advanced Proliferative vitreoretinopathy (PVR) continue to pose formidable challenges, and the importance of retinectomy in these cases cannot be overstated. In this article, emphasis is placed on surgical indications and optimising surgical success while minimising complications.

Indications

a. Proliferative vitreoretinopathy

Most frequent indication.

Especially in cases with intraretinal contraction, circumferential or anterior PVR leading to retinal shortening, where standard membrane peeling and buckling are inadequate

b. Recurrent rhegmatogenous retinal detachment

- Particularly following previous surgeries where standard techniques have failed to flatten the retina.

c. Need to access sub-retinal space

For removing subretinal hemorrhage, abscesses, perfluorocarbon liquid (PFCL), silicone oil, extensive sub-retinal gliosis or napkin ring configuration around the disc and sub-retinal foreign body

d. Retinal incarceration

- Retina becomes trapped in wound sites or fibrotic tissue
- Often post-traumatic or post-surgical

e. Fibrotic Retinal Shortening

- Chronic traction leads to irreversible shortening
- Retina cannot be flattened without excision

f. Proliferative Vascular Retinopathies

- In cases where membrane dissection and/or scleral buckling have failed to flatten the retina

g. Retinoschisis

- Inner wall excision may be necessary in advanced cases

h. Retinal detachment secondary to necrotising retinitis

- Multiple large retinal breaks in cases of rhegmatogenous retinal detachment secondary to Acute retinal necrosis (Video 1), cytomegalovirus retinitis (video 2) etc.

i. Removal of anterior horn of GRT

Tips For Optimum Retinectomy

1. Thorough Membrane Dissection

- Before considering retinectomy, ensure all pre-retinal and anterior PVR membranes are meticulously removed. Use agents like triamcinolone to identify residual vitreous cortex
- A scleral buckle may relieve traction sufficiently to avoid the need for retinectomy altogether or at least, support its edges.

2. Extent of retinectomy

- Place the retinectomy as anteriorly as possible to preserve field of vision and at the same time achieving complete relief of traction.

3. Hemostasis

- To achieve adequate hemostasis it is prudent to first cauterise the retina where vessels will be transected and then perform judicious diathermy along the intended margin of retinectomy.

- Inadequate diathermy before performing retinectomy would lead to both pre retinal and sub-retinal hemorrhage. Attempts to repeatedly remove the pre-retinal blood clot would lead to further bleeding and consequent diathermy induced posterior extension of the retinectomy.

- When a substantial subretinal hemorrhage leads to clot formation beneath the macula, it often necessitates extending the retinectomy circumferentially to facilitate clot removal. This is especially problematic when performing retinectomy under silicone oil. Presence of even thin film of sub-retinal blood would result in inadequate laser retinopexy.

- Maintaining adequate intraocular pressure and use of PFCL before performing retinectomy when all tractions are relieved can avoid sub-macular blood clot formation.

4. Use PFCL for Posterior Stabilisation

- Perfluorocarbon liquids (PFCL) are vital in stabilising the posterior retina during retinectomy and facilitating safe excision.

- After excision, perform a fluid–air exchange and check for residual traction before laser treatment.

- Care must be taken that all pre-retinal and sub-retinal tractions are relieved before injecting PFCL. Forceful injection of PFCL could lead to posterior breaks or radial retina tears

- PFCL should be injected slowly and the cannula should be submerged within the PFCL to prevent fish egg formation, thus preventing sub-retinal migration of PFCL bubble
- Sudden change in intraocular pressure especially when the ports are open would lead to turbulence in the vitreous cavity and sub-retinal migration of PFCL. This has to be avoided.

5. Laser Retinopexy & Tamponade

- Apply multiple contiguous rows of laser photocoagulation along the retinectomy edge under PFCL or air to ensure adequate retinopexy
- Silicone oil tamponade is preferred in complex cases to support reattachment and reduce recurrence.

6. Fluid- air exchange

- Fluid- air exchange should be performed slowly to prevent slippage
- Ensure that the retina is freely mobile before fluid air exchange to avoid sub-retinal migration of air. Gaps or fishtailing at the edge should prompt further trimming and extending the retinectomy
- During fluid–air exchange, a soft-tip extrusion cannula can gently pull the retina anteriorly, mechanically stabilizing it and preventing slippage at the retinectomy margin.

- Using "sandwich technique" (air anteriorly, PFCL posteriorly) prevents the retina from moving or folding and provides counter-pressure during the fluid-air exchange

7. Excision of anterior retina

Excise any remaining anterior retina to minimize ischemia driven neovascularization and post op hypotony.

8. Retinectomy under air

- Pros - better hemostasis, less chances of slippage, PFCL usage can be avoided
- Cons- limited space under air, visualisation could be challenging due to reflected light (angle of illumination needs to be adjusted)

9. Retinectomy under silicone oil

Helpful in tackling recurrent detachments under silicone oil (video 3)

Pros

- Oil removal can be avoided
- Only the detached retina can be addressed selectively
- Retinal pigment epithelium is minimally disturbed and hence less chances of post operative PVR.
- The retina remains attached under silicone oil, making membrane peeling and retinectomy easier. This can shorten the operating time.

Cons

- Achieving hemostasis would be challenging (need to manage the intraocular pressure by timely injection of silicone oil and diathermy)
- Intraocular pressure assessment (look for choroidal folds to assess hypotony, the resistance between the active ports to assess the intraocular pressure (IOP), presence of arterial pulsation indicates significantly high IOP),
- Identifying flimsy membranes under the oil could be challenging (optical coherence tomography could be handy in identifying membranes in the posterior retina)
- Removal of sub retinal fibrosis can be challenging due to shallow sub-retinal fluid

Tips

- Gently lifting the retinectomy margin toward the ora with a soft-tip extrusion cannula facilitates more effective drainage of subretinal fluid.
- Preferably use 1000 cs/1500 cs as its is easier for the assistant to inject (even in eyes with 5000 cs oil in situ)
- The sub-oil fluid should be aspirated at the last to facilitate adequate drainage of the sub-retinal fluid
- The retinectomy margin can be incised using either a cutter or scissors. Scissors are particularly helpful when cutting across thin, thread-like vessels.

- Ensure that most of the air bubbles in the silicone oil are removed before injecting through the infusion cannula as bubbles could interfere with visualisation

- The anterior retina can be extensively cauterised so that removal with the cutter would be easy

- Silicone oil tends to clog the cutter, hence if the cutter is not functioning adequately, it needs to be flushed by repeated aspiration of saline in a container.

10. Combining circumferential and radial retinectomy

This technique involves performing conventional circumferential retinectomy first followed by performing cuts that radiate outward—helpful in addressing both radial and tangential traction inflicted by stiffening due to PVR.

HEAVY SILICON OIL– UTILITY, TIPS FOR REMOVAL, EXPERIENCE SO FAR

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Introduction

Inferior retinal detachments with proliferative vitreoretinopathy (PVR) have always been challenging for vitreoretinal surgeons because of poor anatomical and functional outcomes. Inadequate inferior tamponade associated with lighter-than-water tamponades, like silicone oil, leads to an incomplete covering of the inferior retina. The effect is more pronounced in cases with subtotal filling. Growth factors and aqueous humour accumulate in the uncovered inferior retina, forming a "PVR soup".[1] Hence, a need for a heavier-than-water tamponade was felt to solve this problem.

Heavy silicone oils (HSOs) represent a key advancement in managing complex inferior retinal detachments. With specific gravity >1.0, HSOs provide effective inferior tamponade without the need for compliance to positioning. In the 21st century, high-density silicone oils (HSO) were introduced as tamponade agents for recurrent RD (Wolf S et al.2003; Wong D et al. 2005). The early HSO formulations did not gain much popularity due to the high incidence of postoperative complications

The newer HSOs (Densiron 68 and Densiron Xtra), a combination of semi-fluorinated alkanes or alkenes and high-viscosity silicone oils have demonstrated improved anatomical and visual outcomes in complicated cases.

Densiron 68 Vs Densiron Xtra

Densiron 68(Geuder AG, Neu-Ulm, Germany) has been studied and evaluated comprehensively by various authors. It is composed of 69.5% Siluron 5000 + 30.5% perfluorohexyl octane (F6H8). The postoperative inflammation and rate of emulsification were lower with this formulation compared to the earlier

HSOs but still a cause for concern.

Recently, Densiron Xtra has been introduced, which is a combination of 69.5% polydimethylsiloxane with high molecular weight additive (Siluron Xtra) + 30.5% perfluorohexyl octane (F6H8). The combination is physiologically and chemically inert. Densiron Xtra consists of the Densiron 68 formula mixed with short-chained molecules acting as "lubricants", allowing thixotropic behaviour (Table 1). Siluron Xtra leads to lower emulsification rates,[2] higher resistance to emulsification and a shorter injection time (Williams RL et al.2011) when compared to Siluron 5000, which is used in Densiron 68. Siluron Xtra thus theoretically covers up for the leading complications (inflammation and emulsification) associated with Densiron 68.

Table 1: Densiron 68 Vs Densiron Xtra

	Densiron 68`	Desniron Xtra
Composition	69.5% Siluron 5000 + 30.5% perfluorohexyl octane (F6H8)	69.5% polydimethylsiloxane + 30.5% perfluorohexyl octane (F6H8)+(high molecular weight additive (Siluron Xtra).
Viscosity at 25 deg 35 deg	1387 mPas 1200 mPas	1350 mPas 1000 mPas
Sp gravity at 25 deg	1.06 g/cm^3	1.06 g/cm^3
Emulsification	15%	5%
Refractive index 35 deg	1.39	1.39

Indications for HSO use:

- Inferior rhegmatogenous retinal detachments (RRDs), especially with proliferative vitreoretinopathy (PVR) - Primary and recurrent.
- In patients with a large inferior retinectomy
- Recurrent inferior RD post SB
- Macular holes and inferior retinal detachment patients who cannot maintain a prone position.

RESULTS

Densiron 68

This formulation has been widely used. In a recent, large multicenter matched cohort study by Nikolaos Tzoumas et al,[3] it was found that Densiron 68 provides superior anatomic and visual outcomes compared to Light Silicon Oil (LSO) in eyes with inferior retinal pathology and severe PVR. After matching for key factors, Densiron 68 nearly doubled the odds of single-surgery anatomic success (OR 1.90, 95% CI 1.63–2.23, P<0.001) in eyes with inferior pathology especially if there was associated PVR-C. Visual outcomes were also superior in the Densiron group.

When compared to existing reports, Nikolas reported that the overall primary success rates were high, with studies reporting 80% success in primary RRD with inferior retinal pathology. Romano et al. achieved 91% primary and 94% final reattachment in eyes with inferior breaks between 4–8 o'clock. Kocak & Koc also found higher reattachment at 3 months with Densiron 68 (84%) compared to LSO (74%).

Our results with Densiron Xtra

We performed a retrospective non-comparative study of 19 eyes of recurrent inferior RD or total recurrent RD with inferior pathology who received Densiron Xtra endotamponade at our centre. We assessed our cases for associated complications and long-term anatomical results. The single surgery anatomical success rate was 89.47% in our study. Two of 19 eyes (10.5%) presented with re-detachments with Densiron Xtra in situ. Redetachment under Densiron was due to inadequate tamponade of superior pathology in both cases. After revitrectomy, a 100 % reattachment rate was observed at the end of the follow-up period. Our results are similar to those in the literature. Lim and Vote reported a PVR rate of 20% with Densiron 68 in situ . None of our patients developed proliferative vitreoretinopathy (PVR) during Densiron® Xtra tamponade. While earlier reports have raised concerns regarding heightened intraocular inflammation, prompting recommendations for early removal, we did not encounter such complications. Even in a subset of patients where the tamponade was retained beyond six months, no clinically significant inflammation was observed. These findings suggest that Densiron Xtra may offer a more favourable intraocular tolerance profile than previously assumed, allowing flexibility in tamponade duration without compromising safety.

The higher success rate and lower PVR incidence with Densiron Xtra in our experience make it the HSO of choice in recurrent inferior RD cases. Densiron® Xtra, with its lower viscosity than Densiron® 68, allows easy injection, especially with 25-gauge systems. It also allows easy removal, has a low emulsification rate and a higher resistance to emulsification, making it a favourable tamponade agent

Removal Techniques: Practical Strategies

Densiron, being heavier than water, presents specific challenges during its removal. We have been using the 19 G/20 G cannula under direct visualisation (video 1). It allows for quick removal. If the needle is kept within the bubble, there are few chances of residual bubbles at the posterior pole. If present, these residual bubbles can be safely removed with a flute needle. We did not encounter any complications with this technique. However, some authors have raised concerns that the large bore of the needle and high suction could lead to sudden hypotony and accidentally damage the posterior pole. Another potential complication is the increased risk of entry site tears.

Another technique to circumvent the above concern is using a small-gauge extraction sleeve. We used a 23-gauge 1/2 inch extraction sleeve connected to the automated silicon oil removal module. The capillary action (siphoning effect) keeps the Densiron bubble attached to the needle and the bubble gets lifted from the retinal surface (video 2). Any residual bubble at the posterior pole is removed with a flute needle.

Safety profile :

The widespread adoption of heavy tamponades has been limited due to serious and frequent complications reported in early studies. Reported complications include inflammation, cataract formation, glaucoma, retinal toxicity, corneal decompensation, keratopathy, optic neuropathy, migration of tamponade into the anterior chamber or subretinal space, and emulsification-related adverse effects. These safety concerns hindered acceptance and routine use, despite the potential benefits of heavy tamponades in complex retinal detachment surgery. In our experience, use of Densiron Xtra has shown outcomes equivalent to, or even better than, those reported with Densiron 68, supporting its clinical utility (Table 2).

Table 2: Complications- Densiron 68 Vs Densiron Xtra

COMPLICATIONS	REPORTED Densiron 68 (%)	OUR EXPERIENCE %Densiron Xtra (%)
Cataract progression	100	60
PCO	100	64.3
Intraocular inflammation	37	10.5
Intraocular haemorrhage and hyphema	4	5.2
Emulsification	33	5.3
Ocular Hypotony	3-8	0
Epiretinal membrane	12-30	5.26
Raised IOP	26-42	26

Conclusion

Heavy silicone oils are essential tools for managing inferior RDs and complex PVR cases. They deliver compelling anatomic and visual success, though careful attention to emulsification, intraocular inflammation, cataract progression, and removal techniques is essential. Employing optimal timing, thoughtful surgical strategies, and diligent postoperative care maximizes outcomes while mitigating risks. When applied judiciously, heavy silicon oil offers powerful benefits in challenging vitreoretinal surgeries.

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EXPANDING THE ROLE OF THE VITRECTOMY CUTTER USING PROPORTIONAL REFLUX

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The vitrectomy cutter has always been central to vitreoretinal surgery. Initially designed to cut and aspirate vitreous, it has evolved into a far more versatile instrument with the advent of high cut rates, smaller gauges, and advanced fluidics.

One well-recognized use is the **spatula-like function of the bevelled tip cutter**. The shortened port-to-tip distance makes it possible to lift and separate fibrovascular membranes (**Figure 1**). This has become routine in modern practice.

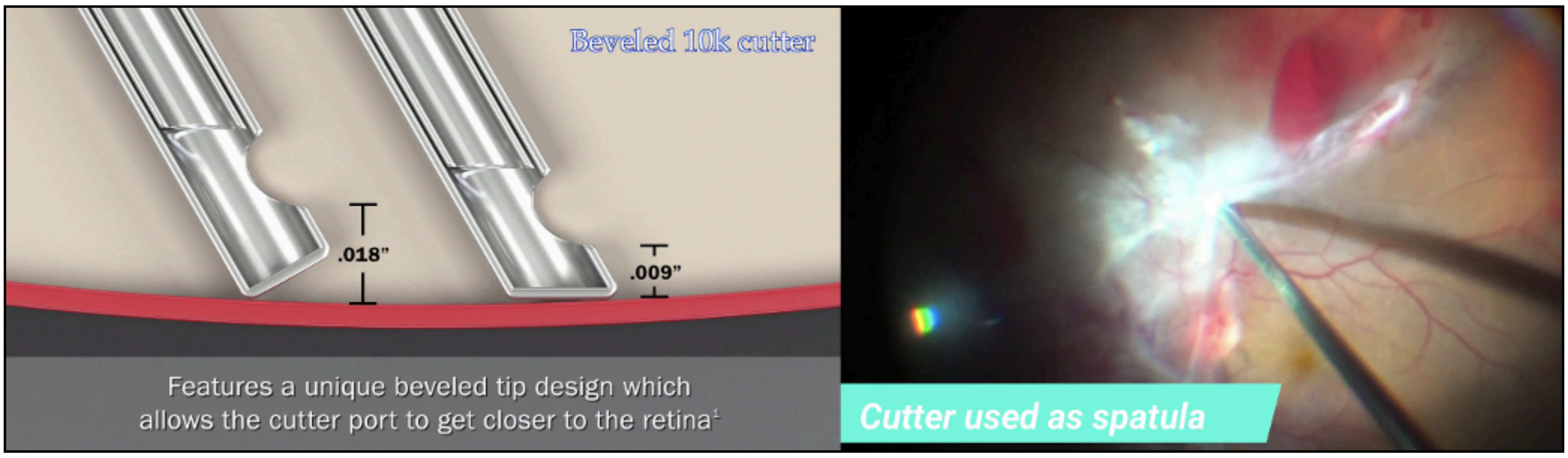

Figure 1. Bevelled cutter tip and spatula-like use. A. Bevelled cutter with reduced port-to-tip distance. B. Intraoperative image showing the cutter used as a spatula to separate membranes.

But the true leap forward comes from using the **proportional reflux feature** of the Constellation Vision System. Instead of being limited to cutting and aspiration, the cutter and its reflux line can be used for a variety of innovative applications that enhance safety, precision, and efficiency. (Video)

Controlled Dye and Drug Delivery

The dye or drug is first aspirated into the cutter lumen with the cutter in off mode. After priming outside the eye, proportional reflux enables slow, uniform release through the side-port as a twin stream. (Figure 2) This avoids jet-stream injury and provides even staining of the ILM with Brilliant Blue G or visualisation of the vitreous with triamcinolone. Importantly, the same cutter can then aspirate excess dye—saving time and reducing instrument exchanges (Figure 3).

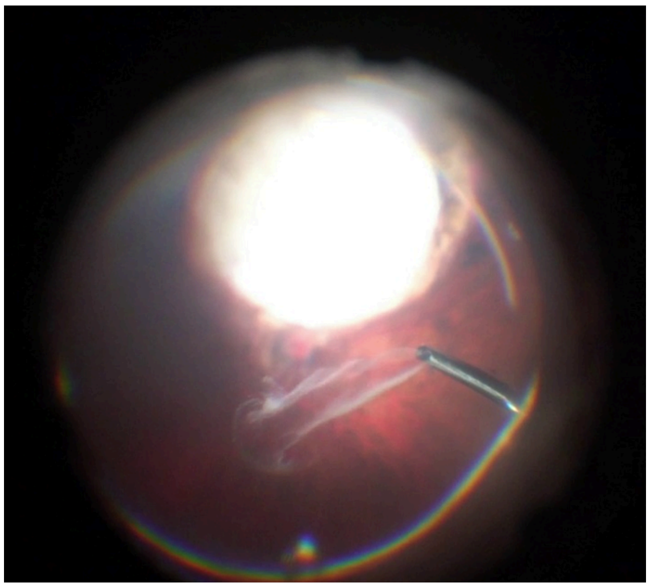

Figure 2. The vitrectomy cutter port ejects fluid as a controlled twin stream using proportional reflux

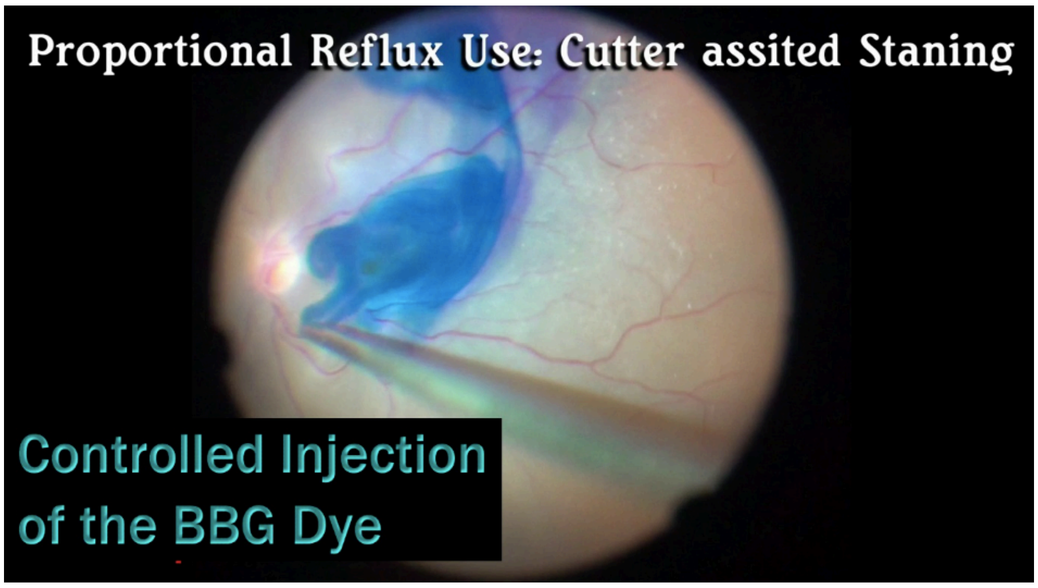

Figure 3. Cutter-assisted proportional reflux for dye injection. Dye aspirated into the cutter lumen in off mode, controlled release of Brilliant Blue G (BBG) through the side-port achieves uniform ILM staining without jet-stream injury.

Quadrant-Specific Injection

Because the port is on the side of the cutter, it can be rotated to direct fluid into any quadrant. This allows targeted triamcinolone dusting, for example in the superior quadrant, to highlight residual vitreous strands. It provides clear visualisation where needed without dispersing drug unnecessarily (Figure 4).

Gentle Clot Dislodgement

Blood over the macula can be stubborn and risky to remove with direct manipulation. Proportional reflux provides a solution and provides a gentle backflush, mobilising the clot for atraumatic aspiration. The clot can then be aspirated with minimal trauma.

Bimanual Surgery Simplified

In challenging diabetic vitrectomies, bimanual techniques are often required. Here, the cutter itself can act as a forceps substitute. In suction-only mode by orienting the port, the cutter stabilizes fibrovascular membranes while scissors cut the tags. Once divided, the cutter trims the tissue immediately—combining holding, cutting, and trimming in one step. This reduces instrument changes and improves efficiency (Figure 5).

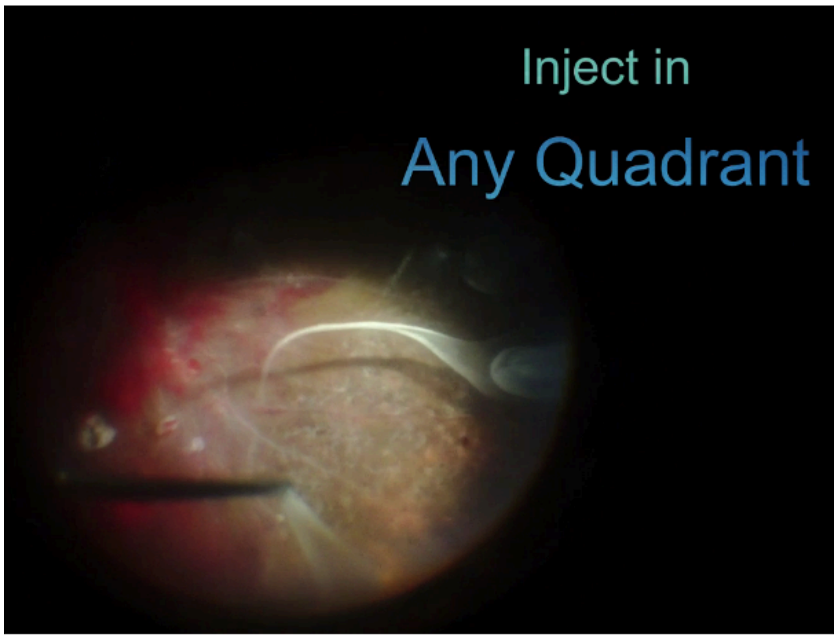

Figure 4. Quadrant-specific injection. By rotating the side-port, the cutter can deliver triamcinolone or dye into any quadrant, enabling targeted visualisation of residual vitreous.

Figure 5. Bimanual surgery with cutter as forceps. Cutter port stabilizes fibrovascular membranes while scissors divide tags; trimming is then done with the same cutter

Subretinal Injections via the Proportional Reflux Line

The innovation extends beyond the cutter tip. By attaching a 38- or 42-gauge cannula to the cutter aspiration line (which doubles as the reflux line), highly controlled subretinal injections can be performed. This allows surgeons to create a precise bleb with saline, or to deliver agents such as subretinal tPA or air. Because the infusion force is graded via proportional reflux, fluid enters gently and predictably, lowering the risk of subretinal damage compared to syringe-based injections

Why It Matters

All these applications show how proportional reflux transforms the vitrectomy system into a multifunctional intraocular platform. Surgeons gain smoother workflow, fewer instrument exchanges, and safer manoeuvres in delicate situations like macular haemorrhage or diabetic vitrectomy. For patients, that means shorter surgeries and potentially better outcomes.