Utility of a FDT Perimeter in a Private Practice Set-up

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Aim:
To assess the utility of a FDT perimeter in a private practice set-up.

Methods:
A retrospective analysis of 50 patients [100 eyes] subjected to FDT perimetry is done. The reasons for advising a perimetry, and the conclusions drawn from the findings, are analysed to study the utility of a FDT perimeter.

Discussion:
FDT perimetry has been extensively used for screening of glaucoma. It has been used where the number of patients is very large, mainly because of it's high speed [only 45 seconds] for a screening programme. It is also available in large set-ups and institutions where the surgeon also has access to a conventional perimeter like a Humphreys. I have tried to assess the utility of a FDT perimeter, using a central 20 field, without having access to a conventional perimeter. The sensitivity and specificity of the FDT perimeter being good, it has proved very useful in the diagnosis of glaucoma. The test is fast, simple, with a high reliability index.

Conclusion:
This being an initial study with only 2 months experience, one cannot jump to conclusions. However, it definitely facilitates the diagnosis of glaucoma, in the early stages, helps to separate the normals from the glaucoma suspects, and differentiates glaucomatous field defects from non-glaucomatous defects. It can be concluded that this Perimeter holds good potential, and is therefore, useful in our armamentarium in private practice.

Introduction:
A routine ophthalmic consultation, involves basic tests to rule out or diagnose glaucoma. With advancement in scientific knowledge, glaucoma now known as an optic neuropathy involves irreversible damage to the involved axon segments, the end results being ganglion cell loss with characteristic visual field losses.[1] Elevation of IOP is not always associated with damage to the optic disc. Conversely, some patients with glaucomatous optic nerve and visual field damage never have an elevated IOP[1]. Hence, though examination of the patient's IOP remains the first clinical test, mere tonometry is not enough[2]. It is imperative to test the visual fields before labelling a patient as having glaucoma. Technological developments have flooded the market with a horde of instruments for the investigations of glaucoma, but how many or in what way do they help in our clinical diagnosis and day to day management of patients? With the stress on early diagnosis and early management of glaucoma, there is need for a highly sensitive and specific test that can be easily performed in a general ophthalmology clinical practice. With this aim, the utility of a FDT perimeter in a private practice set-up is assessed by analyzing the reasons for advising a FDT perimetry and examining the results or findings of the same.

Materials and Methods:
A retrospective analysis of 50 patients [100 eyes] who were advised FDT perimetry is done. The first 20 patients who underwent FDT perimetry on installation of the machine, were excluded to nullify any error in the learning curve of the technician performing the test and the doctor interpreting the findings. The next consecutive 50 patients are included in this study. These included known cases of glaucoma, glaucoma suspects, and patients with retinal pathologies or neurological problems.

Details of age, sex and family history of glaucoma if present were noted. A detailed eye examination including slit lamp examination, IOP recording and fundus examination was done for every patient. According to the reasons for advising perimetry, these patients were classified as follows:

1.Glaucoma suspects. 2. Known cases of glaucoma 3.retinal pathology. 4. neurology references. In known cases of glaucoma, past history of medication or surgery for glaucoma was recorded. The presenting symptoms and relevant history was also recorded in neurological references. A glaucoma suspect was defined as a patient who satisfied any of the following criteria: a)IOP in the range 21.9 to 30.4 or b)a suspicious disc or c) a family history of glaucoma. The various parameters in the FDT print-out ware

more than one, false positives. They were glaucoma suspects whose FDT perimetry detected significant visual field defects, despite these errors. False negative errors [more than one] were seen in 5 patients. 3 of them were having retinal pathology and 2 were neurological cases and they all had very poor central visual acuity. Hence, these results did not interfere in our evaluation of glaucomatous visual field defects.

Discussion:

FDT uses a large, low-spatial frequency [0.25 cycles/ degree],sinusoidal grating [light and dark stripes] that undergoes a rapid {25Hz} counterphase flicker. The use of such a target leads to an illusion, in which at a certain level of contrast the number of visible lines appears to double. Hence, this phenomenon is called "frequency doubling".[3] There are two theories explaining how frequency doubling perimetry is able to detect changes in the visual field. Quigley et al,[4] through histopathologic examination of monkeys and human beings found that the large optic nerve fibres were preferentially damaged in glaucoma. The magnocellular pathways [M cells] are usually associated with large-diameter optic nerve fibers. M-cells are more responsive to low spatial frequencies and high temporal frequencies. According to Maddess,[5] the M-cells are responsible for eliciting the doubling illusion. Hence, according to this theory FDT should be an excellent method of detecting early damage in glaucoma.

Another theory, is the Reduced Redundancy Theory.[3] This theory assumes that a visual field test will be more sensitive if only a subset of the visual system is tested. It may be difficult to detect early damage to a few retinal ganglion cells, if the neighbouring healthy cells with their complete receptive fields fill in any deficiency. If the total number of receptors tested is reduced to minimize the overlap, a deficit would be more easily identified. About 15% of the optic nerve fibers are made up of M cells, and 15% to 25% of these M cells can elicit the frequency doubling illusion. Thus, only about 5% of all retinal ganglion cells are tested during FDT, allowing any loss in these cells to be more easily identified. Johnson[6] suggested that approaches to identify glaucomatous damage might be most successful if they concentrated on ganglion cell channels that have the least redundancy. Thus, FDT should be a very sensitive method of detecting glaucomatous field loss.

analysed viz.Threshold [db], the gray scale plots of the Total Deviation and the Pattern deviation, and the MD and the PSD along with their p values. The reliability factors were noted.

The minimum criteria for defining a visual field defect as glaucomatous were, at least 2 squares in the PSD plot showing p<0.5% or more than 4 shaded squares in the PSD plot, irrespective of the severity of deficiency. A visual field chart that was absolutely clear, [with no gray zones] was considered normal.

Observations:

The 50 patients included in this study ranged from 12 years to 87 years. The mean age was 50.75, +/- SD 17.0. The IOPs of all 50 patients, varied from12.2 to 30.4.The mean IOP was 20.8, +/-SD 4.77, with a median of 21.9. An analysis of the 50 patients showed: a) Glaucoma suspects 72% (n=36). b) Known cases of glaucoma 12% (n=6). c) Retinal pathology 8%(n=4). D) Neurology references 8%(n=4).

Of the 4 patients with retinal pathology, 3 patients had a primary tapeto-retinal degeneration and 1 patient had a heredo-macular degeneration. The neurology references included 3 patients with severe headaches and 1patient who had a head injury in a vehicular accident.

There were a total of 72 eyes of 36 glaucoma suspects. FDT perimetry confirmed glaucomatous field defects in 25 eyes .i.e. in 34.7%. Of the remaining 47 eyes, 29 visual fields were clear i.e.29 normal eyes were separated from the glaucoma suspects. 18 eyes showed few visual field defects, which could be called suspicious but not diagnostic of glaucoma. 10 patients [about 28% of glaucoma suspects] had clear visual fields in both eyes. Of these, 9 were labelled normal, and 1 with a family history of glaucoma and an IOP of 23.8 in the right eye and 25.8 in the left eye as an Ocular Hypertensive. 8 patients who had suspicious fields in one eye and clear fields in the other were also not considered as glaucomatous. 2 patients had suspicious fields in both their eyes. 6 patients had glaucomatous field defects in one eye and suspicious field defects in the other. 1 patient was diagnosed as normal tension glaucoma.

An examination of the reliability factors showed fixation errors [more than one], in only 2 patients. They however, had normal visual fields. 2 patients showed

of the deficiency. This criterion gave a sensitivity of 91% and a specificity of 94%. We have used a stricter criterion viz. a minimum of two locations with P< 0.5% and that too in the threshold mode, as diagnostic of a glaucomatous visual field defect. Hence, it would be logical to conclude that our test results would be of a higher sensitivity and specificity. This study confirmed glaucomatous field defects in 25 out of 72 eyes i.e. in 34.7%. With further studies and patient trials on a FDT perimeter, these evolving criteria should finally crystallize into a standardised algorithm for the quantification of glaucomatous visual field losses. The FDP appears to facilitate both the diagnosis of glaucomatous visual field losses and to grade the extent of disease in a manner compatible with established perimetric standards.[1]

{Since the number of patients with retinal pathology and with neurological problems were very small [4 each], these conditions are not considered in the discussion.}

Conclusion: This study has included 50 consecutive patients. 72% of them were glaucoma suspects .i.e. perimetry is advised in our clinical set-up mainly in glaucoma suspects, to facilitate the diagnosis of glaucoma.

The reliability indices of FDT perimetry are very good in glaucoma suspects.[High false negatives were seen only in those patients having retinal pathologies or neurological problems.]

The tests are simple. FDT perimetry helped to facilitate the diagnosis of glaucoma in suspicious cases.[34.7% of suspects were confirmed as having glaucomatous field defects.]

It also helped to separate the normals from the glaucoma suspects.[10 out of 36 i.e. about 28% had clear fields in both eyes]. This being an initial study, one cannot jump to conclusions. Long term follow-ups of these patients and repeat FDPs will help us understand and analyse these patients better. However, it can be concluded that the FDT perimeter seems to have good potential as a useful addition to our armamentarium in a clinical practice.

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Cello et al[7] demonstrated FDT perimetry having a high sensitivity and specificity for detection of early, moderate and advanced glaucomatous field losses. Yochanan Burnstein et al[8] determined a high sensitivity and specificity for detecting visual field abnormalities with frequency doubling perimetry using the Humphrey visual field testing used as the gold standard. Using the FDT perimeter in the threshold mode, and the presence of any defect [p<0.5] as the criterion for abnormality, the area under the receiver operating characteristic curve was 93.4%, with an abnormal glaucoma hemi-field test as the gold standard. In this study, the presence of at least 2 defects of p<0.5% was taken as a criterion of abnormality. Burnstein et al[8] also concluded that the threshold modes detected defects better than the screening mode. We too have used the threshold mode in all our cases. Santosh Patel et al[9] evaluated an algorithm for the identification of glaucomatous field defects with the screening mode of an FDT perimeter. They concluded that in most cases, eyes were abnormal if they had two peripheral defects or one central defect. Byles at al[10] concluded that FDT gives high discriminatory power in identifying patients with glaucoma. Using a criterion of 1or more abnormal locations, in differentiating eyes with glaucoma from all other groups, FDT showed a sensitivity of 84.6% and specificity of 73.6%. William. Sponsel et al[11] , halfway through their study derived for the FDP, a clinical scoring algorithm modeled after the Hodapp-Parish-Anderson[12] criteria for scoring Humphrey field defects. Their results showed a strong linear correlation of the FDP mean and pattern deviation with Humphrey 30-2 mean deviation [R= 0.75; P< .0001] and corrected pattern deviation values. [R= 0.64; P< .0001]. The new algorithm based upon counts of the 16 FDP test sectors yielded good segregation [66% precise parity; 95% parity within one grade], as follows: severe visual field loss, more than 1 FDP sector at probability 0.5%; moderate field loss, with either 1 FDP sector at 0.5% or more than 13 sectors at 1% to 5%; early visual field loss, with more than 4 FDP sectors at 1% to 5%. We too have in our study considered more than 4 FDP sectors at any severity of deficiency as a criterion for the diagnosis of early visual field loss.

Harry. Quigly[13] in his study to distinguish glaucoma suspects from those having glaucoma visual field loss, used the screening mode and a criterion of two or more abnormal locations, regardless of the severity

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