Original Research Article

A study of normative data for automated perimetry in Indian population

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Abstract

Aim: To formulate normative data and to increase domain knowledge of normative values for automated perimetry in Indian population of different age groups. **Materials and Methods:**Cross-sectional study conducted on patients receiving outpatient care in a span of 2 years, which included 386 healthy normal patients (772 eyes) with vision 6/6 unaided or after refractive correction. The patients were tested with 30-2 SITA FAST threshold algorithm on Humphrey Field Analyzer Model no: 745i.Normative data was calculated on basis of age group ranging from 19-75 years in every decade. Normal values were formulated on basis of perimetry performed on normal patients. The variables tested included age, gender, unaided vision, best corrected vision, test duration, fixation losses, false positive and false negative errors, foveal threshold, visual field index, mean deviation and pattern standard deviation of both eyes. **Results:** To our knowledge, this is the first study to formulate normative data for automated perimetry in Indian population. The right eye foveal fixation in patients of all age groups in our study was 30.84 dB ± 3.34 and the left eye foveal fixation in patients of all age groups was 30.72 dB ± 3.13. The right eye mean deviation of the entire sample size showed a median of -2.4 and the left eye mean deviation of the entire sample size showed a median of -2.32. The right eye pattern standard deviation in patients of all age groups was 1.82 ± 0.57 dB and the left eye pattern standard deviation in patients of all age groups was 1.78 ± 0.49 dB.

Key Words: perimetry.

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INTRODUCTION

Automated static perimetry is currently the standard method for visual field examination.[1] Perimetry is the systemic measurement of the visual field function. Perimetry and visual field testing have been used as a clinical ophthalmic diagnostic tool for many years.[2] Every ophthalmologist in his/her daily practice requires visual fields for diagnosis of ocular and central nervous system conditions, especially to manage glaucoma. Normative data is the formulation of the usual values in a defined population at a specific period of time. It is seen that reliable normative data along with influence of age on sensitivity has been well described in the automated perimeter. The data is then compared with the patient data on performing the test. This data is however based on Asian and European population. Normative data for Indian population has not yet been adequately defined. It is noted that most of the equipments in Ophthalmology have normal data standardized according to European population. Very few types of equipment have normal data standardized according to Indian population. No such study had been conducted to formulate the normative data for automated perimetry in Indian population. Keeping this in mind, it was decided to conduct a hospital based study to formulate age dependent normal values for visual fields using Humphrey automated perimeter customized to Indian population.

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MATERIALS AND METHODS

1. This was a cross-sectional study conducted on patients receiving outpatient care at a tertiary care hospital in India from Feb 2015 to Jan 2017, which included 386healthy normal patients (772 eyes) with vision 6/6 unaided or after refractive correction.
2. The patients were tested with 30-2 SITA FAST threshold algorithm on Humphrey Field Analyzer Model no: 745i
3. Duration of the test: approximately 8 minutes to 10 minutes.
4. The study was based on cross sectional analysis.

Inclusion Criteria

- Healthy normal individuals of age group 18-75 years with 6/6 vision unaided.
- Healthy normal individuals of age group 18-75 years with 6/6 vision with +2D/-2D shperical or cylinder.

Exclusion Criteria

- Visual field defect or suspicion of a visual field defect in the tested eye.
- Patients diagnosed with any ocular pathology on examination.
- History of amblyopia.
- IOP>22 mm/hg in either eye.
- Any systemic disease, or history of treatment with medications, which are likely to affect the visual field.

All subjects in the study were explained about the test perimetry and a consent was taken for same. Patients having vision of 6/6 unaided and after required spectacle correction from the age group 18-70 years were included only. The patients were tested on the on Humphrey Field Analyzer Model no: 745i with 30-2 SITA FAST threshold algorithm. A complete anterior segment evaluation was done to rule out any ocular pathology. A post graduate trainee conducted an ophthalmic examination which was confirmed by a consultant ophthalmologist. Visual acuity measurement were performed on all patients. Direct and indirect ophthalmoscopy were done after pupillary dilatation by tropicamide 0.8% eye drops and 5% phenylephrine eye drops.

Procedure: The technician or the ophthalmologist who operated the machine instructed the patient about the test and duration of test. The test was performed in a dark room. After dilating and giving appropriate refractive correction one eye of the patient was covered using eyepatch. Patient was then asked to place his chin on the chin rest and fixate on the diamond shaped light ahead. Patient was explained not move his eyes and fixate to one yellow coloured light spot, while flickering white lights were displayed all around his visual field. On responsiveness to this stimulus displayed by the machine the patient was asked to click the trigger provided to him in his hand. If any uneasiness or difficulty was experienced by the patient he was asked to speak up so that the tecnician/ophthalmologist could pause the test. Normative data was calculated on basis of age group ranging from 19-75 years in every decade. Normal values were formulated on basis of the perimetry tests performed on normal patients. The variables tested included age, gender, unaided vision of both right eye and left eye, best corrected vision of right eye and left eye, test duration of both eyes, fixation losses of both eyes, false positive and false negative errors of both eyes, foveal threshold of both eyes, visual field index of both eyes, mean deviation and pattern standard deviation of both eyes. Statistical analysis of the variables was performed using various tests.

RESULTS

Table 1: Comparison table for right eye foveal fixation in different age groups

Age in years	Mean dB	Standard deviation
19-29	32.15	1.82
30-39	32.60	1.90
40-49	30.53	2.38
50-59	30.17	2.02
60-75	28.61	5.48

*P value<0.0001 (significant)

The table shows right eye foveal fixation of patients in different age groups. The difference is statistically significant.

Table 2: Comparison table for left eye foveal fixation in different age groups

Age in years	Mean dB	Standard deviation
19-29	32.14	1.42
30-39	32.52	2.50
40-49	29.89	2.30
50-59	30.29	2.69
60-75	28.31	4.22

*P value<0.0001 (significant)

The table shows left eye foveal fixation of patients in different age groups. The difference is statistically significant.

Table 3: Comparison table for right eye mean deviation in different age groups

Age in years	Median	Interquartile range
19-29	-2.17	-3.45 to -1.39
30-39	-2.49	-3.84 to -0.78
40-49	-2.67	-3.24 to -1.99
50-59	-1.86	-3.01 to -1.07
60-75	-2.68	-3.59 to -1.57

*P value=0.0040 (significant)

The table shows right eye mean deviation of patients in different age groups. The difference is statistically significant.

Table 4: Comparison table for left eye mean deviation in different age groups

Age in years	Median	Interquartile range
19-29	-1.88	-2.56 to -1.36
30-39	-1.61	-2.86 to -0.66
40-49	-2.76	-3.45 to -1.74
50-59	-1.98	-2.65 to -0.75
60-75	-2.92	-3.49 to -2.26

*P value=0.0001 (significant)

The table shows left eye mean deviation of patients in different age groups The difference is statistically significant.

Table 5: Comparison table for right eye pattern standard deviation in different age groups

Age in years	Mean dB	Standard deviation
19-29	1.69	0.39
30-39	2.04	0.99
40-49	1.70	0.57
50-59	1.88	0.48
60-75	1.83	0.35

*P value=0.0033 (significant)

The table shows right eye pattern standard deviation of patients in different age groups. The difference is statistically significant.

Table 6: Comparison table for left eye pattern standard deviation in different age groups

Age in years	Mean dB	Standard deviation
19-29	1.69	0.36
30-39	1.57	0.40
40-49	1.96	0.65
50-59	1.82	0.53
60-75	1.93	0.46

*P value<0.0001 (significant)

The table shows left eye pattern standard deviation of patients in different age groups. The difference is statistically significant. The Mean age group of our study was 43 years ±15.60. Distribution of patients across various age groups. 20% of population was in age groups 19-29 years. 16 % was in age group 30-39 years. 12 % was in age group 40-49 years. 24% was in age group 50-59 years and 28 % was in age group 60-75 years. Out of 386 patients, 126(67%) were females, and 260 (33%) were males. The right eye unaided vision of the entire sample size in LogMar showed a median of 0.18 and Interquartile range (IQR) of 0.18 to 0.30. The left eye unaided vision of the entire sample size in LogMar showed a median of 0.18 and IQR of 0.18 to 0.30. The mean minutes taken to perform the test in patients of all age groups was 4.10 minutes ± 0.82 in the right eye and 4.04 minutes ± 0.82 in the left eye. The right eye fixation losses of the entire sample size showed a median of 0 and IQR of 0 to 8.33 and a median of 0 and IQR of 0 to 8.33 in the left eye. The right eye false positive errors of the entire sample size showed a median of 0 and IQR of 0 to 8.33 and a median of 0 and IQR of 0 to 3 in the left eye. The mean deviation in the right eye showed a median of -2.4 and IQR of -3.36 to -1.43 and in the left eye showed a median of -2.32 and IQR of -3.29 to -1.14. There was progressive decrease in foveal fixation with advancing age. However mean deviation and pattern standard deviation were found to be comparable across the age groups.

DISCUSSION

To our knowledge, this is the first study to formulate normative data for automated perimetry in Indian population. Age-related normal values are essential for defining and characterizing visual field defects. It was seen that the visual field tests came out to be acceptable only when the following checklist was fulfilled.

1. Pupil had to be mid dilated. Pupil size smaller than 2mm or larger than 6mm induced artifacts [3]
2. Correct prescription had to be given.
3. Pitch dark room was required.
4. No noise disturbance.
5. It was important that the staff and physician maintain positive attitudes about the value of perimetry to encourage the patient to provide optimal results during testing.[4]
6. Peripheral points, particularly in a 30-2 test, were susceptible to variability and artifact. Trial lens artifacts usually produced sharp depressions at peripheral points, often in a ring pattern. These artifacts were more common in moderate-high hyperopic corrections and when two trial lenses were used. It was made certain the lens is placed as close to the eye as possible; also, using spherical equivalent up to 2.00D of refractive cylinder helped reducing some of these errors.[3]

The mean age group of our study is 43 years ±15.60. Majority (67%) of the patents in our study were male, and remaining 33% were female. In a study by Nassim Calixto *et al*. 181 subjects divided into 6 homogeneous age groups (10 to 19 years; 20 to 29 years; 30 to 39 years; 40 to 49 years; 50 to 59 years and 60 year-old or older) were evaluated.[5] In another study by Andrew John Anderson >275 subjects were tested from 10 years to 90 years.[6] No study in literature has used IQR to formulate normative data for Automated perimetry yet. IQR also called the midspread or middle fifty, or technically H-spread, is a measure of statistical dispersion, being equal to the difference between the upper and lower quartiles.[7] Unlike total range, the interquartile range has

a breakdown point of 25%, and is thus often preferred to the total range. In our study the mean minutes taken to perform the test in patients of all age groups was 4.10 minutes ± 0.82 in the right eye. Similarly the mean minutes taken to perform the test in patients of all age groups was 4.04 minutes ± 0.82 in the left eye. In a study by Chang Mok Lee and Young Cheol Yoo test duration to perform the test was 5.51 minutes ± 1.19 but the test performed with Standarad Automated Perimetry.[8] In our study the time taken increased with age. Also there was a difference between two eyes to perform the test, left eye showing faster test time as compared to right eye. Foveal threshold serves as an internal validation for the visual acuity; the two should correspond. Whereas in our study the right eye foveal fixation in patients of all age groups in our study was 30.84 dB ± 3.34 and the left eye foveal fixation in patients of all age groups was 30.72 dB ± 3.13. In our study the right eye mean deviation of the entire sample size showed a median of -2.4 and Interquartile range of -3.36 to -1.43 whereas the left eye mean deviation of the entire sample size showed a median of -2.32 and Interquartile range of -3.29 to -1.14. In a study done by Lilly Zborowski-Naveh *et al*. mean MD in 1041 eyes was −3.30 dB (±3.57 dB). The mean MD in the group of patients aged 40 years or less was -3.68 ± 4.4 dB. However, from the fifth through the ninth decade, there was a steady decrease in MD, from −2.3 dB to −4.24 dB.[9]The right eye pattern standard deviation in patients of all age groups was 1.82 ± 0.57 dB and the left eye pattern standard deviation in patients of all age groups was 1.78 ± 0.49 dB. Thus, we have formulated age related normative data for Indian population of age group 19-75 using the SITA FAST test strategy. This study could be exploited for better normative data if we also include other testing strategies such as SITA Standard and Short Wave Automated Perimetry (SWAP), thus improving the quality of the equipment.

CONCLUSIONS

This study measured normative data of automated perimetry in Indian population. The findings were:

1. The right eye foveal fixation in patients of all age groups in our study was 30.84 dB ± 3.34 and the left eye foveal fixation in patients of all age groups was 30.72 dB ± 3.13.
2. The right eye mean deviation of the entire sample size showed a median of -2.4 and the left eye mean deviation of the entire sample size showed a median of -2.32
3. The right eye pattern standard deviation in patients of all age groups was 1.82 ± 0.57 dB and the left eye pattern standard deviation in patients of all age groups was 1.78 ± 0.49 dB.

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