

Dear Colleagues,

At the outset I would like to express my heartfelt gratitude to all my friends and well wishers, who supported and encouraged me to accept the responsibility of the post. I know that there are members, who perhaps could have done the job equally well or even better. I am deeply indebted to them for their courtesy. I feel that by arriving at a consensus for the secretary's office we have further strengthened the society.

With the tremendous efforts put in by my predecessors, DOS has achieved a stature in a very short span of time. Maintaining the high standards and indeed, achieving even more, is the mammoth task before us. We are aware of the enormity of this responsibility but with the full support of the able executive and your active cooperation, I'm sure we'll be able to live upto the expectations. Because of the excellent academic content and vast trade, the enthusiasm of the participants in DOS has to be seen to be believed. It will be our endeavor to enhance the participation of faculty and delegates at the national and international level and add new dimensions of entertainment too !

The number of institutions with DNB recognition is rapidly increasing and so are the number of students.

There are no dearth of excellent teachers in Delhi but sometimes they may not be accessible to all the students. If the Executive agrees we would like to create an interactive teaching program, so that the students studying in and around Delhi may benefit, by organizing monthly classes to be held by an expert faculty. The lectures would be postgraduate examination oriented. The details of topics, venue and time will be published in DOS Times regularly for the benefit of students.

For the smooth running of the secretariat it is essential that the office be located near the secretary's place of work. To this end we are deeply indebted to the dynamic Chairman Board of Management, Sir Ganga Ram Hospital, Padamshree Dr. S.K. Sama, for providing a furnished air conditioned office in the busiest & fastest growing hospital in town. We look forward to his invaluable encouragement and the support of our distinguished faculty of consultants & dedicated residents here at Sir Ganga Ram Hospital.

Thanking you,

Dr. Harbansh Lal
Secretary, DOS

Instructions to Authors

Contributions are invited from all DOS Members for publication. The merit of the article will be the only criteria for selection. Precise articles with inputs from personal experience and a practical orientation will be preferred. In an attempt to maintain balance of topics, the following categories have been formed. These are not water tight compartments but just guidelines and are as follows : -

Medical Ophthalmology : This section will cover diagnosis & management of common clinical conditions. It will include the evaluation of recent advances in all fields.

Surgical Ophthalmology : This section is further divided into 3 sub-groups.

Surgical Technique : A well-illustrated step by step description of a complete surgical technique.

Surgical Pearls : A list of "Dos & Donts" for a particular procedure, presented by experts.

Surgical Complications : Prevention & Management

Clinical Dilemma : A clinical case / situation will be presented and expert views invited for solutions. The actual management & outcome will be discussed either in the same or forthcoming issue.

Ophthalmic Procedure / Instruments : Description of the working of an instrument, procedure & interpretation of results.

Hardware Hints : this section is aimed at helping the young ophthalmologists who are starting out in practice. This will consist of a description of instrument.

Medi-News : This section will be contributed by non-ophthalmologists & will consist of articles about systemic conditions related to the eye

Mixed Bag : Question – Answers, Journal Abstracts, Comments on Articles.

Mind – Teasers : Puzzles & Quiz.

For further details log on to www.dosonlin.org

Management of a High Hypermetropic Patient

Sudipto Pakrasi MD, DNB

BCVA is OD : 6/12 and OS: 6/18. The patient is **Amblyopic** since there are no other abnormalities noted in the examination. Hence any option taken will have to be clearly discussed with the patient as expectation level will be high for any procedure adopted. *Amongst the various alternatives available:*

1. Phakic IOL :

Phakic IOLs have been controversial because of the potential damage they could cause to ocular structures. In recent years manufacturers have put great effort into improving designs and materials so that the chief anatomical and functional complications of the implants have been reduced. Most problems came from contact between the IOL and the corneal endothelium, the IOL and the angle, the IOL and the crystalline lens. The **risk of endothelial damage** was common to all types of implant; **pupil ovalization** was a major concern with angle-supported models; **iris tolerance** was the limit of iris-claw lenses, and **cataract** was the mishap of posterior chamber implants

Visual problems such as **glare** and **halos**, on the other hand, came from the relationship between the IOL optic and the pupil. Because phakic IOLs are typically centered on the cornea and not on the pupil, decentration, pupil and optic size, pupil deformation, IOL design and refractive index were all parameters that induce visual side effects.

Each phakic IOL model had its characteristic complication, and the new developments are primarily related to these drawbacks. In addition, all phakic IOL advances take into account the need for a less traumatic surgery through small incisions and aim at a better quality of vision

New developments include new designs, foldable materials, and increased knowledge of complication management and new technologies such as wavefront and, possibly, the revolutionary concept of light-adjustable implants

At +18.00 D, this patient is out of the range of most phakic IOLs. The anterior chamber depth has not been mentioned in the case history – but these eyes assume Nanophthalmic status! The Phakic IOLs of various kinds would not be able to compensate the refractive error. Moreover remember that in all these eyes with an axial lengths of less than 18mm, the anterior chamber is expected to be shallow and there

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will be crowding at the angles of the anterior chamber. There is no way that a Phakic IOL of any type can be fixed without compromising the corneal endothelium and the AC angle.

2. Lasik:

LASIK would not be an option at all. Hypermetropic LASIK will be of no success. This is a well known fact & does not really merit any discussion.

3. Clear Lens Extraction:

Clear lensectomy is usually reserved for patients who are outside the range of other forms of refractive surgery. Consequently, the measurements of axial length or keratometry are usually different from typical cataract patients because of the degree of refractive error. In cases of high hypermetropia, the axial lengths are very short (< 21 mm). If the patient expects to be free of glasses, then at this axial length, clear lens extraction does not have the kind of accuracy required to meet this patient's expectations. If you wanted to proceed with elective clear lens extraction, there are also a number of very serious intraoperative risks for such a patient, such as **choroidal effusions** and **aqueous misdirection**.

Biometry Considerations:

It has been well reported that the most common reason for incorrect IOL power calculations is an error in the measurement of axial length. Until recently, 10-MHz A-scan ultrasonography was the measurement technique most commonly available and limited the resolution of the exercise to approximately 0.10 mm. This translates to about ± 0.25 diopters under optimal conditions, as when axial length is measured using an immersion technique. However, the accuracy of A-scan ultrasonography is less when carried out by the applanation technique, which produces a falsely short axial length and sometimes widely variable results due to varying degrees of corneal compression. The ideal axial length measurement technique should be one that can be carried out in an upright position, without corneal contact or compression, and with a level of accuracy high enough for outcomes consistently within 0.25 diopter of the target refraction.

At this axial length (15.2 mm), ultrasound-based biometry does not appear to have the kind of accuracy required and the **IOL Master** would be the best choice for axial length measurement.

By optical coherence biometry (OCB), axial length measurements with the IOLMaster are the equivalent of

upright, ultra-high-resolution immersion A-scan ultrasonography, approximately five times more accurate than standard applanation A-scan ultrasonography. The IOLMaster is pretty much an “all-in-one” IOL power calculation device. Not only will it do axial length measurements with great precision, but it will also measure the central corneal power by automated keratometry. The instrument takes five keratometry measurements within 0.5 seconds and averages them. The latest software revision (version 3.01) has an improved keratometry algorithm and will alert the operator if a keratometry measurement is questionable. Some operators have found that central corneal power measurements with the automated keratometry feature of the IOLMaster may run anywhere from 0.25 D to 0.50 D steeper than with manual keratometry.

The IOLMaster will also measure the anterior chamber depth – **ACD** (the distance between the optical section of the cornea and the anterior surface of the crystalline lens) using a lateral slit illumination at approximately 30 degrees to the optical axis. This measurement is helpful for IOL power calculation formulae, such as Haigis and Holladay 2, which require a measured anterior chamber depth.

An additional software option can be used to measure the horizontal corneal diameter to within 0.10mm, which is very useful for estimating the haptic diameter of backup anterior chamber IOLs and for inputting ACD data into the Holladay 2 formula.

Included in the standard IOLMaster software package are five popular IOL power calculation formulae (Holladay, SRK/T, Haigis, SRK II, and Hoffer Q).

What formula and What power ?

For a case such as this, the **SRK** and **SRK/T** formulae will typically give a very large under-correction and are not suited to the nanophthalmic eye. In fact, none of the commonly used theoretic formulae will give a predictable result for this type of eye in the setting of clear lens extraction. The problem here is that **Hoffer Q** may over-correct, **Holladay 2** may under-correct and for the **Haigis formula** to work you would need to know the Haigis constants for the lens(es) to be used.

Achieving emmetropia in extremely short eyes after clear lens extraction is a difficult challenge clinically because:

1. Ultrasound axiometers are calibrated with average velocities for normal axial length eyes (23.5mm) which are not the same for extremely hypermetropic eyes causing significant refractive errors
2. Any error in measurement of the hypermetropic eye will have a much greater influence on the final refraction achieved

3. Current third generation IOL calculation formulae are not accurate

Early Formulae (First Generation)

- Anterior chamber depth (ACD) was a constant value
- Early lenses were iris supported which produced small variations in Post Operative ACD
- Later with the introduction of PCIOL's, formula was less accurate
- *Difference of in the bag vs. sulcus was 1 mm therefore 1 D*
- Next First Generation Regression Formula (SRK 1) used multiple regression analysis
- Eliminated ACD variable and replaced it with A-constant
- *Given by manufacturer and is based on expected position in eye, haptic and optic design, and refractive index of IOL material*

Problems With SRK 1 Formula

- Formula assumes 2.5 D refractive change for each 1 mm of axial length regardless the axial length of the globe
- Tended to under estimate IOL power in globes 25 to 29 mm long

Second Generation Regression Formulae

- **SRK II** recognized the non linear relationship between axial length and IOL power
- **Binkhorst II, Holladay, Donzis** also addressed same problems

Third Generation Formulae

- **Holladay 2, SRK/T, and Hoffer Q**
- Normal range of 22.0 mm to 24.5 mm- All three do equally well
- **Short eyes < 22.0 mm Hoffer Q performed best**
- Long eyes (24.5 to 26 mm) **Holladay formula**
- Very long eyes (>26 mm) **SRK/T**

Which lens would you prefer?

Choice of Lens Materials

- In normal, non allergic, disease free eye either **PMMA**, **silicone**, or **acrylic** lenses may be used
- Eyes with silicone oil or anticipated vitro-retinal surgery need heparin surface-modified 100% PMMA -tend to retard adhesion of silicone oil to lens
- Uveitis- use heparin surface-modified (**HSM**)lenses

- Posterior capsule opacification - Prevent with acrylic lenses (stick to posterior capsule and stop proliferation of epithelial cells)

Most available IOL optic materials, including PMMA, silicone and hydrophobic acrylic materials have been used for piggyback implantation. The longest experience has been with **PMMA** lenses, but they require a larger incision. That is why people went to the foldable **AcrySof**. However, interlenticular opacification seems to be more common with the AcrySof lens, and so it is preferred not to use two AcrySof lenses in the bag for piggybacking.

In search of the ideal for primary piggybacking, many different lens combinations have been tried. Initially, heterogeneous implantation with a **plate-haptic RMX-3 IOL** (Staar Surgical) in the bag and an AcrySof lens in the sulcus. But sulcus implantation of IOLs is not ideal under any circumstances, because of the risk of **pigment dispersion** [and] **uveitis**. Over the years placing a pair of plate-haptic RMX-3 IOLs in the capsular bag with the haptics 90 degrees apart have given rise to no opacification. The less biocompatible RMX-3 material is actually an advantage. In eyes that shouldn't have the RMX-3 material, or when it is not possible to fashion a capsulorhexis larger than 6 mm, one can do a bag/sulcus implant. In secondary piggybacking, the second lens can be placed in the sulcus as well. Most foldable lenses, like the AcrySof or the Sensor AR40 (Allergan), are a little oversized for the bag and a little small for the sulcus but will do well in both. A really good foldable sulcus lens is not available as yet. Going for the ideal, you might want to have a larger overall lens diameter, maybe 13.5 mm, which will be much more stable in the sulcus and will not decenter.

Looking toward the future, there are prototypes of **wafer-thin, diffractive, 50 D foldable IOLs**. If that technology becomes widely available, it will supplant the need for primary piggybacking

Currently, a foldable version of the Verisyse named **Artiflex** is in clinical trials in Europe. The Artiflex has a **silicone optic and PMMA haptics**, and it is available in both spheric and toric designs

Currently, for piggyback implantation, RMX-3 silicone material (AA4204VL, Staar Surgical) is preferred to more biocompatible materials such as acrylic.

Single lens or Piggy back IOLs ?

In patients with hyperopia exceeding +8 D, the axial lengths are often less than 21 mm and require lens powers that exceed the normal range (> 34 D). In these cases, piggyback lenses are necessary to achieve emmetropia. The only formula available at this time in these eyes is the **Holladay 2**. If the required lens power is less than or equal to 34 D, then the piggyback lenses are not required and

third-generation theoretical formulas may be used.

Patients with axial lengths shorter than 21 mm should be calculated using the Holladay 2 formula. In these cases, the size of the anterior segment has been shown to be unrelated to the axial length. In many of these cases, the anterior segment size is normal and only the posterior segment is abnormally short. In a few cases, however, the anterior segment is proportionately small to the axial length (nanophthalmos). The differences in the size of the anterior segment in these cases can cause an average of 5 D hyperopic error with third-generation formulas because they predict the depth of the anterior chamber to be very shallow. Using the newer formula can reduce the prediction error in these eyes to less than 1 D.

Accurate measurements of axial length and corneal power are especially important in these cases because any error is magnified by the extreme dioptric powers of the IOLs. Placement of both lenses in the bag with the haptics aligned is essential. Inadvertently placing one lens in the bag and the other in the sulcus can cause a 4 D refractive surprise.

Polypseudophakia, the use of two IOLs in one eye, to provide appropriate optical correction for highly hyperopic patients who need more than 34 D of correction. While the technique is the safest option for these patients, surgeons who use piggyback IOLs face some perplexing challenges, including unexplained opacification between the lenses and hyperopic shift. Piggybacking should be used only when it is the safest way to correct problems. ***The most poignant indication for primary piggybacking is extreme hyperopia due to a nanophthalmic eye.***

Primary piggy back lens or Secondary IOL?

Primary polypseudophakia is a relatively recent concept in ophthalmology. Optically, polypseudophakia would be considered a special intraocular lens consisting of two rotationally symmetric elements. With dramatic advances in foldable lens technology allowing for small, self-sealing incisions, this procedure originally gained a qualified general acceptance. However, the previous practice of stacking two acrylic lenses in the capsular bag has since been abandoned due to occasional problems with interlenticular opacification and reduced visual acuity. When the calculated IOL power exceeds that available, and placement of a single IOL would result in an unacceptable refractive outcome it is often worthwhile for the surgeon to place two IOLs in the eye at the same operative session. This is typically seen in patients with axial lengths less than 20.00 mm, and often with a hyperopic spherical equivalent of +8.00, or greater.

With current technology, the preferred approach is to place two IOLs of different materials in different locations (e.g., a lower power, thin, biconvex silicone lens in the ciliary

sulcus and a higher power negative shape factor acrylic lens in the capsular bag). This is commonly referred to as primary polypseudophakia. With the recent introduction of very high power, foldable, aspheric, hydrophobic acrylic IOLs available in powers up to +40.00 D (SA60AT - Alcon Laboratories), the need for primary polypseudophakia should become less frequent.

Secondary polypseudophakia would be something like a piggyback IOL to correct a refractive surprise months or years after the original surgery. The secondary piggyback IOL will be placed in the sulcus, because trying to place the second lens in the bag several weeks after the primary surgery is difficult. More importantly, it may displace the primary lens posteriorly, reducing its effective power and leaving the patient with a hyperopic error. Placing the lens in the sulcus minimizes this posterior displacement. Decentration of either lens can result in poor image quality and can be the limiting factor in the patient's vision.

Where would you prefer to put two lenses – Both in the bag or One in sulcus and second in the bag.

There are two Surgical Approaches

Two different surgical approaches have been proposed to avoid complications with piggyback IOLs:

- In the first, **both IOLs are implanted in the capsular bag** with a larger diameter capsulorhexis. The cut edge of the capsulorhexis may fuse with the posterior capsule, which should help sequester the retained/proliferative equatorial lens epithelial cells within the equatorial fornix and prevent cell migration toward the interlenticular space.
- In the second approach, the **posterior IOL is implanted in the capsular bag** with the cut edge of a small-diameter capsulorhexis resting on its anterior optical surface. The anterior IOL is placed with the haptics in the ciliary sulcus, anterior to the capsulorhexis. Retained/ proliferative lens epithelial cells are confined to the compartment of the capsular bag around the rear IOL, but the interlenticular space in front of the capsulorhexis is also sequestered.

Be sure the **lens in the ciliary sulcus is angulated** to avoid iris shaving, especially with certain IOL types, such as rectangular-edge IOLs. In addition, **careful cortical cleanup** to remove most remaining cells from the equatorial lens bow can help prevent complications. To do this, one needs to **aspirate the lens epithelial** cells, even off the undersurface of the anterior capsule, in addition to using 12 hydrodissection waves, one for each clock hour.

Complications with piggy back lenses –

Interlenticular opacification (ILO), decentration, anterior segment crowding, glaucoma etc.

List of possible Complications

- Decentration
- Hyperopic shift
- PCO
- Interface opacification
- Pigment between IOLs
- Uveitis
- Secondary Glaucoma

When using piggyback IOLs, it seems that careful patient selection, surgical approach and IOL type reduce the likelihood of complications. The preoperative consultation should include thorough discussion of the potential complications unique to patients with nanophthalmic eyes, including late IPO/ILO. Also, a clinician should emphasize the need for periodic long-term postoperative follow-up. Attentive follow-up of polypseudophakic eyes is important.

A. Interpseudophakos/interlenticular opacification (IPO/ILO) has emerged as a late complication of piggyback IOL implantation. IPO/ILO is characterized by ingrowth of lens epithelial cells (LECs) between the IOLs, 1 to 3 years following piggyback implantation.

A classification system for the condition:

- **IPO-E.** This, the most common type, has clear globular clusters called Elschnig's pearls and is associated with a late hyperopic shift in both PMMA and acrylic lens pairs
- **IPO-A.** This type has a white fibrous opacification caused by A-type lens epithelial cells growing between two AcrySof lenses. One can clearly see the path of the lens epithelial cells migrating from the under surface of the anterior capsule.
- **IPO-P.** (the P stands for particulate). This probably represented material left over from surgically aspirating E-type lens epithelial cells (LECs). This is also seen as particulate matter between pairs of silicone implants.

Cause: In most cases both lenses in the bag with an **overlapping capsulorhexis** with its margins overlapping the optic edge of the anterior IOL for 360 degrees. IOL optic material biocompatibility may be the single most important variable in the incidence of severity of IPO/ILO.

The AcrySof IOL also seems to be too biocompatible for piggybacking, because the lens material has adhesive properties in vitro. When two AcrySof lenses are implanted in the capsular bag, there is a bioadhesion of the anterior surface of the front lens to the anterior capsule edge and of the posterior surface of the back lens to the posterior capsule. In this scenario, the two IOLs are sequestered together with aqueous and lens epithelial cells in a hermetically closed microenvironment. Residual cells from the equatorial bow will have the tendency to migrate toward the interlenticular space. The material opacifying the interlenticular space,

which is mostly retained/regenerative cortical material, changes as the space narrows from the periphery toward the central contact zone: The material attached to the wider peripheral interface (zone 1) is very thick. At the midperipheral interface (zone 2), it is broken into clusters of small, round structures. At the paracentral zone (zone 3) the round structures are progressively compressed until only a flat, compact layer of an amorphous material is seen. At the central interface (zone 4), almost no material is found. ***The take-home message is, we no longer piggyback acrylic material in a bag/bag configuration with overlapping capsulorhexis. The early results are outstanding, but the late results can be disastrous without timely secondary intervention.***

B. Hyperopic Shift is due to following causes:

1. Another unexplained phenomenon that occurs with piggyback IOLs is hyperopic shift with silicone IOLs as also there is clinically significant hyperopic shift after implantation of foldable acrylic and PMMA piggyback IOLs. These develop **proliferating Elschnig's pearls** visible in the peripheral interface between the IOL optics because cellular material between the lenses seemed to cause posterior displacement of the posterior IOL.

2. There is a separation of the two optic surfaces peripherally, affecting zonular tension and causing **posterior displacement** of the whole IOL/capsular bag complex.

3. The two lenses pressed together causing a **depression in the optic** that alters the lens power. The resolution of the hyperopic shift after aspiration of the pearls in some cases supports that flattening between the IOLs does not cause it. Such flattening appears irreversible and would not be affected by surgical removal of the cellular material between the lenses.

4. **Refractive index changes** in the interface between the lenses due to cellular ingrowth and sequestration of fluids could also play a role in late hyperopic shift.

Lenses consisting of RMX-3 silicone material have the lowest index of refraction and are the thickest foldable IOLs, and therefore minimize the contact zone and maximize the distance between the peripheries of the optics (which both serve to decrease the incidence of IPO/ILO). **Because the crystalline lens in eyes with nanophthalmos is larger than in normal eyes, there is sufficient room in the bag for two IOLs**, even two IOLs made of RMX-3, maximizing the postoperative dimensions of the angle relative to bag/sulcus implantation.

Another significant factor in the incidence of IPO/ILO is the relationship between the capsulotomy margin and the IOL optics. IPO/ILO is most frequently observed in cases in which the anterior capsulotomy margin overlaps the anterior optic margin or comes in contact with the interface

between the lenses. To avoid late IPO/ILO, two looped posterior chamber IOLs should not be placed together in the capsular bag in conjunction with an ordinary sized capsulorhexis that overlaps the margin of an anterior IOL. Adopt a large capsulorhexis strategy for looped lens pairs, in which a 6.25-mm to 6.75-mm capsulorhexis is created and both haptic pairs are placed together in the capsular bag. A relative haptic orientation between the IOLs should be chosen to maximize clearance of the anterior capsular remnant from the anterior optic and peripheral interface between the IOLs, but perpendicular alignment best supports the zonule, acting like a capsular tension ring. Creating a large capsulorhexis that extends close to the anterior zonular insertion can be technically challenging in these small eyes. Initially, if a large capsulorhexis cannot be created safely, an alternate strategy can be used. One can place the anterior chamber IOL in the ciliary sulcus in an attempt to avoid late IPO/ILO. Alternatively a 30-D AcrySof IOL is placed in the bag and the eye is allowed to heal for 6 months, at which time any remaining ametropia can be corrected with a secondary IOL in the sulcus. However, bag placement of both haptic pairs minimizes pigment dispersion and maximizes the postoperative anterior chamber depth and angle dimensions. Therefore, when a large capsulorhexis cannot be created initially, one can enlarge the capsulorhexis after IOL implantation to fixate both haptic pairs in the bag.

Treating Opacification : Advanced opacification requires IOL exchange, which is technically difficult. Thus, early treatment is key - with a variable defocus Nd:YAG laser.

Early cases may be treated with a YAG laser with the laser defocus set at 0, by meticulously focusing midperipherally on the interface at the proximal margin of the IPO/ILO ingrowth. Once a gas bubble is created, one can work within the bubble as material is removed from the peripheral interface between the lenses. IPO/ILO that is present centrally is treated last, using the gas bubble generated by the YAG laser to separate the lens optics at the site of the next YAG shot to avoid pitting of the lenses. Then move in and clear any material that is directly across the visual axis. Dense opacification between the central interfaces requires a late IOL exchange.

C. Uveitis & Secondary Glaucoma - An obvious situation following sulcus placement of the second IOL will cause a chronically irritable eye.

My personal choice of course of action in this case:

With the above discussion in mind, as long as there is no cataract, I think that the best choice in the above case would be contact lenses.

Ptosis Evaluation

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Congenital Ptosis is a common entity encountered by oculoplastic surgeons. It results from a developmental dystrophy of the levator muscle of unknown etiology. The management of the condition requires proper evaluation.

Classification of Congenital Ptosis

Congenital ptosis may be classified as

- Congenital simple ptosis
- Complicated
 - With oculomotor abnormalities
 - With Blepharophimosis syndrome
 - Synkinetic ptosis
 - Marcus Gunn Jaw Winking
 - Misdirected third nerve ptosis

Clinical Evaluation

Pre-operative history and examination are vital because these decide the choice of surgery.

History

It is important to determine whether the condition is congenital or acquired. Relevant history should be elicited in all patients regarding the time of onset, any variation of the ptosis during the day, associations with any jaw movements or abnormal ocular movements and head posture. Photographic records of childhood often reveal important information.

Family history of similar conditions should be determined. Any history of previous surgery, trauma or use of steroid should be recorded. Questions on reactions to previous anesthesia both by the patient and his relatives need to be asked. Any bleeding tendencies should also be recorded.

Ocular Examination

Visual acuity

Best corrected visual acuity should be checked to record the presence of amblyopia in the ptotic eye.

Palpebral aperture

The measurement of the palpebral aperture is necessary as the difference between the two eyes gives the

measurement of the ptosis in unilateral cases or the difference from the normal in the bilateral cases. This should be seen in up gaze, down gaze and primary gaze

Normal – 9-10mm in primary gaze

However, judging the amount of ptosis by difference in the size of palpebral aperture has limitations due to possible alterations in the position of lower eyelid.

Margin Reflex Distance (Fig.1)

Hold the light source directly in front of the patient looking straight ahead. The distance between the center of the lid margin of the upper lid and the light reflex on the cornea would give the MRD 1. If the margin is above the light reflex the MRD 1 has a positive value. If the lid margin is below the corneal reflex in cases of very severe ptosis the MRD 1 would have a negative value. The latter would be calculated by keeping the scale at the middle of upper lid margin and elevating the lid till the corneal light reflex is visible. The distance between the reflex and the marked original upper lid margin would be the MRD 1.

Margin reflex distance 1 (MRD 1) : Normal 4 - 5mm

The mean measurement in Indian eyes is 4.1 ± 0.5

Amount of ptosis
The difference in MRD 1 of the two sides in unilateral cases
or
the difference from normal in bilateral cases gives the amount of ptosis.



Figure 1 : Measurement of the Margin reflex distance I (MRD I).

Amount of ptosis may be classified as:

Mild ptosis	2mm or less
Moderate ptosis	3mm
Severe ptosis	4mm or more

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It must be remembered that ptotic lid in unilateral ptosis is usually higher in down gaze due to the failure of levator to relax.

The ptotic lid in acquired ptosis is invariably lower than the normal lid in down gaze.

Levator function

Berke's Method (lid excursion)

Measures the excursion of the upper lid from extreme down gaze to extreme up gaze with action of frontalis muscle blocked. The patient is positioned against a wall while the surgeon's hands press the forehead above the eyebrows ensuring that there is no downward or upward push. The patient is then asked to look at extreme downgaze and then in extreme upgaze and the readings are recorded in millimeters. The measurements need to be accurate. The levator action of the two eyes is compared. In our study in a North Indian population levator action in normal eyelids was 13.8+0.1mm. Crowell Beard reported normal eyelid excursion to be between 12-17mm. (Fig 2a, 2b)



Figure 2 : (a) & (b) Measurement of the Levator action by Berke's method.

The levator function is classified as:

8mm or more	Good
5-7mm	Fair
4mm	Poor

The difference in MLD of two sides in unilateral cases
or
the difference with normal in bilateral cases multiplied by three would give the amount of levator resection required.



Figure 3 : Measurement of the Margin limbal distance.

Putterman's method

This is carried out by the measurement of distance between the middle of upper lid margin to the 6'o clock limbus in extreme up gaze. This is also known as the Margin limbal distance (MLD).

Normal is about 9.0 mm

Assessment in Children

Measurement of levator function in small children is a difficult task as no formal evaluation is allowed by the child. The presence of lid fold and increase or decrease on its size on movement of the eyelid gives us a clue to the levator action. Presence of anomalous head posture like the child throwing his head back suggests a poor levator action.

Iilff Test

This is another indicator of levator action. It is applicable in first year of life. The upper eyelid of the child is everted as the child looks down. If the levator action is good, the eyelid reverts back on its own.

Margin Crease Distance (MCD)

Measurement of the margin crease distance (MCD) is the next important step in examination. The height of the crease on the normal side should be measured and compared to the ptotic eyelid in downgaze. In case of a very faint lid crease it can be made prominent by using a cotton tipped applicator below the lid margin. In patients, when more than one lid crease is present, the most prominent one should be considered. (Fig 4)



Figure 4 : Measurement of Margin crease distance (MCD).

MCD in Normal eyes is 5-7 mm.

The distance of the lid crease from the margin is measured as it helps in planning the surgical incision. Also presence of a distant lid fold in a case of moderate to severe ptosis with good levator action indicates a levator aponeurotic dehiscence.

Bell's phenomenon

It is the upward rotation of eyeball on closure of the eye. This is referred to as Bell's phenomenon.

Confirmation of presence of Bell's phenomenon is important before undertaking any surgical procedure to avoid risk of post operative exposure keratopathy.

Corneal Sensation

The presence or absence of corneal functions should be noted using a cotton wisp.

Ocular Motility

The extraocular muscle functions especially the elevator



Figure 5 : Assessing ocular motility especially the elevators.

muscles should be recorded. Any association of eye movements with change in degree of ptosis should be looked for. (Fig 5)

Tensilon Test

This test is done in doubtful cases where an acquired ptosis due to Myasthenia Gravis is suspected. In adults 1 mg of neostigmine is injected I/M. The ptosis improves in 5 to 15 minutes if Myasthenia gravis is the cause. Edrophonium is faster and more effective than neostigmine. It is loaded in a tuberculin syringe and 2mg injected slowly in 15-30 seconds. The needle is left in situ and rest 8 mm is injected slowly if no untoward incident is observed within 1 minute. The effect occurs in 1 to 5 minutes if myasthenia is the cause. If cholinergic reaction occurs 0.5mg of atropine sulphate is given intravenously.

Phenylephrine test

Phenylephrine 10 % drops are used to assess mild cases of ptosis as in Horner's syndrome. Positive phenylephrine

test suggests that patient would respond well to Muller's muscle resection.

Associations

The presence of jaw winking oculomotor anomalies and blepharophimosis syndrome should be noted. The presence of any other associated ocular anomaly should also be recorded.

The presence of jaw winking is assessed by moving the jaw from side to side (chewing movements), opening and closing the mouth. Before considering for the surgery the possible causes for pseudoptosis should be excluded viz . hypothalmos , enophthalmos, epicanthus , overhanging skin etc.

Surgical approach depends on

1. Ptosis is unilateral or bilateral
2. Severity of Ptosis
3. Levator action
4. Presence of abnormal ocular movements, jaw winking phenomena or blepharophimosis syndrome

The choice of surgical procedure for congenital ptosis depends primarily on-

1. Amount of ptosis as determined on the basis of MRD.
2. Levator action.

Commonly Performed Surgeries

- Fasanella Servat Operation
- Levator resection
- Brow suspension ptosis repair

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Management of Amblyopia

Zia Chaudhuri, MS, MNAMS, FRCS (Glasg), Ashok Grover, MD, MNAMS, FRCS (Glasg), Shaloo Bageja, DNB

Amblyopia is defined as defective visual acuity in one or both eyes, which persists after correction of the refractive error and removal of any pathological obstruction to vision. The significant reduction in corrected central visual acuity is taken to be vision less than 6 / 12 bilaterally or a difference of 2 or more lines between the normal and the amblyopic eye in unilateral amblyopia.

The basis of amblyopia is related to the concept of cortical competition. All cortical cells are potentially connected to both the eyes equally, provided both eyes are functioning equally. If due to some reason one eye predominates, these cortical cells are stolen by the dominating side. This process is specially significant in the early period of visual maturation which is also called the critical period, when neural plasticity makes the visual system vulnerable to any abnormal experience like a blurred defocused image, strabismus or occlusion. Once this period is over amblyopia does not occur. This period is also the period when amblyopia therapy is maximally effective and is approximately upto 7 to 8 years in humans. The earlier the treatment is started, better are the results and shorter is the duration of treatment. Later, morphological changes related to the loss of binocularly driven cells in the Lateral Geniculate Body (LGB) and the visual cortex have been observed. The knowledge of amblyogenic factors in some cases allows them to be eliminated before they can cause damage. Screening for amblyopia should ideally be done in children in the first 2 years of life in an attempt to prevent amblyopia.

Mechanisms Causing Amblyopia

Essentially 2 mechanisms are stated to be cause of amblyopia, which are: -

1. Deprivation of form vision: - This deprivation can be either complete when no stimulus reaches the fovea or more commonly partial when there is presence of a defocused image. This factor comprises the static factor in the development of amblyopia. It can be both unilateral and bilateral.
2. Abnormal binocular interaction: -This occurs when incompatible images are formed on the fovea of both the eyes. Abnormal binocular competition is involved in all types of amblyopia but in bilateral amblyopia only form deprivation is seen.

Characteristics of Amblyopic Vision

1. There is an atypical response present to tests of visual

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acuity. Single letter acuity is better than linear acuity which is postulated to be present due to an exaggeration of the normal physiological phenomena of crowding. This discrepancy may be explained by abnormal contour interaction, abnormal eye movements and other attentional factors, seen in amblyopia. This is specially seen in strabismic amblyopia

2. There is a decrease in contrast sensitivity for high spatial frequencies. However in strabismic amblyopia it has been observed that the contrast sensitivity improves on decreased illuminance. This is not seen in anisometric amblyopia.
3. The amblyopic eye performs better in mesopic or photopic conditions as what is seen when a neutral density filter is placed in front of the amblyopic eye. This can be explained on the basis of various unproven hypotheses related to alterations in the photopic mechanisms, undersampling of orientation detectors, mislocation of optotype elements uninfluenced by a decrease in luminance, and presence of eccentric fixation in patients with amblyopia. This is an effective way of differentiating between organic lesions affecting the eye and amblyopia.
3. Vernier acuity and spatial resolution is disproportionately affected in amblyopia. This is especially true for strabismic amblyopia.
4. Naso temporal OKN asymmetry for the resolution of vertical gratings is seen in strabismic amblyopia.
5. Abnormalities in pattern VEP are seen in both strabismic and anisometric amblyopia. However in sensory deprivation amblyopia changes are seen in both flash and pattern VEP.

Classification of Amblyopia

A. Strabismic Amblyopia

1. No associated anisometropia
2. Associated anisometropia

B. Anisometric Amblyopia (Unilateral)

C. Form Vision Deprivation (amblyopia ex anopsia [unilateral or bilateral])

1. Sensory deprivation Amblyopia (media opacity , ptosis etc)
2. Uncorrected high refractive error (ametropic amblyopia)
3. Astigmatism (meridional amblyopia)

D. Organic Amblyopia

E. Idiopathic Amblyopia

Diagnosis

It has to be remembered that a patient has to undergo a complete ocular examination to rule out any organic cause of loss of vision before the diagnosis of amblyopia is established as amblyopia is a diagnosis of exclusion. The other pointers toward the establishment of the diagnosis and possible prognostic factors would be: -

1. **Visual acuity testing:** - Assessment of both line and letter acuity should be performed to note for any discrepancy. It is advisable to use Snellen E charts or the Landolt's C chart for this purpose. It is also appropriate to assess near vision and the speed of reading as both accommodation and the speed of reading is reduced in the amblyopic eye.
2. **Fixation:** - The ability of an eye to take up fixation and maintain fixation is an indirect sign of the presence or absence of amblyopia. An eye with severe unilateral amblyopia is incapable of taking up fixation. Absence of free alternation of fixation also indicates amblyopia especially in young children.

Assessment of the fixation pattern should be done in every patient with presumed amblyopia and it should be noted whether the fixation is foveal or extrafoveal, steady or wandering. A steady eccentric fixation has worse prognosis than a central wandering fixation as regards the final rehabilitation of vision. The presence of an eccentric fixation is not a limiting factor as far as starting treatment is concerned. If fixation is really eccentric no treatment will change it but if a fortnight or a month of full conventional occlusion centralizes fixation, then the problem was eccentric viewing in the first place due to an abnormal binocular interaction. The fovea in these conditions maintains its property of determining the straight ahead gaze.

3. **Assessment of strabismus:-** Any abnormal head posture, strabismus or nystagmus is a pointer towards possible amblyopia. Cover test for measurement of ocular deviation for distance and near fixations, presence of latent squint and its rate of recovery and the presence of a latent nystagmus has to be performed.
4. **Assessment of binocularity:-** Presence of normal sensory and motor fusion and stereopsis, which is usually seen in association with anisometric amblyopia, is a good prognostic factor for successful treatment. Strabismic amblyopia is relatively more difficult to treat due to the presence of an increased incidence of eccentric fixation
5. **Electrophysiology:-** ERG can at times establish the presence of certain undetectable organic pathologies which can result in loss of vision like foveal hemorrhage at birth which may disappear later, congenital cone deficiency etc (organic amblyopia). ENG can be used to establish the presence of a micronystagmus. Abnormalities in flash and pattern VEP can be used in the diagnosis of amblyopia – the main use however is

in the monitoring of the gain in visual acuity after treatment especially in patients with ametropic amblyopia.

Management

The management of amblyopia includes :-

1. Early detection and initiation of treatment. At times one has to start treatment prophylactically in certain conditions like post congenital cataract surgery where one expects the presence of amblyogenic factors. Obvious squint, abnormal head postures, nystagmus etc should be noted in such cases.
2. Strict vigilance of treatment upto about 10 to 12 years of age even if the patient achieves isoacuity is necessary.
3. Correction of refractive errors and removal of media opacities so as to maximize the visual gains to the patients is essential.
4. An interplay of giving the worse eye a competitive advantage over the better eye is undertaken by the following methods :-
 - Occlusion
 - Penalization (optical and pharmacological)
 - Pleoptics
 - Red filters
 - CAM Stimulator
 - Drugs and Neurotransmitters

1 Occlusion

This forms the mainstay of treatment of amblyopia . A patch applied over the skin is preferred to a patch over the spectacles as the child can easily take off the spectacles or look outside through the sides of the occluded spectacle. Occlusion should be started as soon as possible. The family should be educated to recognize the fixating eye and guide the patient towards free alternation.

Principle

A competitive advantage is given to the worse eye over the better eye so as to do away with the components of abnormal binocular interaction and the inhibitory influences of the better eye on the receptive fields of the worse eye.

Occlusion can be total or partial; full time or part time

Total occlusion refers to exclusion of all perception of light and form. This is done with the help of

1. Direct patch over the skin
2. Patch over the back surface of spectacles
3. Doyne's occlusive spectacles
4. Pirate patches
5. Occlusive contact lens

Partial occlusion refers to partial exclusion of light and form perception. This is done by attaching 2 or 3 layers of sellotape to the back surface of the spectacles or using nail varnish to polish the back surface of the spectacles.

Latent manifest / latent nystagmus is no longer considered to be a contradiction to occlusion by many ophthalmologists as a beneficial effect is seen in many cases

Schedule

A commonly followed schedule is as given below: -

0 – 2 years	2 : 1
2 - 3 years	3 : 1
3 - 4 years	4 : 1
4 - 6 years	5 : 1
6 - 12 years	6 : 1

Continuous occlusion of the better eye may be given when a trial of occlusion is given to an older patient (> 12 years of age)

The intervals of follow – up is related to the age of the patient with younger children being told to present more frequently, as changes of occlusion amblyopia are higher.

Disadvantages

1. Occlusion amblyopia in younger children
2. Intractable diplopia in older children
3. Increase in the magnitude of squint due to loss of binocularity (exotropia)
4. Cosmetic blemish
5. Skin allergy

Contra- Indications

1. Grossly eccentric fixation : This is one situation where establishment of a central stable fixation has to be achieved before conventional occlusion can be started.

When to Discontinue Occlusion

1. Equalization of visual acuity in both eyes
2. Achievement of maximum visual acuity as assessed over a period of 3-6 months
3. Free alternation of squint
4. Development of occlusion amblyopia or diplopia
5. There is no visual improvement after 3 to 6 months of occlusion despite good compliance, depending on the age of the patient. (Occlusion failure)

When to Operate a Patient with Strabismus and Amblyopia

1. Equalization of visual acuity in both eyes.
2. Attainment of free alternation
3. No improvement in visual acuity after 3 to 6 months for cosmetic purposes. (Occlusion failure)

Assessment of strabismus for surgery should preferably be done a week after stopping occlusion as the presence of occlusion might itself produce some changes in the angle of deviation by breaking binocular interaction

Maintenance occlusion therapy may be required

postoperatively for optimum gains. Recent studies have shown part time occlusion to be as effective as total occlusion as maintenance therapy. Partial occlusion is given to anisometropic amblyopes after inducing equalization of images with contact lenses.

2. Penalisation

This comprises selective fogging of one eye by means of glasses and / or cycloplegic drugs.

Principle

A competitive edge of the worse eye over the better eye is established in as much the same way as in occlusion therapy. Advocators of this method of treatment claim that this is preferable to occlusion, as it does not disturb binocular cooperation. However this has never been proven. Besides it is supposed to be more acceptable cosmetically and hence meets with more compliance from patients.

Penalization for distance entails use of the good eye for near and the amblyopic eye for distance. The opposite applies for near penalization. A total penalization fogs one eye for both distance and near. The amount of plus or minus glasses given for the desired effect is empirical and needs to be titrated according to the requirements of each patient.

Indications

1. Moderate amblyopia in patients uncooperative for occlusion
2. Latent / latent manifest nystagmus with no strabismus
3. Anisometropic amblyopia
4. High hyperopia with ametropic amblyopia
5. Maintenance therapy after occlusion

Penalization is not found to be as effective as occlusion as it does not do away with light and form perception completely. In addition as it also offers binocular stimulation, it does not do away with the competitive inhibition of the amblyopic eye by the sound eye. Thus any squint or anisometropia leading to an abnormal binocular interaction has to be corrected before penalization can be instituted.

3. Pleoptics

Pleoptic therapy is indicated in patients with amblyopia and eccentric fixation. The principle is to establish the foveal superiority over the retinal periphery and to bleach out the eccentric point of fixation. Subsequently the fovea is re-educated to assume the straight ahead position. It is an extremely time consuming procedure comprising localization of the fovea, guarding it while bleaching the periphery with dazzling light and teaching the patient to appreciate a proper after-image and project it properly on a screen. The central fixation once established is further stabilized by exercises with Haidinger brushes and covering the amblyopic eye (inverse occlusion) so that the eccentric point does not get stimulated again. Once the foveal superiority is established, conventional occlusion can be started.

Indications

Cooperative and intelligent children of more than 5 years of age with amblyopia and associated eccentric fixation

Contra -Indications

Patients more than 7 years of age who are towards the end of the plastic period of visual maturation as it can cause permanent monocular diplopia (binocular triplopia) by stimulating the central fovea in the presence of eccentric fixation.

Pleoptics does not have a major role in the current protocols for the management of amblyopia except in patients with grossly eccentric fixation, not responsive to conventional occlusion.

4. CAM Stimulator

This treatment is based on the principle that visual areas of the brain respond to stimuli of a particular spatial frequency and this can be stimulated to improve visual functions in amblyopic eyes. It comprises of 7 rotating light and dark discs of different widths and spatial frequencies that are rotated for 7 minutes at the rate of 1 rotation per minute.

The improvement in visual acuity subsequent to use of this modality of treatment has not been substantiated by most authors. It has no role in modern day amblyopia therapy

5. Red Filter Test

This treatment is based on the principle that predominantly rod dominated areas of the retina is used for eccentric fixation. Red light is ineffective in stimulating this area because of the reduced number of cones as compared to the fovea. Thus a suitable red filter motivates the patient to use the fovea and inhibits use of the eccentric area. After the fixation becomes central, conventional occlusion is instilled.

The shift in fixation is rarely seen and rarely sustained. This modality is hardly used in modern day management of amblyopia. It can sometimes be given to young children with eccentric fixation in whom pleoptics is difficult to start.

6. Drugs and Neurotransmitters

Various drugs, gases, neurotransmitters etc have formed a part of the search for a medical treatment for amblyopia that would obviate the painful process of occlusion therapy. However, none have been found to be of permanent use. The different modalities that have been used have included oxygen inhalation, strychnine, bicuculline, Exogenous Nerve Growth Factor (NGF), Levo-dopa / carbidopa combination and Citicoline.

Amelioration of amblyopia and the decision to discontinue therapy can be assessed on the basis of the following clinical examinations: -

1. Isoacuity (both for distance and near)

2. Equal speed of reading in both eyes
3. Isoaccomodation
4. Free alternation of fixation

Conclusions

1. Occlusion remains the mainstay of treatment for amblyopia.
2. Conventional occlusion is effective patients with latent manifest nystagmus.
3. Inverse occlusion with or with pleoptics in cooperative patients can be given in the presence of eccentric fixation. However, one should revert back to conventional occlusion when central fixation is attained.
4. A trial of conventional occlusion should be given to patients with eccentric fixation as most cases of eccentric fixation are actually cases of eccentric viewing with the fovea being able to take up the straight ahead position once the abnormal binocular interaction is done away with.
5. Penalization is indicated as a second modality of treatment in patients uncooperative for occlusion therapy and also as maintenance therapy..
6. Drug therapy can form an important adjunct to occlusion therapy. However this requires further validation.
7. The prognosis for successful outcome is poorer with greater eccentricity of fixation, presence of strabismic or sensory deprivation amblyopia and in patients presenting late for treatment.

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Ketotifen

Ashima Aggarwal, MS

Composition

Ketotifen fumarate ophthalmic solution (0.025 - 0.05%)

Pharmacology

Ketotifen is a relatively selective, non-competitive, histamine antagonist (H1 receptor). It also works by acting as a mast cell stabilizer, and inhibits the release of allergic mediators such as histamine. Decreased chemotaxis and activation of eosinophils has also been demonstrated.

Indications

Ophthalmic solution is used to prevent itching of the eye caused by allergic conjunctivitis, giant papillary conjunctivitis and atopic conjunctivitis.

Contraindications

Not recommended for use in contact lens related irritation, in pregnancy or by nursing mothers.

Not indicated in children younger than 3 years of age.

Dosage

Use one drop in each affected eye every 8 hours.

Side Effects

More common : Eye redness, discomfort, irritation, Headaches, stuffy or runny nose.

Less common : Ocular - Burning or stinging of eyes, dry eyes, photophobia, mydriasis, lacrimation, discharge, pain, hives, increased itching of eyes, rash. Non-ocular - Fever, tiredness, aches, sore throat.

!! Congratulations !!

Dr. Ashok Grover for being honoured at the Asia Pacific Academy of Ophthalmology at Kuala Lumpur, Malaysia, in March, 2005 conducted two instruction courses.

Dr. Ashok Grover for chairing the main symposium on Oculoplastic Surgery at the Asia Pacific Academy of Ophthalmology at Kuala Lumpur, Malaysia, in March, 2005

Dr. Ashok Grover for being invited as a guest speaker at the meeting of Asia Pacific Society of Oculoplastic and Reconstructive Surgery (ASOPRS) in Manila, Phillipines in October 2004.

Dr. Ashok Grover for being honoured by Delhi Medical Association with the DMA Outstanding Services Award on the occasion of the Doctor's Day.

Dr. Ashok Garg, Medical Director, Garg Eye Institute and Research Centre, Hisar for being awarded National "Prime of India Award" by his excellency Dr. R.R. Kidwai, Governor, Haryana for his outstanding achievements in the field of Ophthalmology at an International Level recently.

Dr. Ashok Garg, has been selected for TOP Health Professionals Pinnacle of Achievement Award by International Biographical Centre (IBC) Cambridge, UK.

Dr. Ashok Garg, Has been invited as Guest Faculty in International KMSG Conference to be held at Chennai.

On the release of new International Books on Microphaco, Phakic IOLs, MICS and IOL power calculation in ASCRS conference in Washington (USA) in April, 2005. and his book on Phakic IOL being declared the best book on this subject by Prestigious Euro Times in June 2005 issue.

Dr. Kamlesh awarded " The Prestigious State Award" for the year 2003-2004 for his meritorious service in the field of health care by Govt. of NCT of Delhi and Elected "President of Strabismological Society" of India for the year 2004-2006.

Technique of Scleral Fixation of I.O.L.

Harbansh Lal, MS, Piyush Kapur, DNB, MNAMS, Anita Sethi MD, FRCS

Visual rehabilitation in aphakic patients with no capsular support is a tricky situation for the ophthalmic surgeon. The use of scleral fixated IOL, though surgically more demanding, is a good method with lesser chances of long-term complications.

We hereby describe our technique of scleral fixation of an IOL with special emphasis on achieving good centration and stability.

Material required:

- Prolene 10-0 suture on straight needle (AUM-5 Alcon)
- Scleral fixated IOL (with loops on the haptic)

Technique:

1. After cleaning the eye with betadine; eye is stabilized by passing both superior and inferior rectus sutures.

2. Suture-fixation sites

- With the axis marker, 2 points 180° apart are marked at '2' and '8' O'clock positions, about 1.5mm away

from the limbus (Fig. 2.) Ensure that the marker is placed concentric to the limbus.



Fig. 2 : Use of the axis maker for marking the suture – fixation sites.

- Periotomy is done at these sites and a gentle cautery is done on the scleral bed.

3. Scleral pockets

- A 1.5-2mm long incision, is made on the sclera parallel to and placed 3mm behind the limbus. The incision should be about 450 to 500 micron deep and can be made with a 11 No. blade or a 15° blade.
- Similarly another incision is made 180° opposite in the scleral bed.
- A partial thickness scleral pocket is made with a

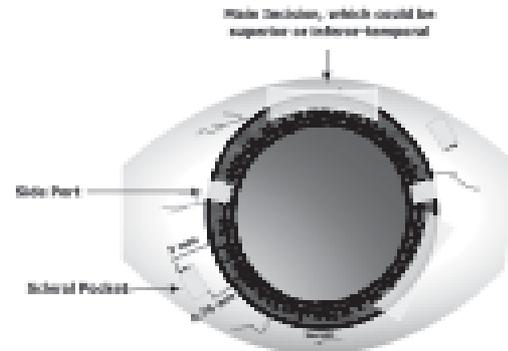


Fig. 1

crescent knife about 2.5mm long and 2mm broad starting at the incision site (Fig. 3). The force applied should be gentle with a side to side swaying movement and the blade directed along the curvature of the globe.

- The 2 scleral pockets created are at 2 & 8 O'clock positions; about 2mm in length and 2mm wide starting 3mm behind the limbus.

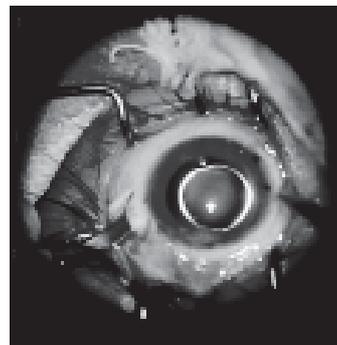


Fig. 3 : Using the crescent knife for creation of scleral pocket



Fig. 4 : Creating the side port with a 15° knife

4. Side port

- A corneal side port entry is made at an inferonasal or temporal site for easy maneuverability (Fig. 4). Cohesive viscoelastic like Healon is injected through the side port to make the eye ball tense.

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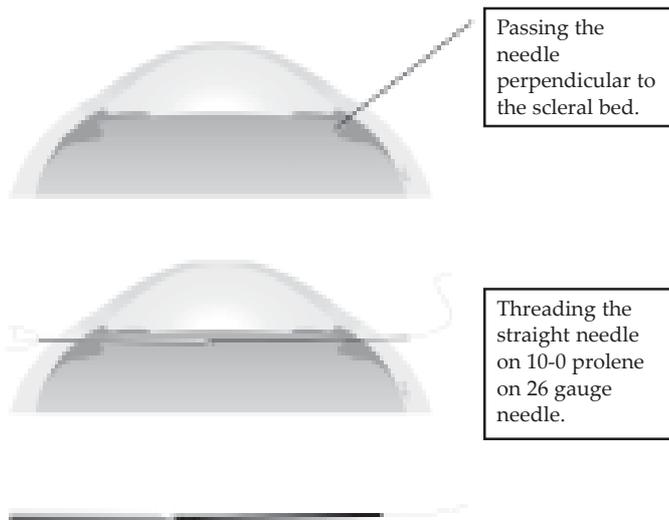


Fig. 5 : Passing the 10-0 suture.

5. Passing the suture

- A 10-0 prolene suture on a straight needle is passed. The needle is held perpendicular to the scleral bed, 1mm from the center. The entry point of the needle should be approximately 1.5mm behind the limbus.
- As the needle punctures the scleral bed, it should be turned horizontal and pushed forward behind the iris till it is directly visualized in the pupillary area. (Fig. 6)
- From the opposite scleral pocket, a 26 gauge needle is passed in a similar fashion entering the sclera 1.5mm behind the limbus, first directed vertically and then horizontally. (you may need to bend the needle in order to pass it from the nasal side).
- Once both the 26-gauge needle and prolene on straight needle are under direct visualization, the straight needle is threaded in the 26-gauge needle and the two of them are pulled out from the

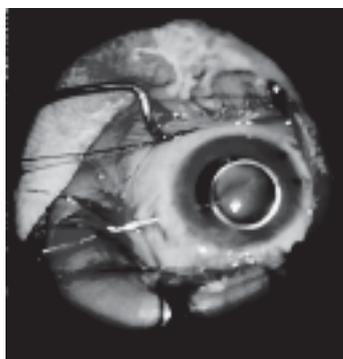


Fig. 6 : 10-0 Prolene suture on straight needle is passed through the scleral pocket, behind the iris till visible in the centre of the pupil.

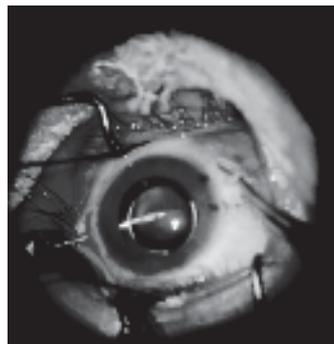


Fig. 7 : 26 G needle is passed through the opposite scleral pocket in a similar fashion. The straight needle is threaded into the 26 G needle.

insertion point of 26 gauge needle (Fig. 7.)

- Similar procedure is repeated by now passing the straight needle (on 10-0 prolene) from the opposite end, i.e. the 8 O'clock position. The needle should enter approximately 1mm away (horizontally) from the previous insertion point, as shown in the diagram. 26 gauge needle is passed through the opposite end i.e 2 O'clock end.
- The needle is threaded in the similar way and pulled out from the opposite end, i.e. the 2 O'clock position. i.e. insertion of the 26 gauge needle.
- The threads should now be parallel, 1mm apart, with a loop on one end (8 O'clock) and the needle on the other end (2 O'clock) Fig. 8.

6. The corneal incision

- Incision is made superiorly in a virgin eye and supero-temporally or temporally in a previously operated eye.
- The incision could either be a grooved one as made in ECCE with an approximate length of 6mm or it could be a sclero-corneal, valved incision with a tunnel length of approximately 1.75mm to 2mm and a horizontal diameter of about 6mm (Fig. 9)
- The incision is made by making a horizontal incision about 6mm made about 1mm behind the limbus. The incision could be either horizontal or a frown incision. The incision should be approximately 400um in depth. With a crescent knife a partial thickness sclero-corneal flap is made and entry wound made with a 3.2mm or 5.2mm keratome.

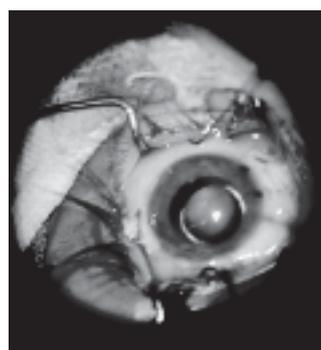
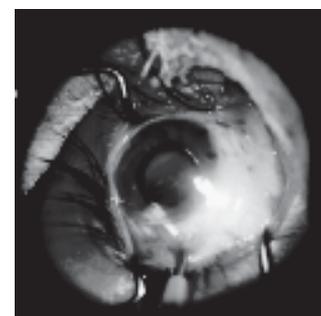


Fig. 9. Making the corneal wound.

Fig. 8 : The two sutures are parallel behind the lens.



7. Tying the suture to the IOL

- After making the corneo-scleral wound the eye is filled with viscoelastic to push back the vitreous and pressurize the eye.

- The 10-0 prolene sutures are hooked with a sinsky's hook and pulled out of the corneal wound one by one. The two sutures are then cut from the center and carefully kept apart. Those towards the 2 O'clock end kept on that side and those on the 8 O'clock end towards the 8 O'clock side.
- Both pair of threads are sutured/tied to the respective ends of the haptics. The knot tied to the haptics should be a very secure one without being too large. We generally use 3;1;1 ratio. If using the scleral fixated IOL the suture should be threaded through the holes in the haptics of the lens. In case using a PMMA IOL without loops then the knot should be in the center of the haptics (Fig. 10).

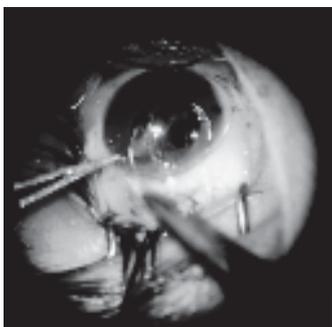


Fig. 10 : Suture is being tied on the haptic.

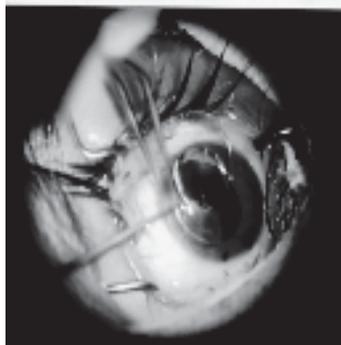


Fig. 11 : The lens is delivered into the chamber and placed into the sulcus

8. Placing the IOL

- After the sutures are tied to the haptics, the IOL is slid into the anterior chamber with upper haptic being pushed in first, behind the iris (Fig. 11).
- A careful assessment of the centering of the lens and its position behind the iris should be done. There should be no iris tuck or tilt of the IOL.
- After satisfactory assessment of the IOL - its position and centration sutures are pulled and tightened; first at the 2 O'clock side and then for the inferior haptics.
- The knots should be tight enough to hold the lens in position and at the same time it should not crush the intervening scleral tissue.
- After tying the first knot at 2 O'clock position the second knot should be tied at the 8 O'clock position. The knots are then pushed in the respective scleral pockets and the extra suture is cut.

9. Closure of the wound

- The corneal wound is sutured with 10-0 Ethilon if

it is a grooved incision or hydrated in case of a clear Sclero-corneal valved incision. (Fig. 12)

- Conjunctiva is then sutured back to the limbus with 10-0 Ethilon.

10. Role of vitrectomy

- It is vitally important to have the entire anterior-chamber clear of vitreous. Vitrectomy can either be done through the pars plana route or the anterior approach depending on the case and the choice of the surgeon. Vitrectomy can either be done after IOL insertion or before it depending on the pre-existing status of vitreous. It should preferably be done after passing of the prolene 10-0 suture as the eye becomes very soft after vitrectomy and makes passing the sutures very tough Fig. 11.

Post-Operative Care/Medication:

- Patients with scleral fixated IOL are kept on a similar post-operative medication schedule as any other cataract surgery. We prefer to give antibiotics-steroid combination for six weeks gradually tapering dose.



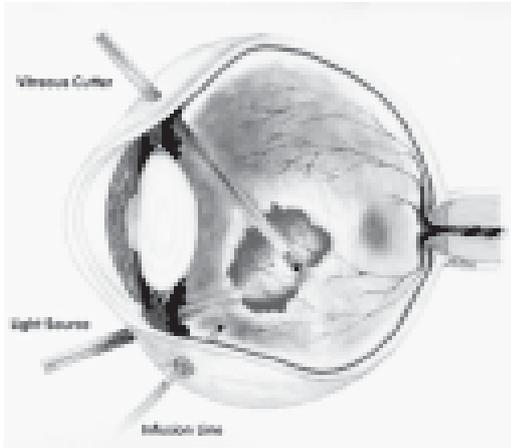
Fig. 12 : The knots are buried into the pockets and corneal wounds are hydrated. The lens is well - centered at the end of surgery.

Suggested Reading

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Basic Vitrectomy Pearls

H.K. Tewari, MD, S. N. Jha, MD, Amit Khosla, MD, Neeraj Manchanda, DOMS, DNB, Tinku Bali, MS, FRCS



- Do not compromise on the quality of the cutter or the endoilluminator.
- Always be sure to visualize the silver *tip* of the infusion cannula clear of retina and uvea before turning on the fluid.
- Do not attempt to do blind surgery. Always do surgery under direct visualization.
- After fluid- air exchange, lower the air pressure to 10mm Hg. If the retina still stays attached, it is quite likely that it will stay attached.
- If the infusion bottle has been raised to prevent intraocular bleeding during surgery, do not forget to lower it later especially in cases with a glaucomatous disc, as its perfusion may be compromised.
- Triamcinolone acetonide is very useful to highlight the vitreous (for induction of PVD, base dissection and removal of adherent cortical vitreous), highlight epiretinal membranes and ILM, and is a much cheaper alternative to other vital dyes.
- Make sure that the peripheral vitreous skirt has been cut adequately in the superior part, to prevent it from hindering the pupillary axis when the patient is upright.
- Before a relaxing retinotomy, make sure that diathermy is applied to the entire area to be cut.
- In aphakic and pseudophakic eyes with a deficient posterior capsule, always make a large inferior iridectomy, *before* silicone oil infusion.
- Infusion fluid can be used in aphakics to push silicone

oil back, if it is in the anterior chamber at the end of surgery.

- For a more complete air – silicone exchange, rotate the globe down so that all residual air can escape from the ports.
- Always cut the vitreous protruding from the ports at the end of the surgery before closing the ports.
- If a band / buckle has been applied, it should be finally tightened only at the end of vitrectomy after the ports have been closed, since the indentation of the globe by the buckle makes it difficult to work on the posterior downslope of the buckle. A high buckle may cause the surgeon to brush against the retina with instruments creating retinal breaks.
- Cryo should be applied just posterior to the 3 ports, at the end of surgery to ensure that any inadvertant peripheral break is sealed.

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Optical Coherence Tomography - Concept and Clinical Application

Elesh Kumar Jain, MBBS, Pankaj Choudhary MS, Shashi Jain MS, P.C.Dwivedi MS, M.K.Rathore MS

Optical Coherence Tomography (OCT) is a noninvasive; noncontact imaging system, that uses a super luminescent diode light source to create high resolution, real time, cross sectional tomographic images of retina. It gives quantitative information on dimensions of intraocular structures with the potential to stage disease progression or response to therapy.

Advances in ocular imaging have made it possible to assess the ocular structures not only for diagnostic purpose but also therapeutic interventions. For a long time B SCAN ULTRASOUND remained the only modality to obtain cross sectional images of ocular structures. However it is unable to obtain image resolution beyond 150μ which prevents a detailed imaging of the layers of the retina. While ULTRASOUND BIOMICROSCOPY by using a high frequency transducer can achieve a resolution of up to 20μ however, the depth of penetration is limited to 4mm, preventing posterior segment application. However Stratus OCT (OCT 3) produces high resolution up to 10μ cross sectional images of the retina .

Generations

Several generations of the commercial version of the OCT device have been developed. The first generation OCT 1 has transverse and axial resolutions of approximately 20μ and 10 to 15μ , respectively. The second generation OCT 2 has similar hardware with an improved user interface. Both generations acquire 100 vertical scans in a standard OCT scan in an acquisition time of approximately 1.2 seconds. The recently released third generation OCT 3 machine has improved resolution of 8 to 10μ and acquires 512 vertical scans. An experimental ultra high resolution OCT system has been developed using Ti: Al_2O_3 laser that provides an improved axial resolution of 2 to 3μ . This resolution makes it possible to identify otherwise unseen intermediate retinal layers, such as the retinal ganglion cell layer.

Instrumentation

The OCT system consists of 2 tables: an operator table and a patient table. The operator table houses the OCT

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computer display, the control panel, the color ink jet printer and the patient table houses fundus viewing unit and the interferometric unit. (fig.1)



Principle & Procedure

OCT is based on the principle of “**low coherence interferometry**”. The OCT device uses a light source consisting of a near – infrared, low coherence super luminescent diode laser of 850nm wave length. This diode source connects with **Michelson interferometer**. Infrared light from the source is divided at an optical beam splitter into reference beam and measurement beam. The measurement beam is directed onto the patient’s eye and is reflected from intraocular structures at different distances. The reflected measurement beam is composed of multiple echoes which include the information about the range or distance and thickness of different intraocular structures. The reference beam is reflected from a reference mirror. The reflected reference beam returns to beam splitter where it combines with reflected measurement beam. Both beams are combined resulting in a phenomenon called **Interference** .The interference is measured by means of a photo sensitive detector. The echo time delay of the measurement and reference beam is compared and then signal is sent, which is processed electronically and used within OCT’s internal computer data acquisition bank for analysis and storage.

On Z axis, 1024 points are captured over a 2 mm depth to create a tissue density profile, with resolution of 10μ . On X –Y axis, tissue density profile is repeated up to 512 times. every 5 – 60 microns to generate a cross sectional image. Several data points over 2mm of depth are integrated by the interferometer to construct a tomogram of retinal structures. Image thus produced has an axial resolution of 10μ and a transverse resolution of 20μ . The tomogram is displayed in either gray scale or false color on a high resolution computer screen.

Interpretation of Normal OCT Imaging

The physical basis of imaging depends on the contrast in optical reflectivity between different tissue microstructures. The proportion of incident light which is directly back scattered by a tissue structure defines the reflectivity of that structure. The OCT signal from a tissue layer is a combination of its reflectivity and the absorption and scattering properties of the overlying layers.

The intensity of the reflected optical signal is represented on a logarithmic scale with varying degrees of brightness. The maximal optical reflection and back scattering are represented by Red – Yellow colors. The minimal signals are represented by Blue – Black colors.

OCT Imaging of Normal Retina

The OCT can scan the macula, paripapillary region including retinal nerve fiber layer and optic nerve head region. There are 10 layers of the retina and cross sectional OCT image of the retinal layers are represented like this. (Fig. 2)



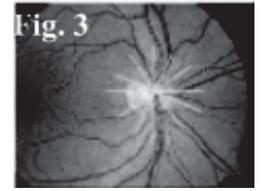
The vitreous being non reflective is seen as a dark space. The vitreoretinal interface is demarcated by the contrast between the non reflective vitreous and the backscattering surface of the retina. The inner margin of retina shows area of bright backscattering, a red layer that corresponding to the nerve fiber layer. A highly reflective red layer delineates the posterior boundary of the retina and corresponds to RPE and choriocapillaries. A dark layer of minimal reflectivity appears just anterior to choriocapillaries layer and represents the outer segment of retinal photoreceptors. The intermediate layers exhibit moderate backscattering. Fovea is identified by the characteristic thinning of the retinal layers.

(1) **The Optic nerve head** : It can be identified on the basis of its contour – central depression of cup and the stalk. OCT3 is provided with two scan protocols for detailed evaluation of optic nerve head.

Optic disc scan consists of equally placed lines scans 4 mm in length, at 30° intervals, centered on the optic disc. (Fig. 3)

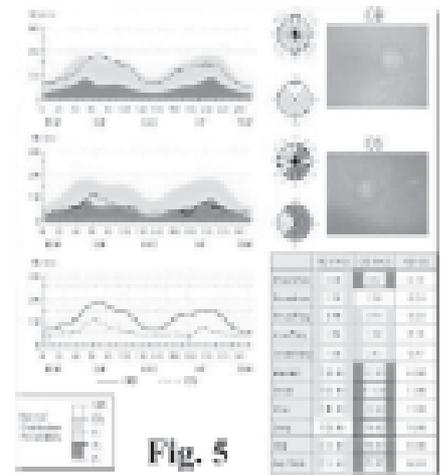
Fast Optic disc scan compresses six optic disc scans into one scan and acquires scans in a short time of 1.92 seconds.

The point at which choriocapillaris terminates at lamina cribrosa determines the disc boundaries. Extrapolation of these points to retinal surface defines a line segment which measures disc diameter. The points at which nerve fiber layer terminates determines the Cup. By this scan OCT images can measure the optic nerve head and its parameters like Rim area, Disc diameter, Rim volume disc area, Cup disc ratio and Cup volume. (Fig 4)

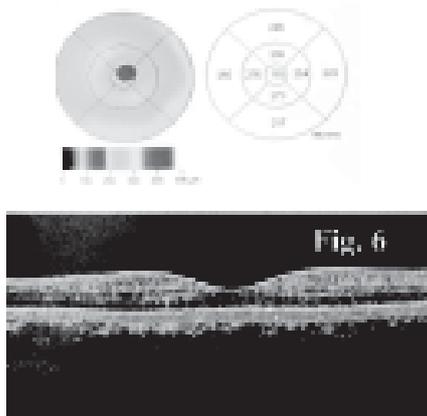


(2) **The Retinal Nerve fiber Layer**: OCT measures the thickness of the retinal nerve fiber layer in the paripapillary region. RNFL thickness increases from macula to the optic disc. OCT 3 offers a variety of RNFL thickness measurement and analysis protocols like RNFL thickness Circle scan, Fast circle scan, Concentric 3 rings protocol, RNFL map and Proportional circle.

RNFL measurement with a circular scan of 1.34 mm radius, centered on the optic nerve head has been shown to have a maximum reproducibility. Mean RNFL thickness is calculated using age adjusted RNFL thickness average analysis protocol. (Fig. 5)



(3) **Macula** : The normal fovea is identified by its characteristic depression of the inner retinal border secondary to the lateral displacement of tissue anterior to Henle's layer. The macular scan is composed from six linear scans in a spoke pattern configuration equally spaced 30° apart. In the color coded macular thickness map blue color represents thinner retina and yellow green, thicker retina. OCT has become part of routine imaging modality with suspected or known macular pathology. (Fig. 6)



Interpretation of Abnormal OCT Imaging

Reflectivity pattern of the scanned images is used to interpret abnormal finding as follows:

Hyperreflectivity: It can be caused by inflammatory infiltrate into any layer of retina, fibrosis like disciform or other scar, hard exudates, and hemorrhages. Thin hemorrhages appear as thin, high reflective bands with little effect on underlying tissue. Thick hemorrhages completely attenuate reflections from underlying structures.

Hyporefectivity: It can be caused by retinal edema, serous fluid, hypopigmentation of RPE.

Nature of Fluid : It is based on the basis of reflectivity. Serous fluid is either optically clear or hyporefective, blood has both enhanced reflectivity and increased attenuation of incident light. Exudate typically has intermediate appearance between blood and serous fluid.

Detachment of Neurosensory Retina and RPE:

Neurosensory detachment appears as a shallow elevation of the retina, with an optically clear space between the retina and RPE. The back scattering from the normally minimally reflective photoreceptors is increased, resulting in a well defined fluid- retina boundary. Serous detachment of pigment epithelium shows elevation of RPE reflection above an optically clear space.

Applications

Application of OCT can be summarized as:

- Follow up of the clinical course, understanding the pathogenesis of the disease.
- For assessing the response to medical, surgical, laser therapy.
- For documentation and explaining the prognosis of a particular disease.

OCT in Glaucoma : OCT provides high resolution measurements and cross sectional imaging of the retina,

optic disc and RNFL. Recent studies indicate that RNFL thinning to be the first sign of early glaucoma. The main uses are

- To evaluate the RNFL for early (pre perimetric) glaucoma detection
- To detect , study and follow the macular changes in hypotony induced maculopathy after glaucoma surgery
- To evaluate cystoid macular edema after combined cataract and glaucoma surgery.

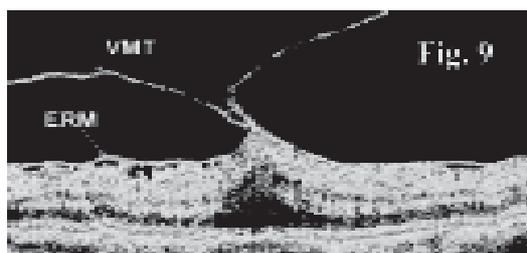
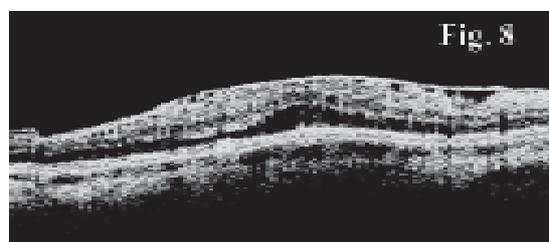
To evaluate optic nerve head tomography in glaucoma patients.

OCT in Macular diseases: OCT provides reproducible, high resolution, cross-sectional imaging of the retina allows diagnosis, monitoring, and quantitative assessment of macular pathology.

(a) Macular Hole: Diagnosis and staging of macular holes by biomicroscopy can be difficult for even the most experienced examiners owing to simulating conditions, such as a lamellar hole, vitreomacular tractional syndromes, and cystoid macular edema with central cyst. It is also useful in monitoring the course of disease, whether spontaneous resolution or progression to a full thickness macular hole, and the response to surgical intervention. (fig.7)



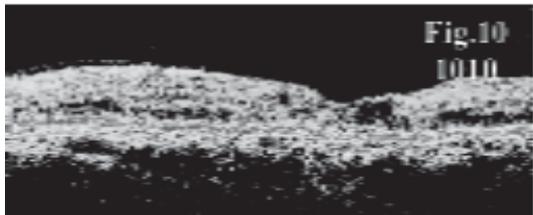
(b) Epiretinal membrane: OCT images confirm the diagnosis of faint, diaphanous membranes and provide a cross-sectional assessment of factors contributing to vision loss. It provides information about membrane thickness, cystic changes and its adherence to retinal surface.(Fig. 8)



(c) Vitreomacular traction syndromes: It allows the accurate diagnosis and monitoring progression of VMT. It has become invaluable in determining the need for and timing of surgical intervention (Fig. 9)

(d) Cystoid macular edema: Although cystoid changes are visible by slit lamp biomicroscopy and fluorescein angiography, only OCT can quantitatively assess retinal thickness and demonstrate any associated RPE structural anomalies beneath the edematous retina, which can be obscured by leakage on angiography. Measurements of retinal thickness by OCT correlate more strongly with visual acuity than the presence of leakage on angiography.

(e) Diabetic retinopathy: Clinically Significant Macular Edema is the leading cause of treatable vision loss in patients with diabetic retinopathy. OCT may be more sensitive than biomicroscopy in detecting macular edema. OCT almost gives the in vivo histopathology of the retinal layers that helps in a better understanding of the pathogenesis of the disease process. It is a useful tool in monitoring response to an intervention in CSME. (Fig.10)



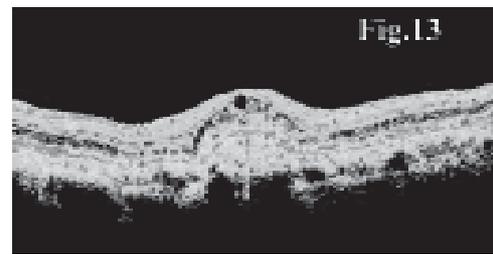
(f) Retinal Vein Occlusion: OCT is useful in quantitatively monitoring the development of macular edema and its resolution following treatment.

(g) Central Serous Chorioretinopathy: It is effective in quantifying the amount of serous fluid accumulation in CSR. It is also used to monitor the course of CSR. It exhibit well defined reflection at fluid RPE interface (Fig.11) , whereas elevation of RPE reflection above an optically clear space occurs when the pigment epithelium is detached. (Fig. 12)



(h) Age Related Macular Degeneration (ARMD): OCT can cross-sectionally image the morphological changes in non exudative ARMD and aids in the diagnosis and management of exudative ARMD. Identification and characterization of Choroidal neovascular membranes as above or below RPE, even when poorly visualized on fluorescein angiography, is possible.

OCT allows the detection, localization, and quantitative evaluation of subretinal fluid and associated CME. Anatomic alteration from drusenoid pigment epithelial detachment, RPE tears, and stages of retinal angiomatous proliferative lesions are also identified by OCT. It is also useful to assess the benefit of various treatments. (Fig. 13)



Limitations

- Presence of conditions like asteroid hyalosis, cloudy media, high astigmatism, decentred lens implant and dense cataracts can compromise quality of the tomograms.
- Limited transverse sampling

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Laser Flare-Cell Photometry

Shalini Mohan MS, A Mullick MD, D. Poplai DOMS

Laser flare-cell photometry is a newer investigative modality that can be used to quantify the amount of blood aqueous barrier breakdown. It evaluates aqueous flare and cells in quantitative manner and is hoped to be of immense aid in determining diagnosis, predicting outcomes and possibly guiding clinical management of the patients¹. In anticipation of the expanded use of these devices, it is appropriate to familiarize readers with the technique of laser flare-cell photometry.

Many subjective and objective techniques to quantify flare have been described over past centuries¹.

Subjective Techniques:

The ability to quantify inflammation relies on examiner skill, experience and bias, which can result in significant inter-observer variability.

1. Slit lamp biomicroscopy - Hogan et al (1959) described the method to count the number of cells in a "wide beam with a narrow slit".
2. Examiner can adjust a rheostat attached to the slit lamp biomicroscopic light until flare is perceived.
3. The examiner compares light projected through series of neutral density filters and compares the reflected light from the neutral density filter.

Objective Techniques:

1. Fluorophotometry can also assess blood aqueous barrier breakdown. It defines a permeability coefficient for diffusion of fluorescein into the anterior chamber from non-protein bound fraction of protein in the plasma. The need for fluorescein injection and duration of test limits the clinical use of this technique.
2. Light reflected by flare is photographed, after which light is passed through the film and analyzed photometrically.
3. Reflected light can also recorded by photomultiplier tubes with quantification by a galvanometer (Photoelectric method)².
4. Laser flare-cell photometry

Laser flare-cell photometry:

Laser flare-cell photometry provides an automated technique to quantify cells and flare in objectively, and it has been used in a variety of research and clinical situations

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to assess anterior segment inflammation. It offers an opportunity to improve upon current techniques of inflammation assessment and should not be considered simply an objective surrogate for clinical grading of cells and flare at the slit-lamp biomicroscope. Its research applications and utility for monitoring patients with uveitis have not yet been fully explored¹.

Instrument and technique:

K o w a company (Tokyo, Japan) has developed laser flare cell photometer (Figure 1) that quantifies aqueous humor protein and cells using Helium-Neon (FC-1000) or Diode (FM-500) laser slit lamp that projects the laser beam



Figure 1: Laser Flare - Cell Photometer

into the anterior chamber. The amount of light scattered by solutes (protein) or particles (cells) in the anterior chamber is detected by photomultipliers fitted in binocular microscope and the data is analyzed in a computer attached to the machine. The instrument has two functional modes:

1. **Diffuse scatter** (Flare measurement): The device records the amount of light detected by the photomultiplier as it is scanned across a window measuring 0.3mm × 0.5mm in 0.5 secs. It records two background readings that are taken as the laser scans above and below the window. The background measurements are averaged and subtracted from the reading obtained in the scanned window to provide a laser flare photometry measurement. Flare is expressed



Figure 2: Anterior Chamber Flare



Figure 5: Laser Flare - Cell Photometer (FM - 500)

as photon units / msec.

2. **Corpuscular scatter** (Cells measurement): The machine scans its laser through an aqueous humor volume of $0.5\text{mm} \times 0.6\text{mm} \times 0.25\text{mm}$ (0.075mm^2) over 0.5 secs; each time light is reflected from a particle, the

photomultiplier records a peak of reflected light. Each peak above a preset background is counted as one cell.

Testing procedure:

The photometer is turned on several minutes prior to use to let the laser warm up. The operator visualizes an image of the detection window through the attached slit lamp. Manual adjustment of the device is to be made until the detection window is visualize in front of the pupil. The operator then activates the machine following which all the measurements are recorded automatically. The device displays the measurements, including two accompanying background levels for flare determinations and calculates

the percentage difference between the two. The laser flare-cell photometry board¹ recommends discarding those readings for which the two background measurements differ by more than 15% and also, a reading of '0', which indicates an inability to calculate a difference from background, is discarded. Seven laser photometry values of $<15\%$ background difference and >0 are saved. The high and low readings are also discarded to avoid outliers. Calibration of the photometer should be checked weekly.

Factors affecting the Laser photometry measurements¹:

A) Factors affecting the flare:

The factors which affect the readings of the laser cell flare photometer must be taken into account as they may influence the results. (Table 1)

1. **Age:** Increase in the readings has been attributed to a true increase in the protein content and increase light scattering caused by cataract.
2. **Pupil size:** Decrease in reading is seen with mydriatics and also with pseudophakia. Shah et al⁵ hypothesized that the decrease may be caused by reduced light scatter when the iris is moved away from the scanning window.
3. **Diurnal variation:** Diurnal variation occurs as increase in aqueous humor flow occurred during the day and decreased at night whereas protein entry into the chamber remains fairly constant over a 24 hrs period.
4. **Protein content:** Increase in the reading with high

Table 1: Factors affecting the laser flare photometry measurements.

Influencing factors	Effect on readings	Special comments
1. Age	with age	App. 50% ↑ in flare from age of 20 years to 70 years.
2. Diurnal Variation	in morning	25-30% ↑ in morning.
3. Pupil size	with mydriasis	20-26% ↓ following instillation of both tropicamide & phenylephrine
4. Protein content	Variable	↑ with concentration of given protein and with high Mol. Wt. protein.
5. Medications • Acetazolamide • Apraclonidine • Mannitol • Pilocarpine • Timolol • Phenylephrine • Tropicamide • Epinephrine • Latanoprost	No effect No effect	40% ↑ after 2-10 hours. 30 mins after instillation. 75% ↑ in 20-22 years patients, after 1 hour 100% ↑ in 55-87 years patients, after 1 hour. 20% ↑ after 3, 8 & 10 hrs. 20% ↑ after 3, 8 & 10 hrs. ↓ after 3 hrs of instillation. ↓ 10-30% at 30-60mins.

molecular weight proteins is seen because of the Rayleigh law, which states that scattering of light by a protein is dependent on both its molecular weight and its concentration.

5. **Medications:** The proposed mechanism for the changes associated with the drug is attributed to alterations of blood aqueous barrier or altered aqueous humor production, resulting in increase or decrease of protein content into the eye or decreased production of aqueous, thereby concentrating the protein already present¹.

B) Factors affecting the cell count:

1. **Pupil size:** Conflicting data has been reported regarding the cell count. Ladas et al found an increase in cell count but some researchers have found a decreased count with dilatation and other have reported no change¹.
2. **Aqueous humor protein:** Increase in cell count with increasing protein concentration does not result in significant change in laser photometry count.
3. **Erythrocytes:** Erythrocytes are counted as cells by laser photometry, which eventually fall at very high concentration possibly because of erythrocytes aggregation or close cellular proximity that prevents discrimination of individual's peak of reflected light.

Clinical applications:

The clinical applications are:

1. Uveitis⁴:

- Patients with acute anterior uveitis, intermediate uveitis including Sarcoidosis, Fuch's uveitis syndrome, Herpes Zoster Ophthalmicus, Pars Planitis syndrome with cystoid macular edema and acute retinal necrosis syndrome demonstrate high values¹ if compared to normals.
- It can also be used to monitor (progression and recurrence) the disease. In a study it was proved that a rise in laser photometry values of 20% (i.e. at least 3 photons units/msec) was associated with recrudescence of disease in 77% of the cases⁶.
- Davis et al found association between high flare values and baseline complications³.

2. Post surgical inflammation:

- The laser flare photometry values are high after sclerocorneal incision than in clear corneal incision.
- Higher values are also seen with scleral fixation of IOL than with in bag implantation of IOL.
- Efficacy of two drugs in post operative period can also be compared.

3. **Corneal graft rejection:** Increased flare values after keratoplasty indicates an early graft rejection.

4. **Pseudoexfoliation syndrome:** Alteration of blood

aqueous barrier demonstrated by both flurophotometry and fluorescein angiography is also seen by laser flare photometry.

5. **Diabetic retinopathy:** Laser flare photometry readings have been found to be increased as a function of duration of diabetes mellitus and with associated rubeosis in patients with diabetic retinopathy.
6. **Uveal Melanoma:** The values of laser flare photometry are found to be high in malignant lesions.
7. **Age related macular degeneration:** The values have found to be increased with advancing age-related macular degeneration.
8. **Cytomegalovirus retinitis:** Increased readings are found in patients of AIDS with CMV retinitis and with lesions within major temporal arcade than in peripheral retina only.
9. **Other posterior segment disorders:** It has shown to measure blood ocular barrier breakdown in other diseases of posterior segment that are not traditionally considered to be inflammatory in nature.
 - Higher values are reported in CRVO than with BRVO and in hemorrhagic CRVO than in venous stasis retinopathy.
 - Grading the severity of cystoid macular edema has also been reported.
 - Increased levels reported after retinal cryopexy have been found to decrease after one month, indicating only temporary blood ocular barrier breakdown.
 - A relationship is established between laser photometry values and visual recovery in patients following retinal detachment surgery.

Future prospects:

- Laser flare photometry may provide new insights into the mechanisms of disease with intraocular inflammation.
- It may provide as a marker for disease severity and prognosis.
- It may predict clinically important outcomes such as vision loss, recurrence rates or development of complications.

To conclude it can be said that laser flare photometry offers an independent and unique new paradigm for monitoring inflammation, but substantial work will be required to identify and confirm the value of this technique for clinical practice.

Advantages:

1. A rapid, accurate, sensitive, safe, reproducible and non-invasive method for assessment of blood aqueous barrier.

2. Subclinical changes in flare can be followed with speed and accuracy;
3. Small changes in aqueous humor proteins, which are not apparent by slit lamp, can be monitored by laser photometry.
4. It can be performed by non-physicians also.

Disadvantages:

1. Laser flare photometry does not identify the nature of the protein in aqueous humor. Higher molecular weight proteins increase flare that may have a greater effect on outflow.²
2. Cell measurements are comparatively less accurate than flare owing to the partial volume effect of measuring a low number of particles in a small volume (0.75 mm³).⁴
3. Persistently elevated laser photometry values in patients with chronic uveitis cannot be lowered with medications.
4. It may be impossible to obtain measurements on patients with shallow anterior chamber, corneal opacities or fibrin within anterior chamber.

5. Background readings may be high in patients with secluded pupil or white cataracts, making it difficult to obtain perceptible results.

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DOS MONTHLY CLINICAL MEETING FOR JULY, 2005

Venue : Auditorium

*Army Hospital (Research & Referral), Near Dhaula Kuan
(on NH-8), Delhi Cantt, Delhi- 110010*

Date & Time : 31st July, 2005 (Sunday) at 10:00 AM

Case Presentation :

1. A case of microbial retinitis : Dr. A. Verma
2. An unusual complication of insect bite : Dr. Maj. A. Jha

Clinical Talk :

- Minimal invasive DCR with KTP laser : Dr. Col. S.S. Panwar, SM

Mini Symposium : Management of complications of Phacoemulsification

Chairman : Col. D. P. Vats

Co-Chairman : Wg. Cdr. H. S. Gill

1. Corneal Complication : Col. D. P. Vats
2. Nucleus Drop : Col. A. Banerji
3. Retinal Complications : Lt. Col. R. Maggon
4. IOP related complication : Lt. Col. M. Bhadauria

DISCUSSION

Microkeratomes for LASIK & Epi-LASIK

Noshir M. Shroff, MS, Sachindra Laishram, MD, Ranjan Dutta, MD

The idea of modifying the shape of normal cornea in order to correct refractive errors of any origin was propounded by J.I. Barraquer in 1949. In 1958, he started the era of manual carving and later mechanical carving, using devices similar to those used for cutting optical lenses. He devised the first microkeratomes based on Dr. Castroviejo's electrokeratome. Thus started the long walk towards perfection in refractive surgery. In 1989, excimer laser was combined with keratomileusis resulting in a technique, which is now known by the name Laser-assisted in situ Keratomileusis or LASIK.

With the advent of the customized LASIK and epi-LASIK we are including more and more people for whom we can give perfect vision. The quality of Laser and the quality of the microkeratomes are getting better and better everyday. We are constantly striving to provide a LASIK flap which is as physiological as possible. We will discuss the microkeratomes with special regard to the recent advances and Laser vision correction.

A microkeratome is an instrument designed to perform circular corneal resections of a predetermined diameter and depth. It cuts across the corneal stromal lamellae by a blade powered by an electromechanical system or turbine system. It has the following parts:

- Head
- Handle
- Footplate
- Console

An ideal microkeratome should be:

- Easy to assemble
- Easy to operate
- Easy to clean and to reassemble
- Allow visualization of the cornea
- Durable
- Show repeatable results
- Safe & dependable

We have come a long way from the first microkeratome created by Barraquer, which consisted of a blade passed manually over the cornea.

All microkeratomes have a suction ring, which holds the globe and increases the intraocular pressure to facilitate the creation of the flap. The inner diameter of the suction ring will determine the size of flaps that can be created. In

the early stages of development of the microkeratomes people used to use different suction rings for different thickness of the flap. The newer microkeratomes use a single size suction ring or 2 sizes; the depth of the flap is determined by adjusting the height of the ring. Higher the vacuum, the thicker will be the flap. For deep-set eyes and narrow palpebral aperture suction rings with small external diameter have been manufactured.

We can classify the microkeratomes into the following generations:

- 1st generation – linear cutting action. It had 0° plane, fixed thickness.
- 2nd generation – pivoted rotational cutting action. Blade was modified to work at 26° angle and fixed thickness. This model was based on the microkeratomes used in pathology. This design reduced the cutting friction and hence producing smoother cuts.
- 3rd generation – pendulum like cutting action introduced in 2000 by Cesar Carriazo
- Epikeratomes – Amadeus II, Moria Epi-K, Gebauer Epilift
- 4th generation - Without blades – Water jet – Visijet hydrokeratome
- Laser – Intralase Femtosecond Laser & Novatec Laser microkeratomes

To know better about the working of the microkeratomes, we need to know about the different parameters and how each one affects the quality of the flap.

The recent microkeratomes come with an adjustable hinge location, which can be customized according to the surgeon's preference for either a superior or a nasal hinge. This has come up following concerns in the ophthalmic society that the flap created for LASIK results in the loss of majority of corneal nerve fibers. A nasal hinge is supposed to preserve the corneal nerve fibers better than with a superior hinge. This is because most of the corneal nerve fibers enter the cornea nasally. It is an irony that the initial flaps were nasal flaps, then we shifted to superior flaps and now we are shifting back to nasal flaps. The disadvantage with the nasal flap is that there is a small risk of the flap being displaced by the movement of the upper lid.

The blade angle of the microkeratomes is also important. The first microkeratomes had a 0° angulation.

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Now the microkeratomes have around 25° to 30°. This angulation results in an oblique incidence over the cornea. This characteristic allows the resection of a positive lenticule if 5 mm or smaller diameter resection are planned.

The other advantage of the newer microkeratomes have over the older ones is the ability to create thinner flaps. This has expanded the patient base eligible for LASIK. Higher refractive errors can be corrected now; also people who previously could not be corrected due to thin corneas can be corrected now.

The rate of oscillation of the blade determines the quality of the flap being made. Higher the oscillation rates the smoother the flap being made.

The advance rate will determine how fast the flap is being created. In conjunction with the oscillation rate it determines the quality of the flap.

We have listed the various microkeratomes with a few of their salient features. This list is not exhaustive and any omission is unintentional.

Hansatome/ Zyoptix XP

- Conventional
- 4-piece microkeratomes
- Oscillation/min – 4000 to 20000 rpm (average of around 8,000)
- Flap – 8.5, 9.5 mm
- Depth – 160, 180, 200 mm
- Blade angle – 25°
- Most widely used microkeratome tried and trusted.
- Hansatome has been found to create a thinner flap by around 20 microns. So we can use it on borderline cases where 20 more microns will make the procedure safer than actually creating a 160 mm flap.
- In cases with deep set eyes and narrow palpebral aperture, hansatome tends to cut the skin or the lashes come in the way. This may lead to creation of irregular flaps and sometimes make it difficult to create a flap.
- The newer version can create thinner flaps. Zyoptix XP also makes nasal hinged flaps.

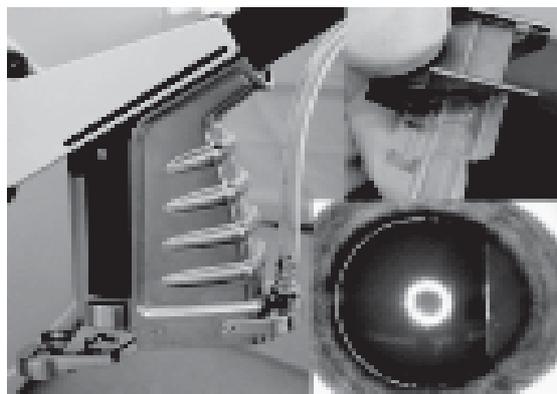
Amadeus II

- Conventional, with epi-LASIK capability
- Single-handed with no cogwheels which allows the surgeon to see the flap creation.
- Preassembled – no assembly over the eye required.
- Advance rate – customizable 1.5 – 4 mm/sec
- Oscillation/min – 4000 – 20000



- Flap – 8.5, 9, 9.5, 10
- Blade angle – 25°
- Depth – 140, 160 mm
- Variable flap orientation
- Though there is a option of a superiorly oriented flap with this keratome it is very difficult to do so.
- It has a shorter learning curve as compared to the Hansatome. Plus the advantage of being able to create thinner flaps makes it quite useful. We also found that the flaps are of good quality.
- It has the inherent disadvantage as with all the keratomes creating nasal hinge flap.

BD K-4000



- Conventional
- Advance rate of 4 mm/s
- 12,000 rpm

- 26° blade angle
- 130, 160, 180 mm

Moria microkeratomes

Moria has a lot of models available in the market. They include:

- CB and CB ALTK
- CB Single use
- M2 single use
- One and One-ALTK
- One use
- One use plus

All of them have some common features, which are:

- Manual, variable advance rate
- 15,000 rpm
- Flap up to 10.5 mm
- 30° blade angle.
- 140, 160, 180 mm

Moria keratomes are also reliable and easy to use. Some of the models available are disposable. The disposable ones come with the ability to create flap of a single thickness.

Moria tends to create thicker flaps than what is indicated on the keratome. It creates flap around 30 mm thicker. This is risky, when the corneal thickness is borderline or when treating high refractive errors. The surgeon may be in a false sense of security while handling such cases.

Nidek MK-2000



- Conventional
- Designed for nasal flaps
- Advance rate of 2 mm/s
- 9000 rpm

- Flap of 8.5, 9, 9.5mm
- 25° blade angle.

Carriazo-Pendular

- Blade translation speed 3 mm/sec
- Ball shaped cutting head protects the central cornea
- Flap diameter of 9 mm or 10 mm
- Four cutting heads available for different flap thickness (110, 130, 150, 170 mm)
- 360° free choice of hinge position
- Suction rings have a small external diameter to allow them to be used in all types of eyes.
- It does not use an applanation plate but a spherical moulding system. This system exerts 0.5 mm of Hg more pressure on the corneal center to protect the central part from any irregular cuts or buttonholes.



Intralase FS

- femtosecond laser of wavelength 1053 nm, fires ultra-short impulses of laser energy. Every pulse creates a cavity of 3 microns in the stroma.
- Multiple pulses in spiral form create a stromal incision starting from the center to the periphery till reaching the surface to make a flap.
- If any problem with the flap making occurs, the procedure can be stopped and the procedure can be reinitiated after 30 seconds. This is an advantage over other systems where one may have to wait for months for the cornea to heal for re-cutting the flap.

The Microjet

- A water beam of less than 33 microns thickness is expelled at 20 to 25 kPsi (1360-1700 atmosphere) through a ruby orifice 50 microns in diameter.

- The collision of the high velocity water beam will break the stromal lamellar layers, making the flap.
- The increase in IOP during the cut is around 10 mm of Hg

We have had first hand experience with Hansatome and Amadeus and we found that they both give reproducible results with good quality flaps. Both of them are equally safe.

We don't have much experience with the nidek microkeratome, Carriazo-Pendular and the intralase and hydrojet. So we cant comment much on the effectivity of these microkeratomes though the different studies have shown so. The studies also indicate that it is not safe to use hydrojet in human eyes. Also intralase is much more painful procedure than the flap creation with conventional blades. Even then, many surgeons are safely using Intralase.

Microkeratomes for Epi-LASIK

With the gaining popularity of Epi-LASIK, a new array of epikeratomes has come in to the market. The first epikeratome assembly was the Centurion. Thereafter, Amadeus II, Moria Epi-K, Gebauer Epilift have come up. All these keratomes have made epi-lasik much safer. They also provide the surgeon with the option of eliminating the need of alcohol and scraping. They also create much more smoother epithelial flaps than with alcohol and scraping. Their features are listed in Table below :

Amadues II SES with epiblade	Epilift	Epi-K	Centurion
Plastic blade, 8.5 to 10 mm	Stainless steel 8.5 to 10 mm	SS NA	Plastic 9 & 10 mm
Nasal hinge	Nasal adjustable	Nasal	Nasal
Voice confirmation, print surgical settings, vacuum settings can be changed	Vacuum settings can be changed	Can be either pre-assembled or assembled on the eye, vacuum settings can be changed	Vacuum fixed

All the epikeratomes have automated drive mechanisms. Amadeus, Epilift and Epi-K use the applanation system and the surgeon can change the vacuum setting. Centurion SES has a fixed vacuum setting of 450 to 650 mm of Hg. Moria Epi-K has not been FDA approved. The rest of them have been approved. Amadeus II and visijet provide wider choice of suction ring sizes. Visijet has one advantage that it can be used to create superior hinged flap while this is not possible with the other types.



The availability of epikeratomes has made epi-Lasik much more controllable with smoother flaps, although it is early to comment on their effectiveness and safety.

In conclusion, there are a wide variety of microkeratomes systems available today. The choice of which one to use is the surgeon's individual preference. Some surgeons do not like to assemble the microkeratomes on the eye. Some prefer to stick to the old tried and trusted microkeratomes such as the Hansatome. Most of the newer microkeratomes vary little from each other in their capabilities. Each one is as good as the other in the hands of an experienced surgeon.

Obituary



Dr. Vijay Pratap Trehan born on 14th July, 1937 and wife Mrs. Adarash Trehan met with an accident on 8th

July, 2005 and are no more amongst us. He was a Post-Graduate of Amritsar Medical College and organized many free Eye Camps in association with National Control of Preventive Blindness.

Flap Related Complications

Namrata Sharma, MD, Rajesh Sinha, MD, Jeewan S Titiyal, MD, Rasik B Vajpayee, MS, FRCSEd

The creation of a regular lamellar flap of uniform thickness is the most important step in the LASIK surgical procedure. The "ESP" approach to LASIK emphasises the important safety aspects of this surgery, which stands for adequate Exposure, Sufficient suction and Precision and patience. The various flap related complications include the following:

Interface Debris

Etiology

Interface debris can come from a number of different origins which include metal fragments from blade shattering during the insertion of the flap, oil material from the microkeratome, meibomian, gland secretions, powder from gloves, sponge debris, fibres and lint, or even eyelashes¹. Although small amounts of debris are visually insignificant, larger debris may be associated with fibrosis and may cause diffuse lamellar keratitis.

Management

Interface debris, if significant, is treated by lifting the flap and cleaning of the interface by copious irrigation. We examine patients routinely at 30 minutes after the procedure and undertake early flap lifting and irrigation if significant axial debris or fibers are noted. This is not necessary with small amounts of non-axial interface debris, which is usually insignificant.

Prevention

The eyelids should be cleaned pre-operatively and any blepharitis or anterior segment inflammation addressed prior to surgery. The measures include use of lint free gloves, gowns, powder free gloves, draping the lashes and applying a draining sponge around the limbus which prevents the regurgitation of surrounding secretions². An aspirating speculum may be used when irrigating the interface.

Epithelial Defect

The incidence of epithelial defects with LASIK is around 5%.³ It may vary from mild punctate epithelial changes to total dehiscence of the epithelial surface. The development of non-compression heads (Hansatome C&L) and dual motors to drive oscillation and translation, have resulted in reduced incidence of epithelial defects. Larger

epithelial defects are more dangerous, especially, those with connection to the flap edge. There are increased chances of epithelial ingrowth and diffuse lamellar keratitis with the presence of epithelial defects.³⁻⁵

Etiology

Epithelial toxicity subsequent to topical medications may predispose to intraoperative or postoperative epithelial defects. Anaesthetic drops pre-operatively should be limited.

Prevention

A thorough slit lamp examination is mandatory pre-operatively to rule out anterior basement membrane dystrophy⁵. Limiting eye drops pre-operatively is essential in reducing the incidence of epithelial defects.

Treatment

With minor epithelial defects the epithelium can be repositioned and a contact lens placed insitu. Pain relief may be required for twenty-four hours until the epithelium has healed. Epithelial defect increases the risk of epithelial ingrowth, and this needs to be monitored very closely in the post-operative period.

Incomplete Cap

Etiology

An incomplete cap is caused by the failure of traverse of the microkeratome.^{2,6} This may occur if the microkeratome is caught on the eyelid, lashes, speculum, loose epithelium or precipitated salts from irrigating solutions or there is a malfunction of the motor or gears. The incidence of this complication ranges from 0.3 to 1.2%.²

Prevention

Exposure is the key to preventing an incomplete flap. The use of various specula to accommodate different eye shapes is essential. With good suction it is also possible to elevate the eye, or manoeuvre the eye to obtain clearance of the eyelids. A check of IOP is mandatory to rule out inadvertent loss of suction pressure when lifting the globe. Microkeratome jamming should be minimized by meticulous cleaning of its components and by inspection of its electrical connections.

Treatment

If there is inadequate stroma exposed to accommodate the ablation, the case should be aborted. The cap is then repositioned accurately and further surgery can be

performed in three months' time, and will invariably do well. Any attempt to deliver the ablation where there is inadequate stroma will result in irregular astigmatism. In cases where retreatment is planned after 3 months, a deeper and a more peripheral cut should be planned to encompass the original area.

Buttonhole/Partial/Thin Cap

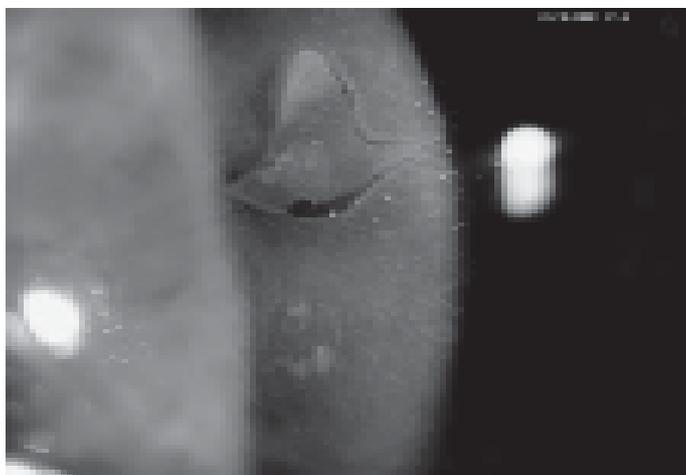
The incidence of thin flaps after LASIK varies from 0.3 to 0.75%. A flap which is $<60\mu\text{m}$ is suspicious as the thickness of the corneal epithelium is $50\mu\text{m}$. Button holes may be partial thickness if they transect the Bowman's layer or full thickness if they exit through the epithelium. The incidence of button holes varies from 0.2 to 0.56%.² A buttonhole is one of the most feared complications of LASIK surgery, because it can result in irregular astigmatism, epithelial ingrowth and significant visual loss.

Etiology

Buttonholes are associated with steeper corneas, and it has been postulated this occurs due to buckling of the cornea due to increased keratometric steepness.^{7,8} Leung et al postulate that a lack of synchronization between the translational flap keratome movement and oscillatory blade movement results in forward displacement of the tissue and hence may cause stepped, thin or button holed caps.⁷

Irregular caps may also result from damaged microkeratome blades, irregular oscillation speeds or poor suction. The poor suction is likely to be present in deep set eyes or small diameter corneas with less than optimal suction ring placement or conjunctival incarceration in the suction port generating a pseudosuction.^{2,7} The integrity of the blade is crucial to the occurrence of irregular flaps and the blade damage may occur either during manufacture or handling.² The occurrence of previous ocular surgery is also a possible risk factor for occurrence of button holes.²

Prevention



Button Hole Flap

It is essential that the keratome chosen has in good working order. Extra care is taken with patients with steep corneas. It is imperative to ensure adequate suction by checking the intraocular pressure which should be $>65\text{mmHg}$ in order to create optimal flaps. Conjunctival incarceration due to repeated suction ring application may lead to a disparity between the intraocular pressure and the actual suction pressure.

In flat corneas, the use of larger suction rings is advocated to prevent the occurrence of small flaps and in steep corneas, an utmost care should be taken to prevent button holes.

The microkeratome blade should be inspected under the operating microscope prior to its placement for evidence of any damage of the blade.

Treatment

In cases of buttonhole, the complication should be recognised early, and excess manipulation of the cap is avoided. Sufficient time is given for corneal drying and a contact lens is placed insitu. This may need to be left for twenty four to forty eight hours. No attempt is made to perform laser treatment. The patient is then followed closely over a three-month period to ensure that irregular astigmatism, haze or epithelial ingrowth does not occur. Three months later repeat surgery can be performed, planning a larger and a deeper cut. Alternatively, some surgeons advocate photorefractive keratectomy especially if the refractive error permits.⁸

Free Cap

A free cap occurs when there is unintended complete dissection of the flap. This occurs more commonly in flat corneas and was more common with the earlier microkeratomes (4.9%) as compared to the newer models (0.01 to 1%).²

Etiology

The factors responsible for free cap are similar to those of thin flaps. Failure of microkeratome reversal coupled with an inadvertent or intended release of suction may cause the occurrence of a free cap.

Prevention

Same measures as for thin flaps should be taken.

Management

If the cap cannot be retrieved, the laser ablation is aborted and the epithelium is allowed to regenerate to cover the denuded area. If the cap is retrievable, pre-placed corneal markings should be used as a guide to correctly orient and place the flap/cap in position. Laser ablation may continue while the free cap is placed in the anti-desiccation chamber. A bandage contact lens should be placed after the procedure and alternatively, some surgeons have also applied sutures.

Dislodged Flap

A dislodged flap is an emergency. It should be repositioned as soon as possible to prevent fixed folds, infection and epithelial ingrowth. The incidence varies between 1.1 to 2.0%.

Etiology

Mechanical movement by the lid action can result in flap displacement, especially if the ocular surface is dry. Larger diameter, thinner flaps and flaps with smaller hinge are more likely to get dislodged. Trauma, removal of contact lens and vitrectomy surgery may also cause the flap to be dislodged.

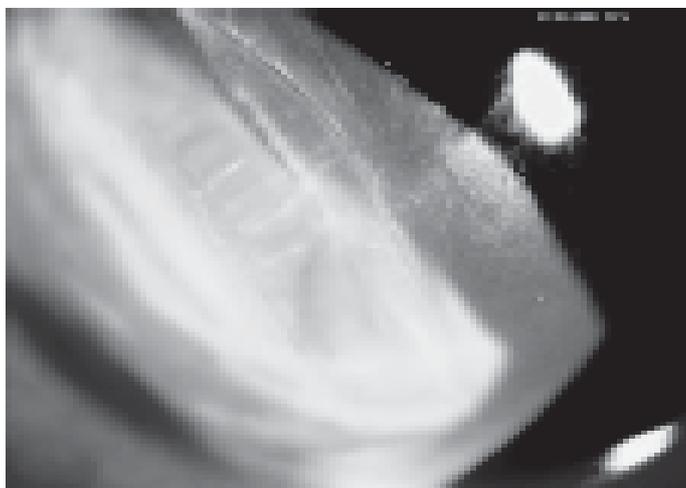
Management

The flap should be lifted and the surfaces should be inspected for any debris or epithelial ingrowth. A contact lens can then be applied after scraping the surfaces to remove epithelial ingrowth.

Prevention

A contact lens may be applied after the LASIK surgery. Patients involved in contact sports should be counselled about the risk of late flap dislocation with LASIK and such patients might be given the option of PRK especially in low refractive errors.

Striae



Dislodged Flap

Striae can either be minor and visually inconsequential, or severe and cause significant irregular astigmatism and loss of best corrected visual acuity, especially if visual axis is involved.^{2, 9, 10}

The flap striae or folds are of two types - macrofolds and microfolds. Macrofolds are easily visualized on slit lamp and are full thickness flap tenting in a linear manner.² Microfolds on the other hand are within the flap itself and

are in the form of wrinkles in the Bowman's layer or in epithelial basement membrane.¹⁰ These folds are best visualized on retro-illumination in the slit lamp.

All folds / striae in the cap/flap do not require surgical intervention as the patients may not be symptomatic. The incidence of folds requiring re-flotation of the flap varies from 0.2 to 1.5%.⁹

Etiology

The causes of striae include malposition of the cap at the end of the LASIK surgery, or dislodgement due to excessive rubbing or blinking of the eyes post-operatively. There is an increased incidence of striae with thin flaps and with a small hinge. There are more chances of striae/folds in cases of high myopes and hyperopes, as due to a greater ablation and peripheral ablation respectively, more redundant hydrated flap has to cover the corneal convexity.¹⁰

Prevention

Ensuring that the cap is well positioned at the end of the surgery is essential in the prevention of striae. The gutter should be checked to ensure that it is equal throughout the circumference of the cap, and excess hydration of the corneal flap should be avoided. This can result in fine microstriae.

Treatment

Striae are easy to manage if detected early. Ideally they are detected at the post-operative examination on the slit lamp, at which time the patient can be taken back to operation theatre and the flap is refloated.

Perforation

The most ominous intraoperative complication in LASIK surgery is anterior chamber penetration.

Etiology

Anterior chamber penetration is totally microkeratome dependent. It may occur if assembly is incorrect. This may very rarely occur during laser ablation.^{2, 11}

Prevention

There is a low risk of intraocular penetration with the newer microkeratomes. It is essential to ensure that the microkeratome is put together correctly and checked by the surgeon.

Treatment

The management of anterior chamber penetration involves immediate primary repair, and may involve cataract extraction, lens implant, iris restructuring, vitrectomy and even retinal detachment repair if it occurs.¹²

Epithelial Ingrowth

Implantation of the epithelial cells in the interface occurs

during surgery or migration of the epithelial cells under the flap.

Etiology

Most isolated nests of epithelial cells disappear without any consequences. The epithelial cells in connection with the flap edge have a bad prognosis as this may lead to irregular astigmatism with flap melting.

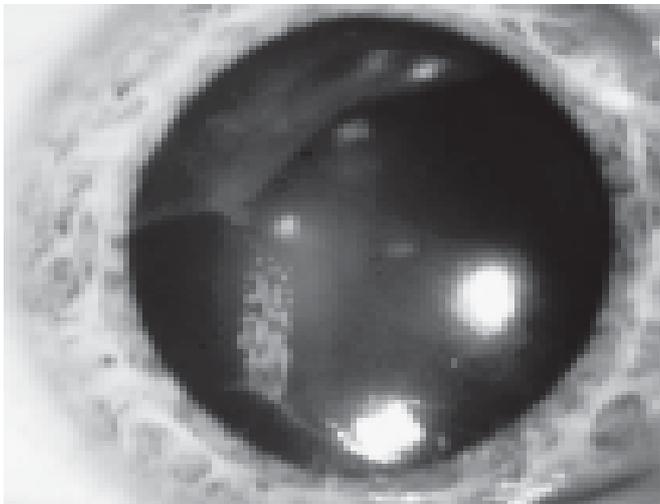
Management

Epithelial cells under the LASIK flap should be managed aggressively to prevent flap melting. The flap is lifted, the stromal bed as well as the flap surface are thoroughly irrigated and scraped and the flap is repositioned. Epithelial scraping may be done with a Bard Parker knife, dedicated instruments or even with phototherapeutic keratectomy.

Prevention

Dedicated instruments for interface manipulation should be used which do not come in contact with the surrounding epithelium. Meticulous attention should be given to avoid flap folds. Caution is mandatory especially when enhancement procedures are being undertaken.

Diffuse Lamellar Keratitis



Epithelial Ingrowth

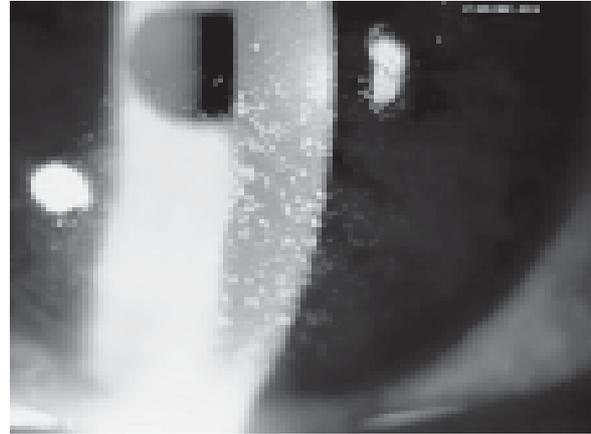
Etiology

Diffuse lamellar keratitis occurs in 0.2 to 3.2% of cases and is characterized by inflammatory cells at the interface. The cases present on the second postoperative day, are associated with pain and photophobia, are usually confined to the interface, are localized and more prevalent with epithelial defects.

Management

Frequent topical steroids in hourly dosage along with topical antibiotics are given. Systemic corticosteroids have also been tried by some surgeons with a variable response. In severe cases, flap re-lifting and irrigation may be indicated along with the topical steroids.

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Carotid Doppler in Ophthalmology

Rajiv Parikh, MS, FRCS, Tarun Grover, DNB, FNBE, Sumit Kapadia, MS, DNB, S. Agarwal, MS

Introduction:

Sudden loss of vision is an important emergency encountered in ophthalmology practice. Amaurosis Fugax (AF) or Transient Monocular Blindness (TMB) is characterized by sudden, partial or total loss of vision usually lasting for a few minutes, but occasionally as long as one to two hours. Vision invariably recovers fully¹.

The underlying cause is commonly an embolus that breaks loose from an atherosclerotic plaque in the carotid artery in the neck². Infrequently, the embolus may arise from heart during atrial fibrillation or post myocardial infarction. Other causes of sudden temporary blindness include vertebral artery stenosis and retinal artery spasm.

AF is a clinical diagnosis based on the patient's typical history: often described as "a shade coming down the vision" or visual blackout. This may be a precursor of impending cerebrovascular stroke. Evidence has shown that patients who experience either Transient ischemic attacks (TIA) or AF and have retinal emboli visible at ophthalmic exam also have a high rate of mortality. Nearly 10% of patients with an AF may have a stroke within 4 years³. Prompt evaluation is hence recommended for temporary vision loss.

On clinical examination there may be audible bruit over the carotid arteries.

Carotid Doppler

Evaluation of carotid arteries in neck should be the first line of investigation in any patient with suspected TIA or AF.

Procedure:

It is a simple noninvasive OPD procedure, which does not require any extra preparation. It can be performed in a manner similar to ultrasound of abdomen, in 10-15 minutes. This procedure is fairly accurate in spite of its operator dependence.

Advantages:

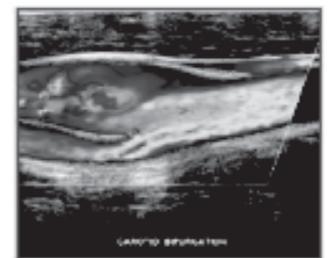
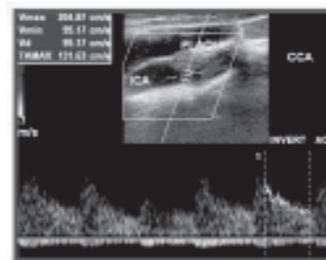
Carotid color duplex scan provides vital information about the carotid and vertebral arterial system. Grey scale imaging is useful for the plaque morphology (Fig 1). Color-flow helps detect areas of abnormal flow and Doppler

velocity waveform analysis provides quantitative measurements to determine severity of carotid stenosis (Fig2). Increase in intima-media thickness and echolucent plaques are frequently associated with cerebral ischemic events.

After a detailed carotid doppler, if a stenotic lesion is detected the patient should be referred to a Vascular and Endovascular Surgeon for carotid angiography which would confirm the location and degree of stenosis. If 70% or more stenosis is detected, the patient requires a carotid intervention to prevent debilitating hemiplegia⁴.

Conclusions:

All elderly patients with a history of diabetes, hypertension, or coronary artery disease with ophthalmic symptoms resembling AF should be assessed by a carotid Doppler to detect carotid stenosis. High-grade carotid stenosis, greater than 70% needs rectification by surgery or angioplasty (with stenting) as such measures can prevent stroke and its attendant morbidity and mortality.



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Deptt of Vascular Surgery and Noninvasive Vascular Lab.
Sir Ganga Ram Hospital
New Delhi, India

Turning Point

Dr. Gullapalli N Rao returned to India in 1986 to establish L V Prasad Eye Institute (LVPEI), after having a successful career in the United States as an academic ophthalmologist. Dr. Rao received his basic medical education in Guntur, Andhra Pradesh, and completed his postgraduate training in ophthalmology at the All India Institute for Medical Sciences, New Delhi. He went to the US in 1972, where he was trained first at Tufts University School of Medicine in Boston, and later at the University of Rochester School of Medicine. He continued to practice and teach in Rochester until his return to India to set up LVPEI, which is at the cutting edge of eyecare delivery and professional training in India. His areas of specialisation include diseases of the cornea, eye banking and corneal transplantation, and community eye health. He is currently the president of the International Agency for the Prevention of Blindness (IAPB), in which role he is at the forefront of the global initiative to eliminate avoidable blindness by the year 2020.

Turning Point

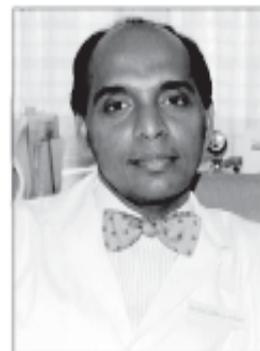
I arrived in New Delhi in June of 1970 from a small town in Andhra Pradesh with the aspiration to do residency in Ophthalmology at Dr. Rajendra Prasad Centre. What I had was a dream to learn at this great institution. I got more than I hoped. The exposure and training changed me fundamentally from becoming just a clinician to a clinician-academician. This was the first turning point and the person responsible was Prof. L.P. Agarwal.

The rigour required for research and becoming a true academician was a gift from American Institutions. The value of detailed and precise observation from Dr. Jules Baum, meticulousness of microsurgery from Dr. James V Aquavella, and the area of research from many examples. It has made me a "sensitive physician" making me realise that "the patient is the only VIP in the medical profession". In addition, I became confident, outspoken and began to appreciate my rights and fight for them. The American decade of my life was the second major turning point.

The creation of the L. V. Prasad Eye Institute was the third turning point in my life. The inspiration for the creation of the institute came from my exposure to a high quality of eye care in American institutions. My vision was to make that kind of care available to all Indians irrespective of their socio-economic status. I had an academic dream career for any ophthalmologist in the U.S – a good clinical practice, extensive publications, travelling and lecturing all over the world. Yet paradoxically, my living there made me want to

come back and do something here.

I was always driven by a passion to do something for my native land, hence I gave up my lucrative position in the U.S. and launched the hospital project. My wife and I discussed the dream project with the aim of returning to India in 1986. She had the veto power to shelve it as well. There



Dr. Gullapalli N Rao

was a sense of sadness, because we had a great life in America. But there was also tremendous excitement at the prospect of doing something so very different for India.

We informed our friends of the decision but initially nobody took us seriously. The common refrain was "no Indian goes back easily". I had studied various institutions in the U.S. looking at them with a 'different eye' to spot the best. I did a similar exercise with institutions in India. Simultaneously I prepared a blueprint and formed a foundation to raise funds. The first contribution was our four years saving in the U. S. Lots of non-resident Indians, friends and family came forward to help and soon we had \$ 500,000. The big boost to our project came when a letter to the then Andhra Chief Minister, N. T. Rama Rao got a surprisingly fast and positive response, offering us land at the outskirts of Hyderabad. Parallely the son of noted film director and philanthropist, L.V. Prasad contributed a huge amount of revenue generated from his popular movie "Ek duje ke liye". He also offered us land in Banjara Hills, a prime location in Hyderabad, which sent us truly on our way.

In the last 18 years the L.V. Prasad Eye Institute has grown beyond my dreams. Today all international organizations support it and every conceivable eye ailment can be treated here. Most people had told me of how impossible my dream was and it would be foolhardy to pursue such dreams in India. The experience and the outcome proved them wrong. It has proven that it is possible to attain excellence in India by focus, determination, perseverance and hard work, without ever compromising on the values one believes in, with no fear to speak one's mind. Friends from all over the globe participated in the creation of the institute and today its impact has indeed become global in providing excellence with equity.

*Chairman, Board of Trustees, Hyderabad Eye Institute
Founder and Former Director, L. V. Prasad Eye Institute*

Application Invited from Institutions for Holding the DOS Monthly Clinical Meetings

As per the DCRS ratings two institutions will be dropped from the monthly calendar of 2005-2006. We request all the institutions/hospitals interested in holding the DOS monthly meeting to kindly see if they fulfill the criteria given below. They may apply to the Secretary's Office with details latest by 20th August, 2005.

No meeting is held in May and June. Meetings are usually held on the last Saturday of the month.

Criteria for selection of a place:

- (a) Seating capacity of 100-200 persons, preferably AC mini auditorium / hall definitely within the premises of the institutions.
- (b) Audio Visual facilities to be available
 - moving mike 1 set
 - multimedia projector 1 set
 - double slide projectors 1 set
- (c) Institute should send the details of the meetings/CME etc., held at that institute in past 2 years to the DOS office
- (d) A sizeable staff in Ophthalmology who would be able to conduct the meeting themselves without any major outside participation as speakers/presenters.
 - Before the submission of application for holding the DOS clinical meeting, all the above mentioned criteria should be met.
 - These may be verified by President and Secretary.

– **Dr. Harbansh Lal,**
Secretary, DOS

NOTICE

ANNUAL GENERAL BODY MEETING

The Annual General Body Meeting of Delhi Ophthalmological Society will be held at Sir Ganga Ram Hospital, Rajender Nagar, New Delhi.

All members are kindly requested to make it convenient to attend.

Dr. Harbansh Lal
Secretary, DOS

FOR SALE

1. MOLLER WEDEL MICROSCOPE

Model No. Head EDS-900, Machine FS-3000
Foot switch with x-y & Zoom functions.
with CCTV attachment. In working condition.

2. CARL ZEISS MICROSCOPE

Model No. OPM 6 CFC 158068
Foot switch with x-y control.
In good working condition.

3. TOPCON MICROSCOPE

OM-5, In working condition

SRI GURU HARKRISHAN SAHIB (C) EYE HOSPITAL, SOHANA (MOHALI)
Near-Chandigarh, Punjab. Contact No. : 093161-96920
E-mail : contact@nayanjyoti.com, info@nayanjyoti.com

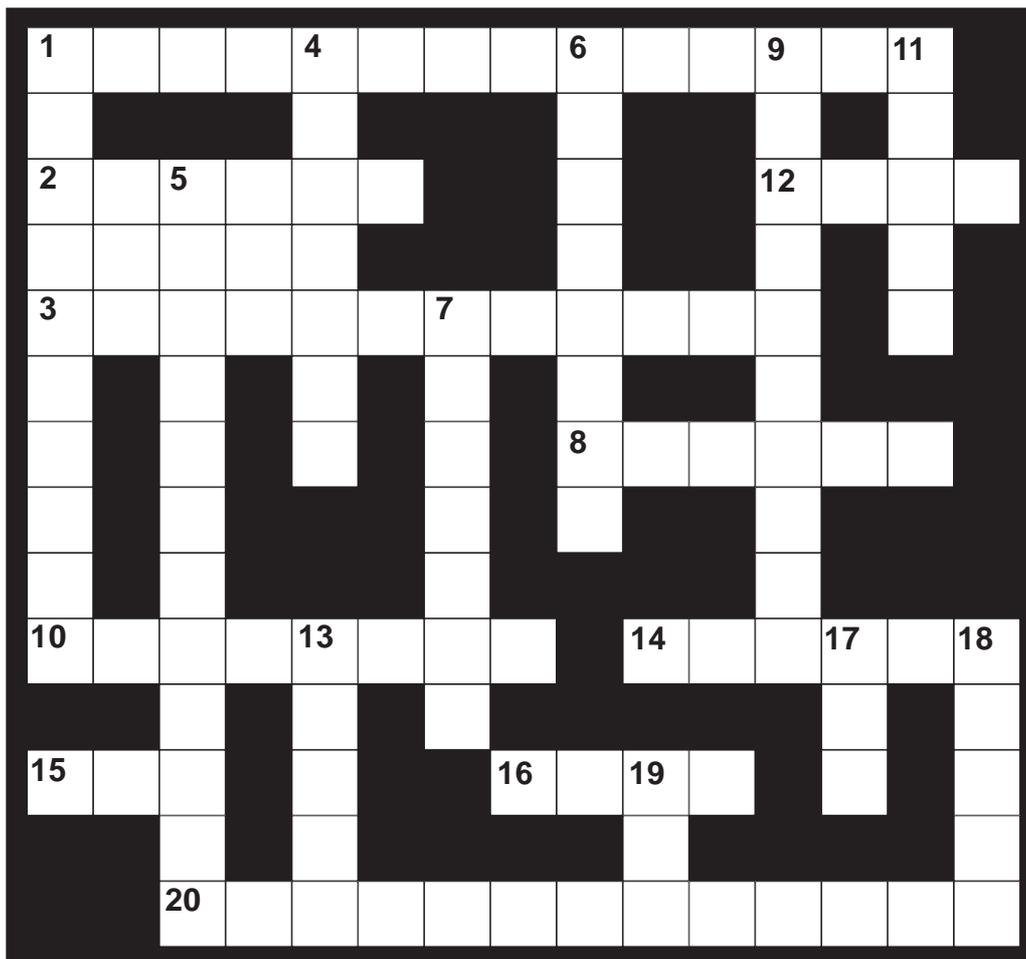
APPOINTMENT REQUIRED

RETINA SPECIALIST (M.S.)

Handsome Salary commensurate with experience.
Apply with Bio-Data, Photograph & all Testimonials.

SRI GURU HARKRISHAN SAHIB (C)
EYE HOSPITAL, SOHANA (MOHALI)
Near-Chandigarh, Punjab. Contact No. : 093161-96920
E-mail : contact@nayanjyoti.com, info@nayanjyoti.com

DOS Quiz No. 1



Across

1. Subluxation of the crystalline lens is one of the features (14)
2. The crazy bull with a rod and a wing (6)
3. Von Recklinghausen's disease is marked by these (12)
8. The brain has it, the suprarenal gland has it, the eye has it, but the good ophthalmologist removes it with a vengeance (6)
10. One of the first membranes that the ophthalmologist encounters (8)
11. As a cataract surgeon, you shed this when you see this (4)
14. Whose Lactate is this ? (6)
15. It is never premature to worry about this, (*Acronym*) (3)
16. Disc of Diffraction, atmospherically speaking (4)
20. A place to stay, perhaps furnished, but no elderly folks please (13)

Down

1. Bloody vascular swelling (10)
4. The vascular layer of the eye (7)
5. Little known colour blindness (12)
6. A round-about way of observing the retina (8)
7. Pancreatic Produce, made for global export. Its scarcity has major ophthalmic ramifications. (7)
9. It could be seen in thyroid ophthalmopathy or Duane's Syndrome. Either way, I withdraw my statement. (10)
12. Yo man, this remixed raga gels with me, for I am a man of culture (4)
13. Nerve or chiasma ? (5)
17. The nature of vitreous humour (3)
18. A model of accommodation (5)
19. 7000 Angstrom, more or less. (3)

Saurabh Sawhney, DOB, DNB

- Please send your entries to the DOS office latest by 20th August, 2005.
- Prize Rs. 500/- *Courtesy: Syntho Pharmaceuticals*