Evaluation of frequency doubling perimetry in ocular hypertone

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Key words: ocular hypertension – perimetry – FDT.

Introduction

The tireless search for diagnostic tests that can reveal retinal ganglion cell damage in its initial stages has led to the development of a new method, frequency doubling technique (FDT), for visual field perimetry measurement.

Standard perimetry, one of the most used examinations in clinical practice, is not specific in its stimulation of the various subgroups of ganglion cells and, therefore, cannot identify initial functional losses. This method will reveal visual field deficits only after 30% of the ganglion cells have been lost (Quigley et al. 1982). Frequency doubling perimetry is a new technology based on the frequency doubling illusion phenomenon which is found when a low spatial frequency grill is caused to flicker at high temporal frequency (Johnson & Samuels 1997). The stimuli used are sinusoidal grills with low spatial frequency (0.25 cycles/degree) and high temporal frequency (25 Hz). The principle upon which this technique rests is based on the premiss that the low spatial frequency in combination with high temporal frequency stimulates the M-cell system preferentially. The M-cell system is thought to be primarily involved in recognizing movement and luminance modification (Johnson & Demirel, 1997). The M-cells that respond to the contrast stimulus are but a small number of cells, about 25% of the total number of M-cells. The hypothesis is that, if the ganglional cells under frequency doubling effect are damaged, it would take a higher contrast level for the stimulus to show up. This lowered sensitivity for specific visual field localizations could then presumably reflect an underlying pathological modification.

The aim of this work was to compare Frequency Doubling Perimetry with Standard Perimetry in subjects with ocular hypertone and thus evaluate this method's possibility of identifying perimetric defects not yet caught by traditional methods.

Materials and Methods

Of 25 subjects aged between 22 and 52 years (mean age 41.44±12.04 years) 46 eyes were examined. The tonometric values of the subjects in more than two checks had been ≥22 mmHg. The control group was made up of 20 normal subjects of similar age.

Subjects were excluded for visual acuity <10/10 or refractive defect over ±4 spherical.

All the subjects had an examination of the visual field with standard perimetry (Octopus 101, Interzeag, programme G2) and with FDT perimetry (Welch-Allyn, Zeiss-Humphrey, programme N-20). Perimetric analysis was made on the second of two consecutive perimetric tests done after an interval of one month from the first.

Defects with standard perimeter were classed according to the Glaucoma Staging System (GSS) (Brusini 1996), which uses the indices MD and CPSD (or CLV). Immediate classification of the damage in 6 stages is read off a special nomogram.

As regards the FDT perimetry, the examination was evaluated on the basis of the number of areas showing a sensitivity reduction:

normal=not more than 2 adjacent areas with a defect $p<5\%$, and/or not more than 1 peripheral area with $p<2\%$;
abnormal=more than 5 areas with $p<5\%$, 2 areas with $p<5\%$ and 1 area adjacent with $p<2\%$, 3 or more areas with $p<2\%$, 2 or more areas with $p<1\%$, at least 1 area with $p<0.5\%$;
borderline=changes between the two foregoing categories.

Results

Normal subjects. FDT perimetry did not reveal any alteration; standard perimetry caught a slight perimetral defect in 5% of the cases.

Ocular hypertension subjects. FDT perimetry indicated a normal response in 78% (Table 1), borderline in 13% and abnormal in 9%. Evaluated by Standard perimetry and GSS, results were: normal 50% (23 eyes), very slight defect 41% (19 eyes), initial defect 7%, with full-blown defect 2%.

Of the 23 eyes classed as stage 0 by the GSS, FDT perimetry indicated normal in 91% and borderline in 9%.

The 19 eyes classed as stage 1 were, by FDT perimetry, split into: normal,75%; borderline, 10%; abnormal, 15% (Table 2).

Statistical analysis (Pearson correlation and linear regression) did not produce a significant correlation between the MD (Mean Defect) by Standard Perimetry and that by FDT (Fig. 1).

Discussion

Analysis of the results exhibits that FDP indicates a higher number of normal (100%) and ocular hypertension (78%) subjects having a perimetry within the norm than does conventional perimetry (Table 1). The absence of a statistically significant correlation between the corresponding perimetric indices of the two examination techniques could, therefore, be due, as reported by Iester and coworkers (2000), to the lack of a stabilized damage, absent by definition, in ocular hypertension.

The results obtained suggest that the traditional perimetry examination has a better sensitivity than has the FDP. It must be noted, however, that the type of defect found in the conventional perimetry – generalized depression – has rarely had an evolution in follow-up and could, therefore, be referred to other factors rather than to cellular damage. It is important to

Table 1. Percentage of subjects with no FDT or SP perimetric alterations

Subjects	Normal	Ocular hypertension
FDT	100%	78%
Standard perimetry	95%	50%

Table 2. Percentage of patients with FDT/SP(GSS) perimetric alterations.

Standard perimetry	FDT normal	FDT borderline	FDT altered
Stage 0 no.=23	91%	9%	0%
Stage 1 no.=19	75%	10%	15%

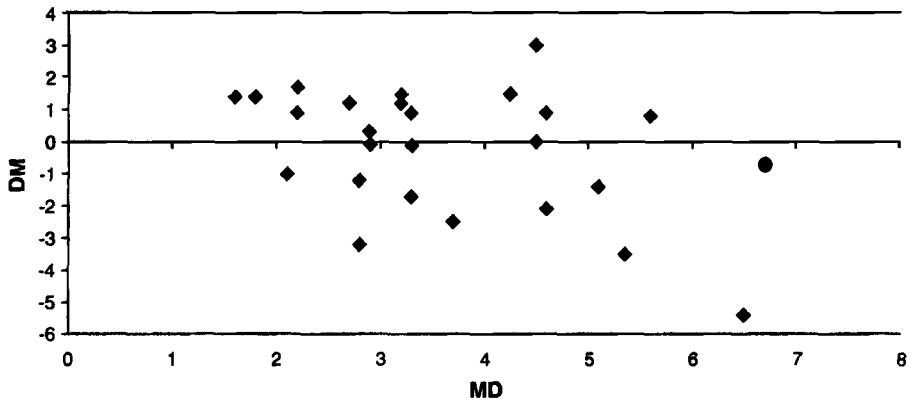

Fig. 1. Dispersion of MD values: FDT (DM) vs SP (MD), in ocular hypertension subjects.

remember that this technique examines only the visual field central 20° so that the more peripheral defects, normally found by standard perimetry if present, would not be identified (Iester et al. 2000).

Frequency doubling perimetry, on the other hand, seems to be more specific than conventional perimetry in picking out a cell damage signal.

The FDT method is simple, short (about 5 minutes against the conventional perimetry 10 minutes), not very much influenced by miosis and refractive defect and can, therefore, be considered efficacious in identifying a glaucomatous-type defect, but probably not, yet, of equalling conventional perimetry in the follow-up of patients with initial perimetric defects. The disadvantage of the method is its difficult repeatability of localizing and quantifying a defect.

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Latanoprost and the ibopamine test: a year's experience

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Summary

We report here the results obtained in a group of 52 eyes affected by open-angle Glaucoma (OAG), whose intraocular pressure (IOP) was inadequately controlled by two drugs of different pharmacological categories, into which there was introduced Latanoprost, both in place of one of the two drugs and in addition to the preceding therapy. The ocular hypotensive effect was good (21.74%). The ibopamine provocative test, carried out before the Latanoprost administration, and at 3 and 6 months into treatment gave evidence that outflow pathway compromission was uninfluenced by the drug.

Key words: latanoprost – OAG – IOP – ibopamine provocative test – outflow pathway compromission.

Introduction

Among recently introduced antiglaucomatous drugs, latanoprost foredrug of the prostaglandin F2α (Stjernschantz & Alm 1996), acts on the dynamics of ocular blood flow. Its association with traditional drugs is rational if one thinks that, to the action on the aqueous humour outflow through the trabecular meshwork and Schlemm's canal of the parasympathicomimetics or to the action on the production of aqueous humour of the α-stimulants and the β-blockers, Latanoprost would bring the addition, according to the recent literature, of a complementary activity on the uveo-scleral outflow (Crawford & Kaufman 1987).

The aim of this work was to evaluate Latanoprost action on the outflow pathways with the use of the ibopamine provocation test: ibopamine is a D1-dopaminergic drug that has shown itself capable of inducing a significant increase in aqueous humour production.

Materials and Methods

Fifty-two open-angle glaucoma affected eyes, of 26 patients, 11 males and 15 females, with a mean age of 65.96±7.56 years, were examined.

Inclusion criteria included:

positivity in the ibopamine provocation test consistently found at least three times before the study was begun;

IOP uncontrolled by two drugs of different pharmacological categories (α-stimulants, β-blockers, carbonic anhydrase inhibitors topically applied, parasympathicomimetics) both in addition to and in substitution of one of the two drugs. The ibopamine test was repeated at 3 and 6 months after the start of treatment with Latanoprost, and IOP was measured. Statistical analysis relied on Student's t-test for paired data with significance set at $p=0.05$.

Results

Fig. 1 illustrates the mean IOP progress in the 52 open-angle glaucoma eyes after