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Short Report

Comparison of Visual Evoked Potentials, Automated Perimetry and Frequency-Doubling Perimetry in Early Detection of Glaucomatous Visual Field Loss

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A B S T R A C T

The present study compares frequency-doubling perimetry (FDP), automated perimetry (AP) and visual evoked potentials (VEP) for their ability to diagnose early glaucoma. In present study 224 patients of Clinic for Eye Diseases, Clinical Hospital »Sestre Milosrdnice« that had diagnosis of open angle glaucoma and glaucomatous visual field loss proven by automated static perimetry on only one eye were performing all three tests. Visual evoked potentials, automated perimetry and frequency-doubling perimetry were performed four times in each patient with six months period in between testing. Significant difference was proven between frequency-doubling perimetry and automated perimetry in favor for FDP in early detection of glaucomatous field loss. There was no significant difference between FDP and VEP neither between VEP and AP measurements. The results of this study indicate that frequency-doubling perimetry is significantly better method for early detection of glaucomatous visual field loss than automated static perimetry.

Key words: *frequency-doubling perimetry, glaucoma*

Introduction

Glaucoma is one of the leading causes of blindness in the world.[1] It is thought that the detection and treatment of glaucoma at an early stage helps to prevent subsequent progression of vision loss. The present study compares visual evoked potentials (VEP), automated perimetry (AP) and frequency-doubling perimetry (FDP) for their ability to diagnose early glaucoma. Frequency-doubling illusion has been shown to have value in diagnosing glaucoma.[2–10] Several lines of evidence suggest that we access a different pathway by using frequency-doubling stimuli.[2,3,11–16] In this study we compared this method with Octopus standard static perimetry as gold standard and visual evoked potentials as an objective method.

Subjects and Methods

Visual fields measurements

Visual fields were measured with automated static perimetry (Octopus perimeter 101 Interzeag AG, Schlieren, Switzerland) and with frequency-doubling perimetry (Frequency doubling perimeter Welch-Allyn, Skaneateles, NY; Zeiss-Humphrey, San Leandro, CA).

Two perimetry tests were performed:

– Octopus perimetry ST-test, with Goldman III stimuli, time of exposition of 100 miliseconds, and background illuminance of 4 apostilbs.
– Frequency doubling perimetry Full Treshold Test (N-30)

Tests taken by both methods will be taken into consideration only if reliability factor remains under 10%. On each exam both tests were performed with minim um of half hour in between two tests. Visual evoked potentials will be tested with pattern stimulation.

Subjects

In present study 224 patients of Clinic for Eye Diseases, Clinical Hospital »Sestre Milosrdnice« that had diagnosis of open angle glaucoma and glaucomatous visual field loss proven by automated static perimetry on

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only one eye were performing all three tests. Visual evoked potentials, automated perimetry and frequency-doubling perimetry were performed four times in each patient with six months period in between testing.

Patients that had any other eye disease or neurological disorder that could influence visual field measurement were excluded from study. Informed written consent was obtained from the subjects after the nature and possible consequences of the study were explained to them. The research was approved by the Ethical Committee of Clinical Hospital »Sestre Milosrdnice«.

Statistical data analysis

All three methods: visual evoked potentials, automated perimetry and frequency-doubling perimetry were compared with each other using Chi-square test. All statistically significant differences will be taken on level of $p<0,05$.

Results

Frequency-doubling perimetry found significantly higher number of eyes with early glaucomatous visual field loss than automated static perimetry (Table 1). At the same time the difference between frequency-doubling perimetry and visual evoked potentials and between automated perimetry and visual evoked potentials was not statistically different (Table 1). Frequency-doubling perimetry found higher number of eyes with visual field loss on each measurement (Figure 1). There are two possibilities: either frequency-doubling perimetry is really more sensitive method than automated static perimetry either it is showing higher number of false-positive results. Since each visual field loss that was found with

TABLE 1
NUMBER OF EYES WITH VISUAL FIELD DEFECT

	measurement			
	1	2	3	4
Octopus	0	9	14	19
FDT	23	29	34	39
VEP	2	11	15	20

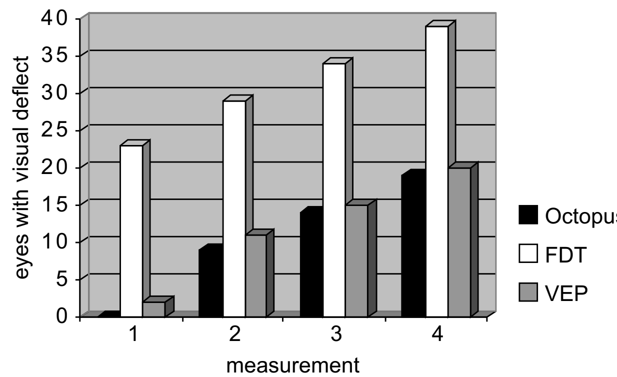

Fig. 1. Comparison of three methods.

automated static perimetry on later tests, was proven by frequency-doubling perimetry on one of previous tests, we concluded that frequency-doubling perimetry is more sensitive method.

Discussion

Since Kelly introduced frequency-doubling perimetry[16] there have been a lot of papers that showed that it is comparable to automated static perimetry.[17–19] Our result showed that there is significant difference in results between those two methods. The fact that we learned following patients in tame frames of six months during 2 years follow up is that automated static perimetry will show the same defect in visual field like frequency-doubling perimetry that wasn't there before on one of later measurements. Due to that fact it was easy to conclude that frequency-doubling perimetry is showing pathological finding earlier than automated static perimetry. That can improve our knowledge on glaucomatous visual field loss and give us more powerful weapon in early diagnostic of that disease

The results of this study are encouraging for frequency-doubling perimetry. We proved that early glaucomatous visual field loss can be found earlier than with standard static automated perimetry. That leads to earlier diagnosis and according to that to earlier therapeutic procedures which could lead to improvement in vision and overall quality of life of glaucoma patients.

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USPOREDBA VIZUALNIH EVOCIRANIH POTENCIJALA (VEP), AUTOMATIZIRANE PERIMETRIJE (AP) I »FREQUENCY-DOUBLING« PERIMETRIJE (FDP) U DIJAGNOSTICI RANOG GLAUKOMSKOG OŠTEĆENJA VIDNOGA POLJA

S A Ž E T A K

Cilj istraživanja je usporedba »frequency-doubling« perimetrije (FDP), automatizirane perimetrije (AP) i vizualnih evociranih potencijala (VEP) u dijagnostici ranog glaukomskog oštećenja vidnoga polja. U istraživanje je uključeno 224 pacijenta Klinike za očne bolesti Kliničke bolnice »Sestre milosrdnice« kod kojih je dijagnosticiran glaukom otvorenog kuta, te glaukomsko oštećenje vidnoga polja dokazano automatiziranom statičkom perimetrijom na jednome oku. Svi su bolesnici uradili tri navedena testa tijekom svakog od četiri kontrolna pregleda u razmacima od po šest mjeseci. Statistički značajno više pacijenata sa ranim glaukomskim oštećenjem vidnoga polja dokazano je »frequency-doubling« perimetrijom u odnosu na automatiziranu perimetriju. Nije bilo statistički značajne razlike između FDP i VEP metoda odnosno AP i VEP metode. Rezultati ovoga istraživanja pokazuju da je »frequency-doubling« perimetrija značajno bolja u ranoj dijagnostici glaukomskog oštećenja vidnoga polja od statičke perimetrije.