

# RetONE

A Quarterly Retina eNewsletter

## *This Issue*

*Macular Function Tests*

*Intravitreal Injections for Endophthalmitis*

*Featured Video*

*\*Intravitreal Injection Technique*



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## *From the Editors Desk*



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We thank you all to for making “Posterior Segment Conference” held on 1<sup>st</sup> Aug 2010 at Sir Ganga Ram Hospital a success.



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## Macular Function Tests Before Cataract Surgery

With the advent of phacoemulsification, expensive accommodative and multifocal IOLs, the 21<sup>st</sup> century has seen drastic change in the outlook of both patient and eye surgeon towards cataract surgery. On one hand, patient seeks medical attention at the earliest hint of visual deterioration; the surgeon also embarks upon cataract surgery on diagnosing it. However the “actual visual loss” does not equate with the “severity of cataract” and this is the most important aspect to be kept in mind by all cataract surgeons. The preoperative assessment of the patient must be done keeping this aspect in mind and macular function should be assessed so that the patient can be given realistic counseling regarding the postoperative levels of vision that can be attained.

There is battery of useful tests to judge the macular function. The retinal function testing can be divided into psychophysical and electrophysiologic methods. Few tests can be easily performed in clinic with minimum instrumentation.

<b>Table 1.</b>	
<b><i>Psychophysical tests</i></b>	5. Entoptic phenomenon
1. Visual acuity	6. Two point discrimination test
2. Pupillary reactions	7. Amsler grid
3. Maddox rod test	8. Color vision
4. Photostress test	9. Dark adaptation

<b>Table 2.</b>	
<b><i>Electrophysiologic tests</i></b>	
1. Electoretinography (ERG)	
2. Electrooculography (EOG)	
3. Visually evoked response (VER)	

## VISUAL ACUITY

Visual acuity measurement is the most common test of foveal function. The best-corrected visual acuity is a measure of actual foveolar function. Visual acuity is measured by the visual resolution of a letter, symbol or a pattern. The smaller the visual angle subtended by the parts of the test letter correctly seen by the observer, the better the resolution of his visual apparatus. **Snellen chart** can subjectively assess the drop in visual acuity corresponding to density of cataract on slit lamp examination. The **pinhole** aperture can be used to know the gross macular function as it increases the depth of focus and limits the scattering effect of corneal scars and lenticular opacities. The most useful pinhole diameter for clinical purposes (refractive errors from -5 to +5 D) is 1.2mm. In patients with macular disease the visual acuity may worsen on seeing through pin hole.

Other methods of visual acuity testing in cases of clear ocular media are Landolt C chart, grating acuity and Optokinetic Nystagmus (in children).

Laser Interferometry and Potential Visual acuity Meter (PAM) are used to measure visual acuity, if media is opaque.

## POTENTIAL VISUAL ACUITY ESTIMATION

### *Principle*

It is based on projection of visible targets through the cataract to reach retina for subjective interpretation. Laser interferometry and potential acuity meter are two of the several methods by which postoperative acuity can be estimated.

Devices for determination of potential visual acuity		
1) Guyton –Minkowski potential acuity meter <sup>1</sup>	:	Reduced snellen chart
2) Lotmar Visometer	:	Laser interferometer
3) Rodenstock	:	Laser interferometer
4) IRAS interferometer	:	Laser interferometer

### *Two basic target forms have been employed*

Firstly potential acuity meter is temporarily attached to slit lamp and uses a reduced snellen chart that is projected through a pinhole aperture onto macular region. Refractive errors are compensated. If there is improvement by four lines, this indicates good prognosis.

In second type, the potential acuity apparatus uses coherent white light or helium neon laser generated interference strips or fringes that are projected onto retinal surface. The width of fringes, corresponding to acuity is variable<sup>2,3</sup>.

Very dense opacities may yield false negative results and some cases of maculopathy may yield false positive.

### *Technique*

1. The pupils are widely dilated.
2. The light beam is directed into the center of the pupil in the plane of the iris.
3. The pupil is scanned until the fringe pattern is seen.
4. The patient is asked to indicate the orientation of the bands of light.
5. Initially, large gratings are used and then they are gradually diminished until the patient is unable to detect their correct orientation.
6. The potential visual acuity is estimated from the width of the gratings.

## **PUPILLARY REACTIONS**

The pupillary reactions should be normal even in the presence of a mature cataract and also in macular disease.

The defect usually indicates either a lesion of the optic nerve or extensive retinal disease.

## **MADDOX ROD**

The easily available Maddox rod in combination with a bright light source is a valuable dark room procedure for assessing macular function.

### *Principle*

It is a high power cylindrical lens used to form a line image from a point source of light (Fig<sup>4</sup>. 1). Every astigmatic lens produces two focal lines perpendicular to each other. The real focal line produced by a Maddox rod is formed so close to the patient's eye that patient cannot focus on it; the second focal line is a virtual focal line passing through the point light source which is perceived by the patients (Fig.2).



Fig. 1

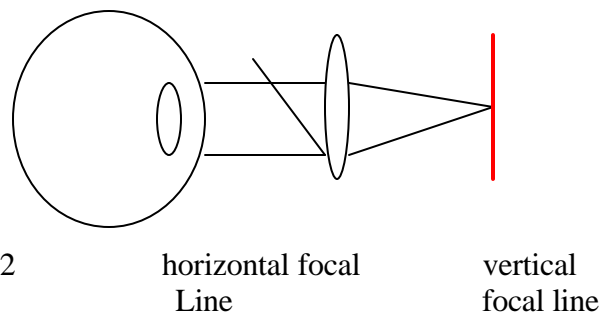


Fig. 2

### *Technique*

Maddox rod can be used as a simple test of macular function in-patient's who do not have totally opaque ocular media. Maddox rod is held in front of eye to be tested and light source is held approx. 14 inches or 35cm away (Fig 3)



- a) If patient observes an unbroken red line, one may assume macular integrity. (fig.3a)
- b) If patients observes a discontinuity in red line, this represents a large scotoma and should raise the possibility of significant macular disease.(fig.3b)

### **PHOTOSTRESS RECOVERY TIME**

This test can also be performed during routine eye examination to differentiate between macular or optic nerve pathology.

#### *Principle*

Photostress testing is a gross test of dark adaptation in which the visual pigments are bleached by light. This causes a temporary state of retinal insensitivity perceived as scotoma by the patient. The recovery of vision is dependent on the ability of photoreceptors to re-synthesize visual pigments<sup>5</sup>.

#### *Technique:*

1. BCVA is determined
2. An indirect ophthalmoscope is held about 3 cm away for 10 sec.
3. The photostress recovery time (PSRT) is the time taken to read any 3 letters of pre-test acuity line
4. Recovery time is 15 to 30 sec. in normal eyes.
5. More than 50 sec is an indication of macular disease but not in optic neuropathy.

## TESTS BASED ON ENTOPTIC PHENOMENA

### PURKINJE'S ENTOPTIC PHENOMENON

This test is based on the ability to appreciate the retinal vasculature and can even be performed with a pen torch at the bed side. First described by Goldmann who used a vertical light source 7mm away from limbus. Goldmann et al<sup>6</sup> reported that the appearance of Purkinje vessel shadows is shown to give post operative visual acuity of 6/12.

#### *Principle*

This is a subjective test to assess the function of retina. A rapidly oscillating point source of light when directed over the closed lid stimulates perception of purkinje vascular tree images. Due to rapid movement of light source the shadow of retinal vasculature falls on photoreceptors and can be appreciated as receptors fail to adapt rapidly.

#### *Technique*

This test is useful in comparing two eyes of one patient. The involved eye with opaque media is compared with assumed normal eye. The patient's ability to detect shadow images of the retinal vasculature provides a rough indication of attached retina.

### BLUE LIGHT ENTOPTOSCOPY

#### *Principle:*

This test is more specific for macular function and is based on the ability of the patient to observe the flow of white blood cells in the parafoveal capillaries which appears as shadows. Blue light is absorbed by Red blood cells but not the white blood cells<sup>7,8</sup>.

#### *Technique:*

- 1) The patient is asked to view an intense, homogenous blue light background
- 2) If the patient sees shadows macular function is probably intact.

This test has a limitation as it requires special apparatus and patients find the instructions difficult to comprehend hence rarely used.

## **TWO POINT DISCRIMINATION**

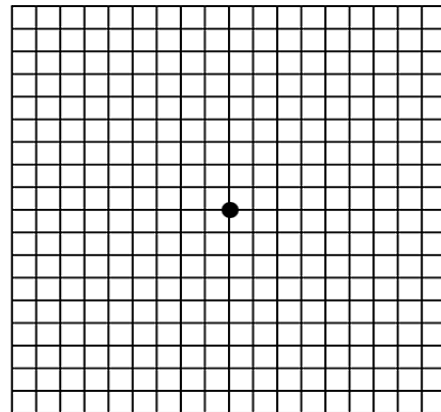
The value of this test is limited as there are no guidelines for objective assessment of results.

Two point discrimination testing follows “rule of two”. It employs two light sources of equal intensity 2mm in diameter, 2 inch apart that are 2 feet away from patient .If patient can correctly identify the two lights, retinal function is assumed intact.

## **AMSLER GRID**

Very useful screening and monitoring test for macular diseases e.g.: ARMD, retinopathies and optic neuropathies. A simple grid can be used by the patient for self assessment of macular function. Evaluates 20 degree of visual field,

Patient is instructed to wear glasses for near correction and hold the card at reading distance 33cm away, close one eye and fix the gaze on central black spot and look for interruptions in the network of small square. Ability to see all vertical and horizontal lines parallel to each other denotes normal macular function whereas perception of wavy lines or missing / faint lines are associated with macular disease and optic neuropathy respectively. It helps in diagnosing scotomas, metamorphopsias, micropsia and macropsia.



## **COLOR VISION**

Retinal function can be assessed by perception of red, green and blue colors. This test is not a good indicator of macular function as many cones are present outside foveal area. There is increased absorption of blue light in nuclear cataract so this also adds to false results.

## **DARK ADAPTATION**

This test requires special instrumentation. Useful in patients with hereditary macular degenerations. This test is not routinely done.

## *Principle*

Dark adaptation refers to the ability of visual system, both rods and cones, to recover sensitivity after exposure to light. The recovery is faster in cones but the sensitivity is greatest in the rods. Therefore the first rapid recovery is attributed to the cones and the later recovery to the rods. The dip that occurs between the cone plateau and rapid rod recovery is called the rod-cone break. Goldmann – Weekers adaptometer tests dark adaptation.

## **ELECTROPHYSIOLOGICAL TESTS**

### *1. Electroretinography (ERG)*

The clinical electroretinogram is the recording of the electrical potential waveform generated by the pre-ganglionic retina in response to a diffuse light stimulus.

The test is performed using a corneal contact lens electrode which records changes in the corneo-retinal potential with each light stimulus. The initial corneal negative a-wave is believed to emanate from the inner segments of photoreceptors and the second positive b-wave from Muller cells in the bipolar region. The b wave has three or four small wavelets known as oscillatory potential, which originate from inner retina. These wavelets require bright stimulus. These disappear in severe diabetic retinopathy, CRAO and cone dysfunction syndrome. Since ERG measures only mass response of the retina and gives no information about optic nerve pathology, hence it has less diagnostic role in macular diseases.

Multifocal ERG produces topographic maps of retinal function. Here the stimulus is scaled according to the variation in photoreceptor density. At fovea where the photoreceptor density is high, a smaller stimulus is used than periphery. A 3-dimensional plot resembling the hill of vision is produced.

Foveal ERG gives specific information from the foveal region; this can be of potential use in eye.

### *2. Electrooculography (EOG)*

The EOG measures the changes in the corneoretinal potential of the eye or the resting potential of retina. The EOG is used to assess the function of the pigment epithelium. EOG does not add information over ERG except in Best's vitelliform macular dystrophy. Therefore this test is done only for experimental and teaching purpose.

### *3. Visually Evoked Response (VER)*

The visually evoked response measures the electrical potential generated in response to a visual stimulus. It is recorded with scalp electrodes placed over the occipital lobe region, a cortical area with primarily macular representation.

Clinical usefulness of VEPs includes the following:

1. Beneficial in infants , malingering , mentally retarded and aphasic patients.
2. Objective and reproducible test for optic nerve function
3. Helpful to establish optic nerve function in patients with subjective complaint of visual loss; normal VEP excludes significant optic nerve disorder
4. More sensitive and Inexpensive than MRI or physical examination in prechiasmatic lesions

There are many different techniques of foveal stimulation in VER testing.

One method uses diffuse light stimulus flashes, which are applied intermittently. This method is most useful in the assessment of suspected monocular pathology.

In the second method retina is stimulated by a patterned stimulus. One such pattern represents alternating dark and light bars in the form of a sinusoidal grating. The light bars become dark and the dark bars become light with the pattern reversing at a constant rate while a third technique employs a checkerboard pattern stimulator with alternation of dark and light checks.

The usefulness of the VER in detecting lesions of the macula must be inferred by the fact that the ultimate record reflects neural transmission.

VER has potential use in detecting optic nerve diseases (optic neuritis, compressive lesions), unexplained visual loss following head injury, glaucoma and amblyopia. It is a useful diagnostic tool for ophthalmologists.

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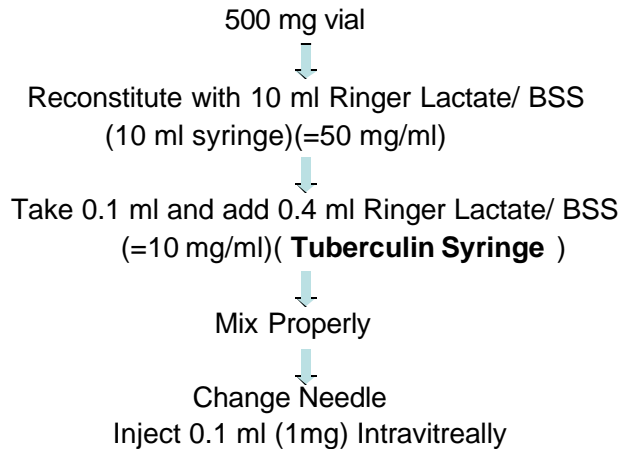
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4. Photograph courtesy of Kveim M Miller, MD
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## DOSES FOR INTRAVITREAL DRUGS

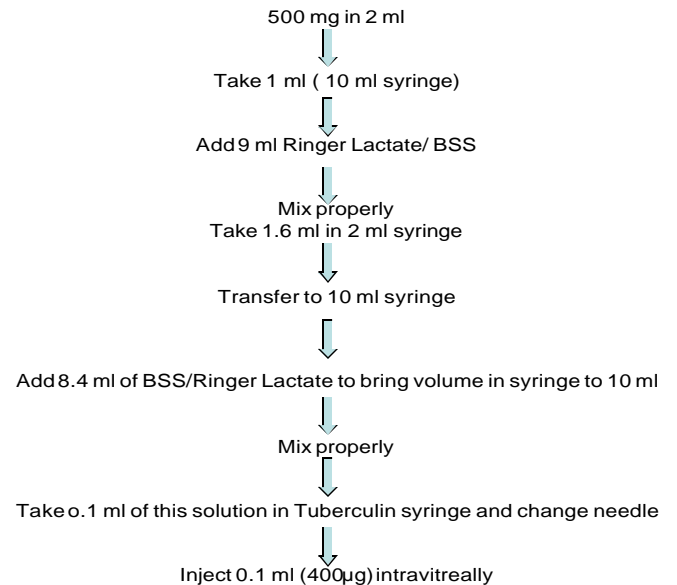
### VANCOMYCIN

( Intravitreal Dose 1 mg in 0.1 ml )



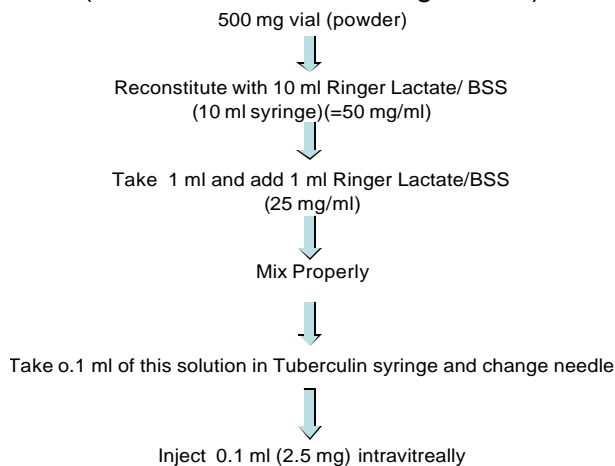
### AMIKACIN

( Intravitreal Dose 400µg in 0.1 ml )



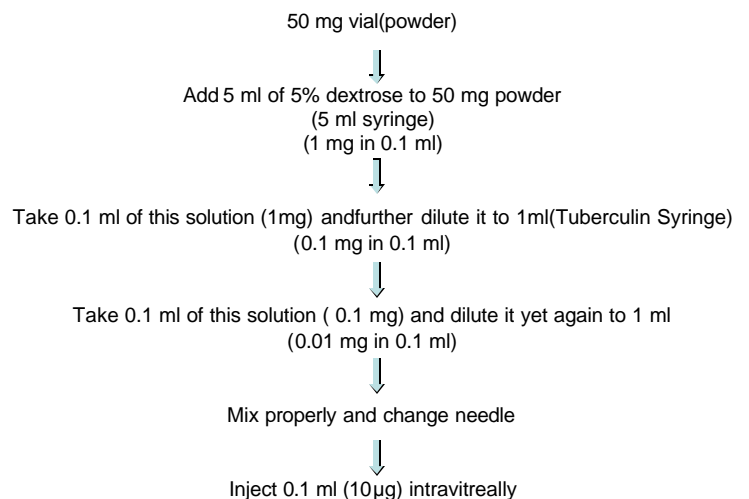
### CEFTAZIDIME

( Intravitreal dose 2.25 mg/0.1 ml )



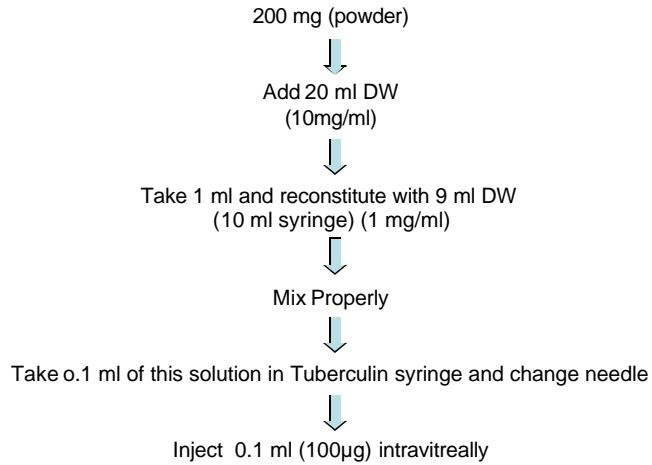
### AMPHOTERICIN B

( Intravitreal Dose 5 -10 µg in 0.1 ml )



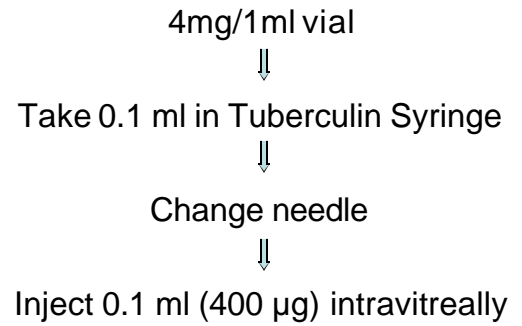
## VORICONAZOLE

( Intravitreal dose 50-100 µg/0.1 ml)



## DEXAMETHASONE

( Intravitreal dose 400µg in 0.1 ml )



# How to administer

## *Salient points*

- Use 30G, ½ inch needle.
- After loading don't mix injections in one syringe.
- Inject at pars plana route; 3.0, 3.5, 4.0 mm from the limbus in aphakic, pseudophakic and phakic patients respectively, preferably inferotemporally (away from visual axis)
- Inject with needle bevel up, facing towards globe.
- Intravitreal Injection should be given in drop by drop manner, slowly in rotatory motion.
- After injecting raise the head of patient.

## **NOTES:**

1. Prepare under aseptic conditions.
2. Sterile Needle should be taken and changed at every step of dilution

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