

## Exploring The Prognostic Value of Conventional Macular Function Tests in Comparison to B Scan Ultrasonography in Mature Cataract in Government Set Up

Trupti A Bhesaniya<sup>1</sup>, Priti R Kapadia<sup>2</sup>, Devangi V Patel<sup>3</sup>

### How to cite this article:

Trupti A Bhesaniya, Priti R Kapadia, Devangi V Patel. Exploring The Prognostic Value of Conventional Macular Function Tests in Comparison to B Scan Ultrasonography in Mature Cataract in Government Set Up. *Ophthalmol Allied Sci.* 2020;6(3): 149-154.

**Author Affiliation:** <sup>1,3</sup>Senior Resident, <sup>2</sup>Professor and Head, Department of Ophthalmology, Government Medical College, New Civil Hospital, Majuragate, Surat 395001, India.

**Corresponding Author:** Trupti A Bhesaniya, Senior Resident, Department of Ophthalmology, Government Medical College, New Civil Hospital, Majuragate, Surat 395001, India.

**E-mail:** [ptrupti430@gmail.com](mailto:ptrupti430@gmail.com)

### Abstract

**Aims:** To assess the prognosis in eyes having Mature cataract by Conventional Macular Function tests and B- Scan Ultrasonography, to analyses the utility of both in Mature cataract and to compare the post-operative status in relation to results of both.

**Design, Methods and Material:** A hospital-based Cross-sectional study was conducted on 177 patients with mature cataract from July 2018 to August 2019 in a Tertiary care hospital in South Gujarat. The Conventional macular function tests like Pupillary light reaction, Projection of light and Perception of rays, Color vision test, Maddox rod tests, Two-point discrimination test and B Scan were performed.

**Statistical analysis used:** Data collected and put in excel sheet and were analyzed using Statistical Package for the Social Sciences (SPSS) 16.0 software. For the descriptive analysis, the mean, standard deviation, and percentage were used. The chi-square test applied for the comparative analysis. A p value < 0.05 was considered be statistically significant.

**Results:** Age range was 25 to 90 years with mean age of 58 years. 75 patients were male and 102 females. Pupillary light response was normal in majority of cases. Color vision was normal in all the patients. Binocular Maddox rod test revealed red spot in 63.3%, polyopia in 28.2%, and white spot in 8.5% patients. Majority of the patients with abnormal B Scan had white spot response on Maddox rod test. In hyper mature cataract, majority of the patients were not able to discriminate or had short discrimination distance. Most of the patients with abnormal B scan findings were not able to discriminate. B Scan ultrasonography was normal in 61.2% patients. 34.4% patients had Vitreous detachment, vitreous haemorrhage seen in 1.7%, posterior staphyloma in 1.7%, 0.50% had retinal detachment and 0.50% had vitreous haemorrhage with Retinal detachment.

**Conclusion:** Conventional macular function tests were altered when there was an evident posterior segment abnormality seen on B Scan. So, in setup where B Scan Ultrasonography is not available, the conventional macular function tests do help in cases of mature cataract.

**Keywords:** Mature cataract; Conventional macular function tests; B-Scan Ultrasonography.

### Introduction

Cataract has been documented to be the most significant cause of blindness in India. The most

recent estimates from WHO reveal that 47.8% of global blindness is due to cataract and in South Asia region which includes India, 51% of blindness is due to cataract.<sup>1</sup>

Cataract is the commonest surgery performed worldwide. In India, being the developing country, patients having mature cataract are much more. It is very important to give prognosis of visual function which will be obtained following the extraction of a mature cataract. In case of immature cataract, the ophthalmoscopic examination of the fundus provides a source of considerable information concerning the function of the retina. In presence of mature cataract however, fundoscopic examination becomes impossible due to the obstruction of the light pathway by the opacity of the media.

Macular function tests available for opaque media are Maddox rod, Two-point discrimination test, Entoptic phenomena, Laser interferometry, Potential visual acuity meter test, Focal Electroretinography, visually evoked potential.<sup>2</sup> Minimum facilities available in government set up. So, options remain with us are pupillary reaction, projection of light and perception of rays, color vision test using red and green torch light, Maddox rod test and Two-point discrimination test.

Ultrasound was first used in ophthalmology in 1956 by American ophthalmologists MUNDT and HUGHES.<sup>3</sup> They used A scan mode to evaluate an intraocular tumor. B-scan was introduced in ophthalmic practice by BAUM and GREENWOOD in 1958.<sup>3</sup> However, it was not until 1972, when Bronson and Turner produced the first contact B scan method, that ultrasonography became a more practical investigation B scan mode is more useful than A scan for a better demonstration of the shape and topographic relationship of lesions in the posterior segment.

The Government hospitals receives huge pool of cataract patients. Routine evaluation of all patients with advanced cataract by ultrasonography is time consuming and of questionable cost-effectiveness. B-scan can provide information regarding the posterior segment pathologies like vitreous hemorrhage, vitreous detachment, retinal detachment, chorioretinal thickening, posterior staphyloma which helps in explaining accurate prognosis post-operatively. Though some disorders such as branch and central retinal vein occlusion, macular hole, diabetic maculopathy, optic nerve affections cannot be identified by B-scan.<sup>4</sup> So the conventional macular function tests performed and compared with B-Scan ultrasonography will give good idea of its utility in comparison to B-scan.

## Methods

A hospital-based Cross-sectional study (Descriptive)

was conducted on 177 patients with Mature cataract attending the outdoor patient department in The Government Medical college, Surat, Gujarat, India. Informed consent was taken from the patients participating in the study. All the patients enrolled in the study were evaluated during a period from July 2018-August 2019. The patients were examined and investigated thoroughly as per the protocol.

The inclusion criteria were: All adult patients with mature cataract who gave consent for the study and either sex.

The exclusion criteria were patients with: immature cataract, mature cataract having recorded posterior segment abnormalities and traumatic mature cataract.

A detailed history of patients was taken. Diagnosis of mature cataract put if the patient had no glow observed on direct ophthalmoscopy and slit lamp examination.

### *Ophthalmic examination*

Following Conventional macular tests were performed in Dark room:

*Pupillary light reaction:* Pupillary evaluation was carried out with low background illumination using a bright focused torch light with the patient looking into the distance.

*Projection of light and Perception of rays:* The perception of light was assessed by throwing light on to the eye to be examined occluding the other eye in the dark room. The patients were asked to identify the direction from which the light was coming by projecting light from various directions (superior, inferior, nasal and temporal). They were classified as PL+ PR+4 when patients correctly identify all 4 directions, and put as? PR when patients' answers were different at different time.

*Colour vision test:* In case of mature cataract, assessment of color vision cannot be done by using Ishihara and other tests which are used in clear media. So, we have checked color vision by using red and green filters to check the primary colors.

*Maddox rod tests:* Maddox rod test 1: Patients were made to sit 1 meter away from a bright electric bulb and Maddox rod was placed in front of the eye to be examined, other eye being open, and patients were asked about what they see. Answers were recorded in their language as polyopia when patient saw multiple red line and multiple red spots, red spot

when they saw only one red spot and negative Maddox rod when they saw white spots.

Maddox rod test 2: Patients were made to sit 1 meter away from a bright electric bulb and Maddox rod was placed Infront of the eye to be examined, other eye being occluded, Maddox rod was rotated in three meridians, vertical, horizontal and oblique; and patients were asked about seeing a line, its color, continuity, direction and straightness. Answers were graded as below\*:

Grade-1: Correct direction (in all three positions), Continuity, Straightness, Correct color, Grade-2: Correct direction (in all three positions), Straightness but broken line, Correct color, Grade-3: Only correct direction and color (Not definite about straightness and continuity) and Grade-4: Cannot interpret anything correctly but color.

\*Dubey A. K. et al[5]

*Two-point discrimination test:* It was done by putting a card board with two illuminated pin holes of size 2mm, 2 inches apart, placed 2 feet away from the eye to be tested. The patient was then asked to indicate whether he can perceive the two points separately or not, and answer were taken as “yes” or “no”. If they can’t perceive, the card board then moves towards the patient and distance measured at which they can perceive two points separately.

### B-Scan ultrasonography

The patients were made to lie supine on the examination table. They were evaluated using ultrasound machine OTI Scan 3000 equipped with a real- time linear high-frequency probe of 10 MHZ placed in ophthalmology department. Contact method of examination was used. The probe was placed over the closed eyelid after application of coupling gel. B-scan pictures were obtained in axial, transverse, and longitudinal sections. The lowest possible decibel gain consistent with the maintenance of adequate intensity was used to optimize the resolution of images.

Evaluation of fundus on dilated pupil on post cataract surgery day-1 by Heine’s Indirect ophthalmoscope with 20 D lens for detailed retinal examination to note posterior segment abnormalities which is not diagnosed by conventional macular function tests and B Scan Ultrasonography and also to correlate positive findings with the condition.

### Statistical analysis

Data collected and put in excel sheet and were

analyzed using Statistical Package for the Social Sciences (SPSS) 16.0 software. For the descriptive analysis, the mean, standard deviation, and percentage were used. The chi-square test applied for the comparative analysis. A p value < 0.05 was considered be statistically significant.

### Observations and Results

A total 177 patients having Mature cataract were included in this study.

Most common age group having mature cataract was 41–60 years and mean age was 58 years (Table 1). Total 75 (42.4%) males and 102(57.6%) females. 168(95%) patients had unilateral mature cataract and 9(5%) patients had bilateral mature cataract. 23(13%) patients had nuclear mature cataract, 122 (69%) patients had cortical mature cataract, and 32 (18%) had hyper mature cataract.

**Table 1:** Age wise distribution of Study Population.

Age group (years)	No of Patients (n=177)	Percentage
Less than or equal to 40 years	15	8.5
41-60 years	95	53.7
61 - 80 years	62	35
> 80 years	5	2.8
Total	177	100

Mean ± SD: 58.76±12.1 years, Minimum 25 years, Maximum 90 years.

Most of the patient had visual acuity PL+PR+4 (54.2%) and 38.4% had HM+PL+PR+4 (38.4%). All patients were able to follow light and had projection of rays in all four quadrants except 4 cases (3.3%). Pupillary light response was normal in majority of patients. Relative afferent pathway defect seen in 5 cases (2.8%). Color vision was normal in all the patients.

Binocular Maddox rod test revealed red spot in 63.3%, polyopia in 28.2%, and white spot in 8.5% patients. Polyopia seen more commonly in nuclear mature cataract. Red spot was most common Maddox rod test response in Cortical mature cataract. Hyper mature cataract patients saw only White spot. On unocular Maddox rod test, majority of patients’ response was Grade-3 (57%), followed by Grade 4 (36%). 8% patients did not fit in any grades. Majority of the patients with abnormal B Scan had white spot response on Maddox rod test. Association between Maddox rod test and B Scan Findings was statistically significant (Table 2).

**Table 2:** Association between Maddox rod test and B Scan Findings.

Maddox rod test	B Scan Findings		
	WNL	Abnormal	Total
Polyopia	48	2	50
Red spot	109	3	112
White spot	12	3	15
Total	169	8	177

Chi square- 9.241, dof-2, p value-0.0098.

Majority of Cortical and nuclear mature cataract patients had Two-point discrimination test distance between 26–30 CM (24.9%). In hyper mature cataract, majority of the patients were not able to discriminate or had short discrimination distance. Most of the patients with abnormal B scan findings were not able to discriminate. Association between Two Point Discrimination test and B Scan Finding was statistically significant (Table 3).

**Table 3:** Association between Two Point Discrimination test and B Scan Finding.

Two Point Discrimination test	B Scan Findings		
	WNL	Abnormal	Total
10–15	22	2	24
16–20	37	1	38
21–25	38	0	38
26–30	44	0	44
Not able to discriminate	28	5	33
Total	169	8	177

Chi square- 13.65, dof-4, p value-0.008.

B Scan ultrasonography showed no abnormality in the posterior segment in 61.2% patients. 34.4% patients had vitreous detachment. vitreous haemorrhage seen in 1.7%, posterior staphyloma in 1.7%, 0.50% had retinal detachment and 0.50% had vitreous haemorrhage with Retinal detachment (Table 4). None of the patient with abnormal B Scan finding had RAPD, p value of chi square test 0.622 which was statistically insignificant. On comparing B Scan ultrasonography with conventional macular function tests, it was observed that B scan could not diagnosed pathologies like diabetic retinopathy, optic atrophy, macular scar, CRVO.

**Table 4:** Distribution of cases as per B Scan Ultrasonography findings.

Findings of B-Scan	No of Patients	Percentage
VH with RD	1	0.5
RD	1	0.5
Posterior Staphyloma	3	1.7
VH	3	1.7
VD*	61	34.4
WNL	108	61.2
Total	177	100

On post-operative fundus examination, 88.1% of the patients had no abnormalities in the fundus of the eye. The most common fundus finding seen post operatively was Diabetic retinopathy (2.3%), macular scar in 1.7%, optic atrophy in 1.7% and posterior staphyloma in 1.7%. Macular edema seen in 1.1%, CRVO with macular edema in 0.5%, macular hole with BRVO in 0.50%, mild disc pallor in 0.50%, and dry ARMD in 0.5% (Table 5).

**Table 5:** Distribution according Post OP fundus examination.

Post OP fundus examination	No of Patients	Percentage.
Crvo With Macular Edema	1	0.5
Dry Armd	1	0.5
Macular Edema	2	1.1
Macular Hole With Brvo	1	0.5
Macular Scar	3	1.7
Mild Disc Pallor	1	0.5
PDR	4	2.3
Optic Atrophy	3	1.7
Posterior Staphyloma	3	1.7
WNL	158	88.1
Total	177	100

## Discussion

It is very important to give visual prognosis to all the patients of mature cataract preoperatively who undergo cataract surgery. Various tests are available for retinal function. These tests are easy to perform in case of immature cataract in which the media is clear. But in presence of mature cataract it is a real challenge to give the visual prognosis.

Age range of patients in our study was 25 to 90 years. Most of the patients were in the range of 41 to 60 years of age. Similar study conducted by Kanarek I. et al,<sup>6</sup> in their study, age ranged from 11–86 years with majority being in the older age group (65 years and above).

In present study, among the study population, total 75 (42.4%) males and 102(57.6%) females. Female preponderance can be explained as, male population is working group, so they become vigilant with minimal symptoms as well and seek health care facility earlier. Whereas, females are busy with looking after family, so they seek medical care a bit later stage.

Out of 177 patients, 168(95%) patients had unilateral Mature cataract and 9(5%) patients had bilateral Mature cataract. 23(13%) patients had nuclear mature cataract, 122 (69%) patients had cortical mature cataract, and 32 (18%) had hyper mature cataract. In a study done by Salman A. et



al<sup>7</sup>, 24 patients had bilateral dense cataract, 310 eyes (74.2%) had mature cataract, which is comparable with our study, and 41 eyes (9.8%) had hyper mature cataract, which was high as compare to our study.

Most of the patient had visual acuity PL+PR+4 (54.2%) followed by HM+PL+PR+4 (38.4%). All patients were able to follow light and had projection of rays except 4 cases (3.3%). A conducted by Kanarek I. et al<sup>6</sup>, nine of the ten patients were able to follow light and had fair to good projection. Pupillary light response was normal in majority of patients. Relative afferent pathway defect seen in 5 cases (2.8%). All had normal color vision.

Most common response of binocular Maddox rod test was red spot in 63.3%, polyopia in 28.2% and white spot in 8.5% patients. On unocular Maddox rod test, majority of patients' response was Grade-3 (57%) and Grade-4 in 36%. 8% patients did not fit in any grades. In the study conducted by Dubey A. K. et al<sup>5</sup>, Grade-1 response to Maddox rod test was the most common, which may be due to the sample size being immature cataract. On binocular Maddox rod test, polyopia seen more commonly in nuclear mature cataract. Red spot was most common Maddox rod test response in Cortical mature cataract. Hyper mature cataract patients saw only White spot.

Majority of patients had Two-point discrimination test distance between 26–30 CM (24.9%), followed by 21–25 CM and 16–20 CM (21.5%). 18.6% patients were not able to discriminate and 13.6% had shortest two-point discrimination test distance. Dubey A. K. et al<sup>5</sup> conducted a study, in which only 8 cases answered positively to two-point discrimination test, rest 72 cases gave variable answers at 2 feet distance. In hyper mature cataract, majority of the patients were not able to discriminate or had test distance range of 10–15 cm.

The ultrasonographic examinations revealed that 61.2% of the patients did not show any abnormalities in the posterior segment of the eye, 34.4% patients had vitreous detachment (VD) which was considered as normal finding as it had no effect on visual prognosis and can be a natural occurrence during senescence. Vitreous hemorrhage seen in 1.7%, posterior staphyloma in 1.7%, 0.50% had retinal detachment and 0.50% patients had vitreous hemorrhage with Retinal detachment. Most common B-Scan finding was vitreous detachment. A study conducted by Qureshi et al<sup>8</sup>, in non-traumatic cataract patient group observed that b-scan ultrasound detected retinal detachment in 1.47%, vitreous hemorrhage

in 1.91%, posterior vitreous detachment in 1.03%, posterior staphyloma in 1.32%, and no pathology in 93% patients. We observed low incidence of retinal detachment in our study i.e. 0.5% as compared to 1.47% in their study. No pathology was observed by us in 61.2% patients as compared to them in 93%. Posterior vitreous detachment incidence was high in our study 34.4% as compared to 1.03%.

On post-operative fundus examination, 88.1% of the patients had no abnormalities in the fundus of the eye. The most common fundus finding seen post operatively was Diabetic retinopathy (2.3%), macular scar in 1.7%, optic atrophy in 1.7% and posterior staphyloma in 1.7% patients. Macular edema seen in 1.1%, CRVO with macular edema in 0.5%, macular hole with BRVO in 0.50%, mild disc pallor in 0.50%, and dry ARMD in 0.5%. On post-operative fundus examination, it was observed that B Scan ultrasonography could not diagnosed pathologies like PDR, optic atrophy, macular scar, CRVO. Association between Maddox rod test and Two point discrimination test with B Scan Findings was statistically significant.

## Conclusion

It was observed that, the conventional macular function tests like papillary reaction, maddox rod test and two point discrimination test do indicate the prognosis in patients of mature cataract having severe diabetic retinopathy, optic atrophy or macular scar.

B Scan ultrasonography is a useful investigation to see major posterior segment abnormalities like vitreous haemorrhage, different types of retinal detachment, asteroid hyalosis, choroidal detachment etc. But the optic nerve and macular pathologies were not revealed on B Scan Ultrasonography.

On comparing the conventional macular function tests with B Scan ultrasonography, we found that Conventional macular function tests were altered when there was an evident posterior segment abnormality seen on B Scan. So, in setup where B Scan Ultrasonography is not available, the conventional macular function tests do help in cases of mature cataract.

## References

1. Kumar J, Prasad K, Nathram A. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN:

- 2279-0853, p-ISSN: 2279- 0861. Volume 17, Issue 4 Ver. 15 (April. 2018), PP 29-32.
2. Kumar V. Psychophysical and other clinical macular function tests. Chaudhari Z, Vanathi M. 1st ed, postgraduate Ophthalmology. New Delhi: Jaypee Highlights;2012; p.1142.
  3. Mundt GH, Hughes WF. Ultrasonics in Ocular Diagnosis. American journal of ophthalmology. 2018 May 1;189: xxviii-xvi.
  4. Chanchlani M, Chanchlani R. A Study of Posterior Segment Evaluation by B-Scan in Hyper Mature Cataract. J Clin Exp Ophthalmol. 2016;1(7):516.
  5. Dubey AK, Masani PH, Shroff AP. Quantitative assessment of conventional macular function tests in cases of cataract. Indian journal of ophthalmology. 1983 Dec 1;31(7):895.
  6. Kanarek I, Venable HP. Diagnostic testing of retinal function in the presence of mature cataracts. Journal of the National Medical Association. 1966 Jul;58(4):284.
  7. Salman A, Parmar P, Vanila CG, Thomas PA, Jesudasan CN. Is ultrasonography essential before surgery in eyes with advanced cataracts? Journal of postgraduate medicine. 2006 Jan 1;52(1):19.
  8. Qureshi MA, Laghari K. Role of B-Scan Ultrasonography in pre-operative cataract patients. International journal of health sciences. 2010 Jan;4(1):31.
-