Theme section

Tests for Potential Vision

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Abstract

Macular function tests are applied for diagnosis and follow up for macular diseases and for assessing potential macular function in eyes with opaque media. One subset of such tests, the Potential vision tests have been devised to assess whether patients with impaired vision have the potential to benefit from cataract surgery. Many such tests have been described in literature namely : 1)Potential Acuity Meter 2)Laser Interferometry (retinometre, visometre) 3)Critical Flicker Fusion Frequency. A brief overview will hereby be presented in the following article.

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Keywords:*Macular Function Test, PAM, Laser Interferometry*

INTRODUCTION

We so readily use our eyes to organize and process information that we ignore the remarkable adjustments our eyes make to view the world around. The anatomical and biological processes transforming myriad of photons falling on the photoreceptors is a place of great scientific curiosity and interest.

Macular Function Tests

Applied for diagnosis and follow up for macular diseases and for assessing potential macular function in eyes with opaque media. The macular function tests are classified as below:

a) Tests in clear media
b) Tests in opaque media

TESTS IN CLEAR MEDIA	TESTS IN OPAQUE MEDIA
a)Visual Acuity	a) Maddox rod test
b)Contrast Sensitivity	b) Focal ERG
c)Slit-lamp Bio microscopy	c) Laser interferometry
d)Photo-stress test	d) Potential Vision Tests
e)Colour vision	e) VEP
f)Amsler grid	f) Entoptic phenomenon
g)Two-point discrimination	
h)Microperimetry	
i)FFA	
j)OCT	

Potential vision tests have been devised to assess whether patients with impaired vision have the potential to benefit from cataract surgery. Therefore, it is also important to determine whether impairment in vision is solely due to cataract or some other co-existing retinal, neural pathology which might limit the results of a successful cataract surgery. Many such tests have been described in literature namely-

1) Potential Acuity Meter
2) Laser Interferometry (retinometre, visometre, SITE-IRAS)
3) Critical Flicker Fusion Frequency

Potential Acuity Metre Test

It is a slit-lamp mounted instrument which produces a point light source of 0.15mm diameter, in the pupillary plane which is directed through clear areas of cataractous lens. It was first described in 1981.

Procedure

1. An incandescent light source mounted on a slit lamp that is set to the lowest magnification is used to generate an aerial image of a miniature Snellen chart with a 6 0 field of view.
2. The instrument must be focussed to account for patients ametropia.
3. Pupil dilation is preferable as it may allow the light to be passed through less dense areas of the cataract.
4. After dilating the pupil, the patient is asked to read the projected Snellen's chart. 3
5. The objective is to focus the beam onto the patient's retina through the cataract.The patient is encouraged to read the lines until no other smaller lines are comprehendible and this process shall continue until the examiner is certain that the patient cannot read further lines.
6. In case a patient reads three characters of a certain line then the visual acuity is established.

Advantages

1) Strong positive correlation of PAM with Snellen's VA in normal retinas
2)Useful in early-moderate cataracts
3) High myopes with long axial lengths
4) Predicting VA before Nd: YAG capsulotomy, macular hole surgery

Figure 1: *Potential Acuity Metre*

Disadvantages

1) Prediction depends on patients' activity, compliance with examination, making adjustments to head position, literacy and mood.
2) Underestimates potential acuity in severe cataracts
3) Underestimates potential acuity in patients with Pre-op VA<20/200
4) Underperforms in posterior subcapsular opacities.
5) Accuracy of PAM predictions could be reduced by spherical aberration from peripheral parts of the optic media.
6) PAM overestimates retinal VA in cystoid macular oedema, early post-op retinal detachments, serous retinal detachments
7) Erratic results in patients with severe glaucomatous damage

Thus, PAM is a simple, slit lamp-based procedure to assess potential VA in patients with early to moderate cataracts with normal retina. But cognizance of the fact should be taken to not obviate the benefit from cataract surgery based solely on underperformance in Potential Acuity Metre testing.

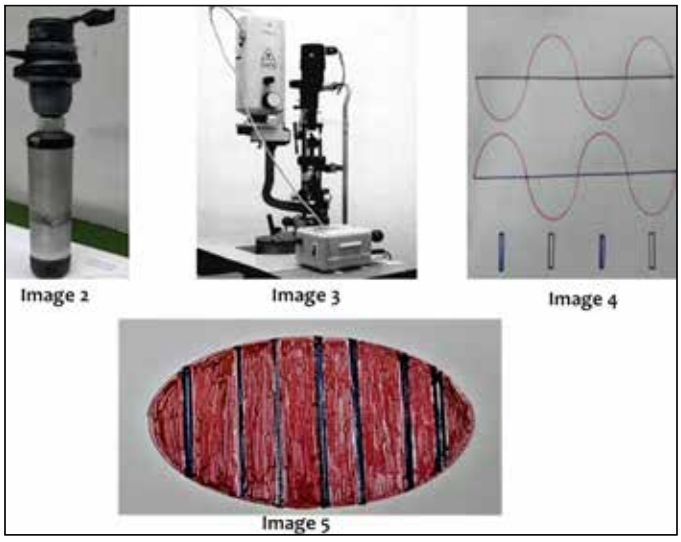

Figure 2,3,4,5: **(2)** *Handheld LI* **(3)** *Slit-lamp mounted LI* **(4)** *Coherent light beams* **(5)** *Diagrammatic representation of Interference Fringes*

Laser Interferometre

Laser interferometry employs the use of two coherent light beams for production of a three-dimensional interference fringe on the retina. Varying the distance between the light beams enabled in changing the fringe width which correspond to different interference visual acuities with the Snellen equivalent from 20/660 to 20/20, independent of the optics of the eye.

Procedure

1. The patient should be familiarised with the possible fringe patterns before starting the test.
2. The patient should not be subjected to prolonged light testing and should be explained that scotomas may be seen but these are to be ignored.
3. The patient is seated in front of the apparatus mounted on a slit lamp in a dark room with dilated pupils and broad vertical stripes in a circular field are shown. A hand-held interferometer may also be likewise used.
4. The patient is asked to indicate the direction of the fringes – vertical, horizontal or oblique.
5. If the patient is able to see the fringes, they are gradually made finer until they disappear.
6. The patient's end point fringe pitch decimal reading is read off from one of the knobs and converted to Snellen's equivalent, using the conversion table supplied. The circular field size can vary from 2 -8 degrees. [14]

Table 1 compares PAM with LI

Table 1 : PAM *VS LI*

PAM	LI
Field Projected- 6^0	Field Projected- $2\text{-}8^0$
Altered By Refractive Status Of Eye	Unaffected By Optics Of Eye
Underestimates Va In Severe Cataracts Profoundly	Less Profound Effect
Does Not Overestimate	Overestimates Va In Amblopic Patients
Accurate In Exudative Armd	Accurate In Atrophic Armd

Advantages

1) Good predictor in mild to moderate cataract.
2) Less influenced than Snellen's visual acuity by: a) clarity of media, ametropia, surface irregularities, orientation of photoreceptors.
3) Very reliable in High myopes (AL>29mm) with moderate cataracts.

Disadvantages

1) Overestimates VA in Central macular oedema, early post-operative retinal detachment
2) Overestimates VA in Geographical atrophy, macular holes and cysts
3) Miscalculates VA in Serous macular detachments, visual field defects through fixation
4) Overestimates VA in Amblyopia
5) Unreliable in dense immature and mature cataracts
6) Underestimates visual outcome in posterior subcapsular cataract

Laser Interferometer is thus a simple test that can be applied to assess potential vision in patients awaiting cataract surgery. However, the test results should be interpreted with caution in situations mentioned above.

Thus, the review of literature suggests PAM and LI are particularly useful in moderate cataracts. Although the results of both these tests may not concur in various scenarios such as severe cataracts, retinal disorders etc but when used together they supplement one another.

Other Potential Acuity Tests

Critical Flicker Fusion Frequency (CFFF)

It is defined as frequency at which flickering light appears to be continuous, a function of temporal visual processing.

Figure 6: *CFF Apparatus* [18]

Advantages

1) Useful in dense cataracts
2) Sensitive indicator of retinal and optic nerve disease
3) Small macular lesions can be assessed

Disadvantages

1) Overlooks small foveal lesions

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