COMPARISON BETWEEN LOSS VARIANCE OF TENDENCY–ORIENTED PERIMETRY AND NORMAL STRATEGY PERIMETRY USING OCTOPUS 32 PROGRAM

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ABSTRACT

Objectives: To compare the values of loss variance (LV) obtained by a faster strategy- Tendency oriented perimetry (TOP) with those obtained by a standard stair casing strategy i.e. normal test strategy using OCTOPUS 32 program.

Design: Cross-sectional comparative study.

Place and Duration of Study: Eye Department of Military Hospital Rawalpindi from February 15, 2007 to October 10, 2007.

Patients and Methods: A total of 61 eyes were included in the study. Thirty with normal ocular examination and 31 with ocular pathologies producing visual field defects. Each eye was analysed with the normal (stair casing) test strategy and TOP strategy using 32 programs on Octopus 311 perimeter. LV was compared for two strategies.

Results: There was statistically significant difference between LV obtained from TOP and Normal strategy ($p = 0.001$).

Conclusions: TOP strategy tends to obtain fields with less pathological results especially for the calculation of the extent and depth of each scotoma in comparison with the normal strategy.

Keywords: Loss variance, Normal strategy, Perimetry, TOP.

INTRODUCTION

Glaucoma is the commonest cause of irreversible blindness in local population[1]. A total of 7.1% of all cases of blindness in Pakistan are attributable to glaucoma[2]. In glaucoma the functional effect of retinal ganglion cells (RGC) loss is evaluated clinically using perimetry[3]. Merely raised intraocular pressure (IOP) is not sufficient to diagnose glaucoma[4]. Assessment of visual field damage is the main parameter of functional impact of glaucoma with direct relevance to quality of life[5].

Despite recent advances in optic nerve and retinal nerve fiber layer evaluation white light perimetry remains the most reliable widely used tool to determine significant functional impairment as a result of glaucoma[6] While determining differential light sensitivity with the normal (stair casing) test strategy, the examination may take as long as 12 to 20 minutes per eye, depending on the number of test locations, the degree of pathology and the fitness of the patient[7]. Threshold testing is a demanding examination where, due to fatigue patients make more mistakes towards the end of the test especially if it is second session[8] and as a result, the differential light sensitivities become more depressed with longer test duration[9].

Recent progress in the definition of faster test strategies is tendency oriented perimetry (TOP) strategy. TOP enables the sensitivity of the visual field to be estimated in approximately 2.5 to 3 minutes[10].

Correlations between global indices of the visual field (mean deviation [MD] and loss variance [LV]) for a normal strategy and the TOP algorithm are high when assessed on a moderately sized group with mixed disease states[10,11]. However, significantly reduced values for LV when compared with normal strategy, suggests that the TOP strategy underestimates the depth of focal defects[12,13].

Extensive and careful search has revealed that no comparative study for these strategies has been done on local population. The purported significance of this study was to ascertain whether the values for LV obtained by these two strategies are comparable when done

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on local population so that the strategy that produces same results in lesser time and is convenient for patient as well may be utilized, in clinical practice, for assessment of visual fields.

PATIENTS AND METHODS

This cross-sectional comparative study was carried out in Eye Department of Military Hospital Rawalpindi from February 15, 2007 to October 10, 2007. In patient selection, non-probability convenience sampling was adopted.

A total of 61 eyes were included. Out of 61 eyes, 30 were with normal ocular examination and 31 had ocular pathologies classified as glaucoma suspect (3), early glaucoma (13), advance glaucoma (11) and neur-ophthalmological (4) producing visual field abnormalities.

An informed consent was obtained from all participants. Cases having glaucoma (early and advanced) with visual field defects, glaucoma suspects, patients having visual field defects due to neurological lesions or retinal diseases and volunteers with normal ocular examination were included in the study. Patients having no previous experience with automated perimetry were familiarized with the perimeter and perimetery.

Children under 12 years of age, patients having visual acuity less than 6/60, Subjects unable to sit for 15 minutes on perimeter, cases with history of vitreoretinal surgery, pupil size less than 3 mm and poor reliability on automated perimetry testing were excluded.

Complete ocular examination, including visual acuity, refraction, slit lamp biomicroscopy, gonioscopy, IOP measurement and fundus examination with special attention to optic nerve head changes, was performed in all eyes.

All visual fields were carried out using OCTOPUS 311 perimeter using white on white perimetry with OCTOPUS 32 program. Corresponding thin rim trial lenses were selected for far vision correction. Complete examination procedure was explained to the patients by ophthalmologist, prior to examination, and all examinations were carried out by same ophthalmologist and he stayed nearby during the examination and often informed the patients about the progression to encourage them to answer the questions properly. Each eye was subjected to normal (stair casing) strategy and TOP strategy on the same day within six hours, allowing minimum of 30 minutes rest between two tests. Values for LV were noted for both the strategies

Data was analyzed using SPSS 12.0. Mean ± SD was calculated for age. Frequencies and percentages were calculated for gender.

Comparison between values of LV from TOP and standard threshold perimetry was done using student's t-test. p value of < 0.05 was taken as significant.

RESULTS

As each eye was tested with both strategies, a total of 122 visual fields were available for comparison: 61 of normal strategy and 61 of TOP strategy. Out of total 61 eyes, 30 were with normal ocular examination and 31 had ocular pathologies. Ages of all patients ranged 20 – 74 years with mean age 42.93±17.090 years (Table 1). Sample had (82%) males and (18%) females.

Comparison of LV obtained by two strategies is shown in table 2 which depicts statistically high significant difference between values for LV obtained by TOP and Normal strategy perimetry.

DISCUSSION

Although visual field examination is used in conjunction with intraocular pressure and assessment of optic nerve head and retina changes, perimetry remains an indispensable test to determine extent and deterioration of glaucomatous damage[14]. After all, patients are not concerned about pressure or appearance of their discs but they are worried about maintaining vision.

Review of the published literature showed that computer perimetry is constantly being developed but still remains a subjective examination method. The patient's cooperation plays an important part and therefore

Table-1: Age-wise distribution of subjects

Age (years)	Minimum	Maximum	Mean	Std. Deviation
Whole Group	20	74	42.93	17.090
Normal Ocular Exam	20	70	35.70	13.671
Ocular Pathologies	21	74	49.94	17.334

Table- 2: Comparison of loss variance (Decibels2)

Group	Technique	N	Mean	Std. Deviation	p value
Whole Group (n=61)	TOP Strategy	61	11.75	12.71	**0.002**
	Normal Strategy	61	20.37	17.55	
Normal Ocular Exam (n=30)	TOP Strategy	30	4.09	1.81	**0.001**
	Normal Strategy	30	7.64	4.79	
Ocular Pathologies (n=31)	TOP Strategy	31	19.16	14.30	**0.001**
	Normal Strategy	31	32.69	16.57	

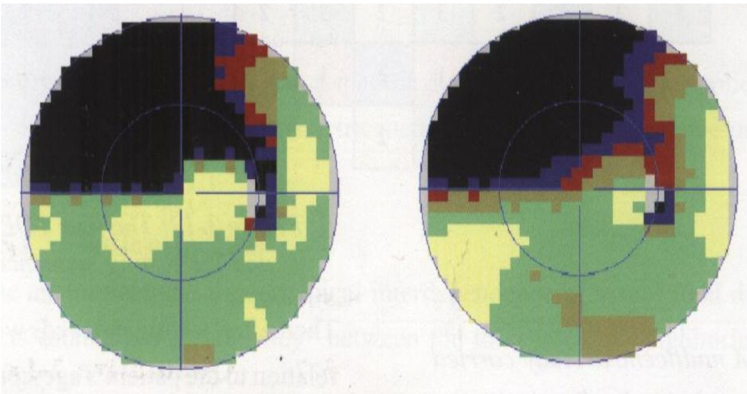

Figure: The same field with Normal strategy (left) compared to an examination with TOP (right).

examination strategies have been improved to make it possible to obtain the most accurate possible results during the shortest possible examination time.

Although highly reproducible and accurate fields can be obtained with traditional techniques, the length of test is frequently a problem because of the traditional way of approximating the threshold by a staircase approach. The patient may end fatigued and is subsequently reluctant to take the test. In some cases, the results of the test seem to deteriorate due to the fatigue effect[9,15].

Turpin and colleagues[16] demonstrated that on the edge of a scotoma, the results by full threshold are extremely variable. The variability increases markedly with increasing deficit depth. This severely limits the ability to determine progression of visual field loss in areas that already demonstrate damage.

In the interest of increasing the patient's comfort as well as reducing fatigue effect, faster threshold strategies have been developed to estimate the sensitivity of the visual field in significantly less time than conventional staircase techniques. Recent progress in the definition of faster test strategies is TOP.

TOP is a relatively new procedure that is used within the Octopus perimeter. The TOP takes into account that anatomical and topographical interdependence of visual field defects establishes a "tendency" between the thresholds of neighboring zones. The TOP method takes advantage of this relationship by using every patient's answer in two ways: First, to test the threshold of the differential light sensitivity in the test location where the stimulus is presented (conventional "vertical bracketing" method), and second to assess the thresholds of neighbouring points by interpolation. This means that instead of questioning each individual test point 4-6 times, the threshold in every location is adjusted five times with only one question per location – once by a direct question and four times by the results from questions in neighbouring locations.

TOP enables the sensitivity of the visual field to be estimated in approximately 2.5 to 3 minutes[11]. The TOP strategy is faster than SITA Fast[17].

In assessment based on the grayscales, TOP receives an outstanding grade. The field at left was obtained in close to 12 minutes while the result at right took less than three minutes. (Fig. 1)

Mean age of sample was 42.93 years (SD 17.09) whereas patients with ocular pathologies had higher mean age (49.94 years, SD 17.334). This is explained because glaucomas are more common in older age groups.

Male to female ratio in this sample was 4.5:1. It was not possible to distribute gender equally in the sample because the study was conducted in a hospital where mainly armed forces serving and retired personnel are entitled to free treatment and the number of females serving in armed forces is far less than the males. Thus our results are comparable with related studies on the subjects.

As far as test time is concerned we found TOP convenient and friendly for both patient and examiner. During visual field testing with Normal strategy, considerable number of subjects requested for pause for rest because of fatigue, epiphora, eye strain or loss of concentration, while some of them took rest twice. None of subjects took rest during TOP examination.

Our study shows significant difference in means of LV of TOP and Normal strategy in normal subjects and patients with ocular pathologies.

Our findings are comparable with other studies. King and colleagues reported that TOP strategy estimated LV to be less than SITA Fast values, the difference increased as the magnitude of the defect increased[17].

Gonzalez - Hernandez reported significantly lower LV values with TOP than normal strategy[18].

Maeda also reported lower LV value in the TOP strategy compared with the Normal strategy in the glaucoma group[13]. Lachkar and coworkers evaluated 79 visual fields with the program 32 using the normal strategy and the TOP strategy. Sample included normal visual field or glaucoma suspects (52), moderately advanced glaucoma (16), advanced glaucoma[11]. They reported significantly lower LV with TOP than normal strategy[12].

Although in a multi-center study comparing 122 eyes with TOP and program 32 on an OCTOPUS 1-2-3 produced remarkable good correlations: MD = 0.96, LV = 0.9411, however, the TOP procedure underestimates the extent of localised deficits and decreased sensitivity estimates for normal locations surrounding a localised deficit[19]. The rapid test time makes TOP a suitable choice for testing children[20]. TOP perimetry is useful to detect visual field defects in children with abnormalities of the eye or optic nerve or other patients who struggle with the longer test times of more robust techniques.

After careful search of national literature, we found that no study has been conducted to compare the TOP with either Normal strategy or other strategies of Humphrey visual field analyzer. So no local literature was available for comparison of my study results.

The limitations of this study are that non-probability convenience sampling was used and sample size was small and patients had lesser past experience of perimetry. Further testing of larger samples of the general population will give more information regarding clinical usefulness of this faster perimetry strategy

CONCLUSIONS

From our study results, it is suggested that the TOP strategy tends to obtain fields with less pathological results especially the extent and depth of each scotoma than those obtained in the same patients by the normal strategy. The TOP strategy may be used for patients in whom time-consuming perimetry is not possible

Further testing of larger samples of the general population to establish a new database for this type of test and larger samples of individual pathologies will increase our ability to draw conclusions regarding test results obtained from this faster perimetry strategy. Longitudinal studies testing the ability of TOP strategy to detect visual field changes and comparative studies with the Humphrey SITA strategy would also be valuable.

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