VER AND PUPILLARY REFLEX

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ABSTRACT

Visual evoked responses and pupillary reflex have been recorded simultaneously with the automatic perimeter PERIMATIC. Results are reported from normal patients and several cases of visual pathway disturbances. These results are compared to the subjective responses obtained with the same instrument.

INTRODUCTION

There are presently several techniques available to the clinician for the evaluation of light perception. The visual field subjective examination and the visual evoked responses (VER) are now currently used in the neuro-ophthalmic clinic. The pupillary responses have not been so successful but there is some evidence that they can give very interesting information. Each of these methods has its specific interests and limitations. The visual field subjective evaluation gives precise information on the localisation of perception thresholds but it is very dependent on the cooperation, understanding and fatigue of the patient.

The VER are extremely valuable as objective measurements which are little affected by the patients's behavior. There is much evidence that these measurements are relevant to the 'quantity of visual information' received. Several attempts in using VER for the objective evaluation of the peripheral visual field have not really been successful and many reports indicate that stimuli received by the peripheral retina do not elicit occipital VER (Hache 1974; Henkes 1974; Van Lith 1976; Adachi 1977).

Pupillary responses can also be qualified as objective measurements. They involve different visual mechanisms and pathways and have been shown to be very sensitive at the fovea as well as at peripheral retinal locations. (Harms, Aulhorn & Ksinsik 1949; Lowenstein, Kawabata & Lowenfeld 1964).

These three methods provide correlative and complementary informations and their confrontation should be extremely valuable for the establishment of

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a diagnosis. Such confrontations have already been carried out (Hellner, Hamann, Jensen, Muller-Jensen & Zschoke 1979). However, the use of different instruments and examination conditions is not well adapted to such comparative studies.

METHOD

We have developed a new automatic instrument specifically designed for the clinical investigation of subjective visual field and objective electric and pupillary responses. This instrument is composed of a hemispherical screen, 1 m in diameter, of a stimulation projector providing an adjustable background illumination level and a light spot of controlled size, position, luminance, displacements and presentation time. This projector can generate the different stimuli used in subjective kinetic and static perimetry. It can also generate stimuli adapted to objective examinations. Stimulus sizes up to 10 degres are obtained, structured patterns (images) can be projected and presentation times can be reduced down to 10 ms with stimulation frequencies up to 50 Hz.

The eye is monitored during the examination with an infrared camera located behind the screen through the blind spot of the eye. The video signal is analysed by a microprocessor which determines the pupil surface area and the fixation point from the position of the corneal reflection relative to the pupil.

VER are recorded with standard amplifiers (A6/B from E.C.E.M.) and averaged with a specific microprocessor. The examination protocol is entirely controlled by a supervising processor. In such conditions, the operator involvement is kept to a minimum and reproduceable standard examination procedures can easily be followed. Examination time is also considerably reduced and patient's fatigue minimized. The fixation point of the eye is controlled throughout the examination and the procedure automatically interrupted when deviation of fixation occurs.

Stimulation parameters and examination protocol are chosen according to two important considerations:

1. to obtain the maximum information within the minimum examination time.

2. to use similar conditions for subjective and objective examinations, which will inprove the comparative evaluation of their results.

The same photopic background level of 10 Asb is used for both subjective and objective examinations. The stimulation parameters are identical for the objective examinations (size = 2 degrees of visual angle, luminance = 1000 Asb, duration = 200 ms), except for the frequency of stimulation which is chosen as 1 Hz with VER and .5 Hz with pupillary responses. The VER are averaged over 64 stimulations whereas 10 stimulations are sufficient for the pupillary reflex.

RESULTS

Case 1. A.M. was a 25 years old normal patient. Fig. 1 shows pupillary reactions elicited by stimuli of different retinal positions. P20,45 indicates a stimulus 20 degrees away from the retina, on a meridan line with an angle of 45 degrees relative to the horizontal. This same notation will be used throughout this paper. Responses were still obtained as far as 60 degrees away from the fovea.

Fig. 2 shows visual evoked responses at different retinal locations. The response obtained with foveal stimulation becomes considerably altered for stimuli more than 12 degrees of eccentricity. Further away, different waveforms are recorded which do not have a clearly established significance.

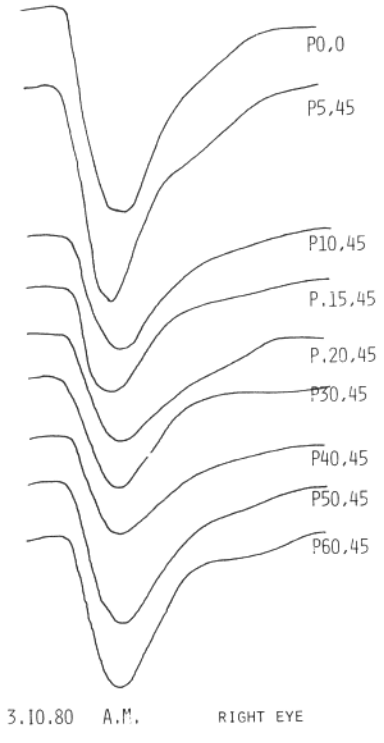

Fig. 1. Pupillary responses at different retinal locations.

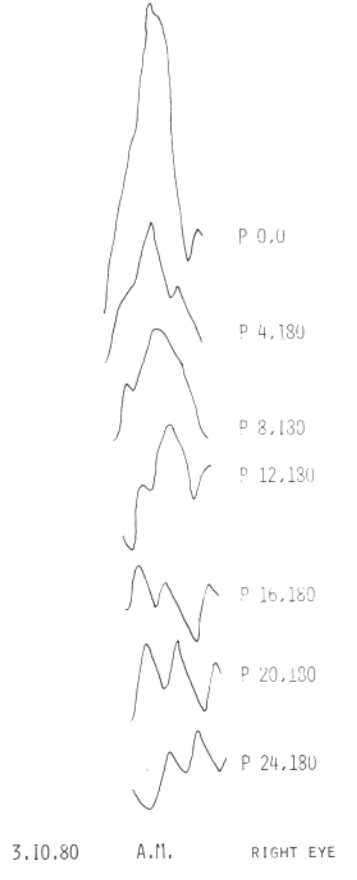

Fig. 2. VER at different locations.

Case 2. M.J. was a 35 years old man with right homonymous hemianopsia. The subjective visual field findings were confirmed by the pupillary responses (Fig. 3). These results demonstrate that stray light within the hemispherical screen or the eye does not play a significant role.

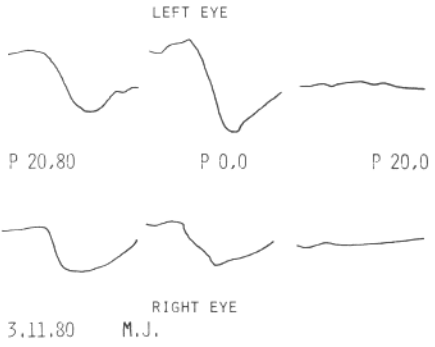

Fig. 3. Pupillary responses in right homonymous hemianopsia.

Case 3. P.M. was a 52 years old man with suspected tobacco-alcohol amblyopia. Visual acuity was 1/20 on both sides. The visual field examination indicated a general contraction of peripheral vision. This finding was in conflict with the behavior of the patient who did not have much difficulty avoiding obstacles when walking. Patient's collaboration was poor. Central VER (Fig. 4) indicated an important alteration in agreement with a central scotoma. Pupillary responses (Fig. 5) with amplitudes increasing toward the periphery were elicited. The central scotoma and the persistance of peripheral vision as well as the absence of other neurological disease were confirmed.

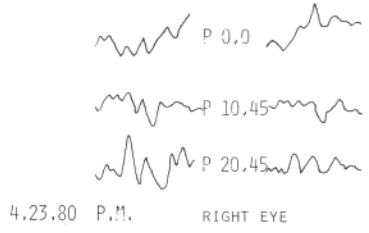

Fig. 4. VER of a patient with tobacco-alcohol amblyopia in response to stimuli of various locations, left and right hemispheres.

CONCLUSIONS

A new instrument for the clinical evaluation of light perception has been presented. This instrument permits subjective and objective examinations in comparable controlled conditions. The first clinical results indicate a good correlation between subjective and objective responses when similar

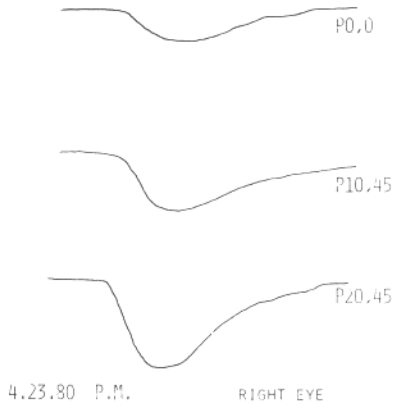

Fig. 5. Pupillary responses of a patient with tobacco-alcohol amblyopia in response to stimuli of various locations.

conditions are used. Objective measurements are extremely valuable when patient's collaboration is poor. There is some evidence that the visual evoked responses and pupillary responses provide different types of information about vision. They are concerned with suprathreshold perception and they are involved with different anatomic structures and physiologic mechanisms. More investigation is necessary to establish the significance of the different responses which are now available and to obtain a valuable tool for clinical diagnosis.

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