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Clinical applications of microperimetry techniques – advantages and disadvantages. Own experience

Kliniczne zastosowanie mikroperymetrii – wady i zalety tej metody. Doświadczenia własne

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Summary

Microperimetry technique is a kind of visual field test which provides the study of retinal sensitivity and the imposition of tests performed on the color fundus image. That made the test accurate in identification of defects in the visual field and also allows to monitor disease progression. Microperimetry is an accurate examination to identify and assess the possible defects in the field of vision and as well as assess the stability and progression of these lesions which could be combined with assessment with distribution of the examined eye's fixation. We can ascertain that its advantages are precision, repeatability and the follow-up function which allows for monitoring of changes in time. The main clinical applications of this technique include: retinopathies and maculopathies – degenerative, vascular, inflammatory, genetic and infectious. Microperimetry can aid the early monitoring of central and peripheral retinal lesions, helping to understand the natural course of the various eye diseases.

Own experience suggests that microperimetry is extremely useful addition to testing the quality of vision, assessment of disease progression and finally effectiveness of therapy.

Key words: microperimetry, visual field, advantages and disadvantages

Streszczenie

Mikroperymetria jest jednym z rodzajów badania pola widzenia, które umożliwia analizowanie czułości siatkówki oraz nakładanie uzyskanych obrazów na kolorowe zdjęcia dna oka. Sprawia to, że metoda ta doskonale sprawdza się w rozpoznawaniu ubytków w polu widzenia i pozwala na monitorowanie progresji choroby. Mikroperymetria jest doskonałą metodą w identyfikacji możliwych ubytków w polu widzenia, jak również doskonale służy jako metoda oceny stabilności i progresji tych zmian, co może zostać połączone z oceną rozkładu fiksacji badanego oka. Możemy stwierdzić, że zaletą tej metody jest dokładność, powtarzalność i funkcja *follow-up*, która pozwala na monitorowanie w czasie zmian stwierdzonych w trakcie poprzednich badań. Główne zastosowania tej metody obejmują: retinopatie i makulopatie – zmiany degeneracyjne, naczyniowe, zapalne, genetyczne i infekcyjne. Mikroperymetria może być pomocna we wczesnym monitorowaniu zmian siatkówki centralnej i obwodowej, co pomaga w zrozumieniu przebiegu schorzeń okulistycznych. Doświadczenia własne autorów pokazują dużą przydatność mikroperymetrii w badaniu jakości widzenia, ocenie progresji choroby i wreszcie skuteczności przeprowadzonego leczenia.

Słowa kluczowe: mikroperymetria, pole widzenia, wady i zalety

INTRODUCTION

Microperimetry, also called fundus perimetry, is a type of field of vision examination in which the

sensitivity of retina to light stimuli is assessed. The stimulus used in this method is a light spot presented on a precisely specified by the examiner region

of the retina. Microperimetry combines a field of vision examination with eye morphology of the examined patient. This allows a creation of a map of retinal sensitivity to stimuli in respect to the actual anatomical structure of the region examined (fig. 1). The function of the repeated examination is to allow a reexamination of the same patient in exactly the same configuration as during the previous examination. The MP-1 device produced by Nidek Technologies (Padua, Italy) enables a combination of fundus tracking microperimetry with colour fundus imaging.

The MP-1 microperimeter is a successor of the Scanning Laser Ophthalmoscope – SLO (Ottobrunn, German) which was being developed since the 80's (1). The SLO was complex, expensive to maintain and difficult to use. Its primary function was to mark the size and location of the scotomas in the field of vision and determine fixation. Currently, SLO is no longer in production; it has been replaced by the MP-1. An important feature of this device is its capability to track patient's eye movements during an examination and to overlay the examination performed with an infrared camera on colour fundus image. Such examination guarantees a functional assessment of a specific, examined, region of the retina.

CLINICAL APPLICATIONS OF MICROPERIMETRY

Standard perimetry is an examination which goal is to identify and assess the possible defects in the field of vision as well as assess the stability and progression of these lesions. Through a comparison of the acquired values of parameters with a statistical norm for a given population, it allows a detection of early symptoms of a disease. Fixation stability during the test is a crucial condition for a properly performed examination of the field of vision. In the case of central retinal diseases, a distinct lack of fixation stability is commonplace. Thus, the standard perimetry is not an objective method of examining the field of vision in cases where the central fixation is disturbed. Such a drawback is not present in the microperimetry, due to eye movement tracking during the examination. Although the MP-1 microperimeter was built mostly to assess macular sensitivity, it can be of use in other eye diseases.

From the clinical point of view, the most important uses of the microperimetry are, above all, degenerative, vascular, inflammatory, genetic and infectious retinopathies and maculopathies:

1. **Age-related macular degeneration** – both dry and exudative. This examination allows for a functional assessment of the AMD patients' vision quality, identification of scotomas in the central field of vision, disease progression assessment, therapy efficacy assessment (as well as assessment of anti-VEGF therapy effectiveness confronted to angiographic image and OCT). The level of central fixation is also assessed dur-

ing the examination. An interesting use of the MP-1 microperimeter is a function of visual rehabilitation in persons with impaired central vision. This function allows for a change of central fixation in a new localization, in the location not affected by the disease. Microperimetry can aid the early monitoring of central retinal lesions, helping to understand the natural course of the AMD (fig. 2).

2. **Macular lesions related to diabetic retinopathy** – this technique allows the assessment of lesions caused by diabetes complications, especially diabetic macular oedema, assessment of retinal laser photocoagulation treatment results (comparison of the effects of using different photocoagulation techniques on the quality of central vision).
3. **Vitreoretinal disorders** – retinal sensitivity assessment, mostly when vitreoretinal tractions, preretinal membranes, central retinal transmural (or laminar) openings, retinoschises or retinal detachments are present, but primarily the assessment of vitreoretinal surgery effects.
4. **Vascular disorders** – venous thrombosis, retinal artery occlusion.
5. **Glaucoma** – especially advanced lesions in the field of vision, with widening of the blind spot (a possibility of choosing a strategy of retinal sensitivity assessment in the parapapillary region) (fig. 3).
6. **Progressive retinopathy** – possibility of full-field examination. In this case, monitoring of the field of vision is key in field of vision and disease progression assessment.
7. **Every maculopathy requiring precise functional diagnostics** – as a complement to other diagnostic examinations (electrophysiological examinations, OCT, angiography) (fig. 4, 5).

Useful clinical functions of the MP-1 microperimeter:

1. **Clinical perimetry** – the MP-1 microperimeter allows for a kinetic perimetry examination both in manual function as well as in automatic. This facilitates precise determination of scotomas location and establishing their borders.
2. **Fixation examination** – it is extremely helpful not only in the case of maculopathy but also in nystagmuses and patients who are malingering. During the examination, a fixation map is created, which demonstrates quantitatively the distribution of the examined eye's fixation (fig. 6).
3. **Function of visual rehabilitation** – it is used in the case of central vision disorders, in degenerative and genetic maculopathies (e.g. Stargardt disease). By moving the preferred fixation point onto the region without lesions, the patient reports a subjective improvement of visual acuity and quality.

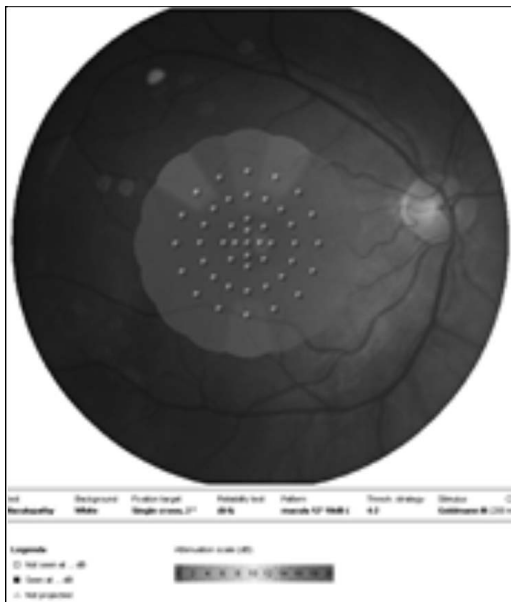


Fig. 1. Macular microperimetry in a 35-year-old healthy patient.

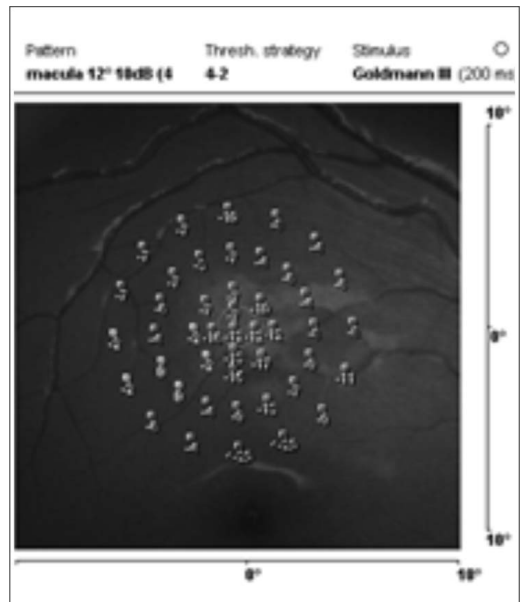


Fig. 4. Macular microperimetry in 12-year-old Stargardt disease patient.

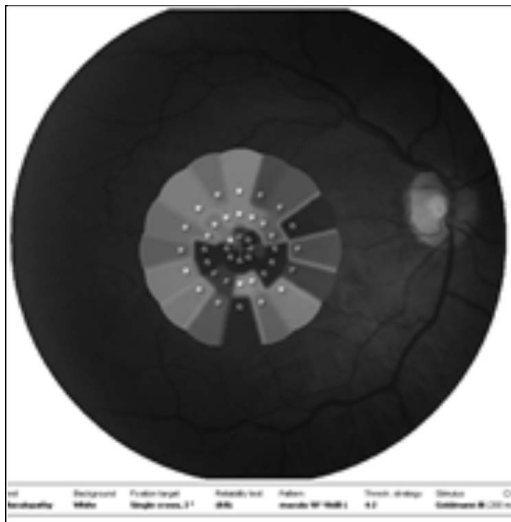


Fig. 2. Macular microperimetry, 57-year-old dry AMD patient.

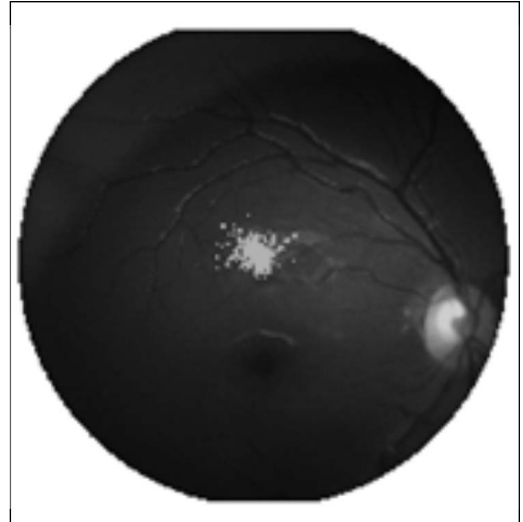


Fig. 5. Distribution of eccentric fixation in 12-year-old Stargardt disease patient.

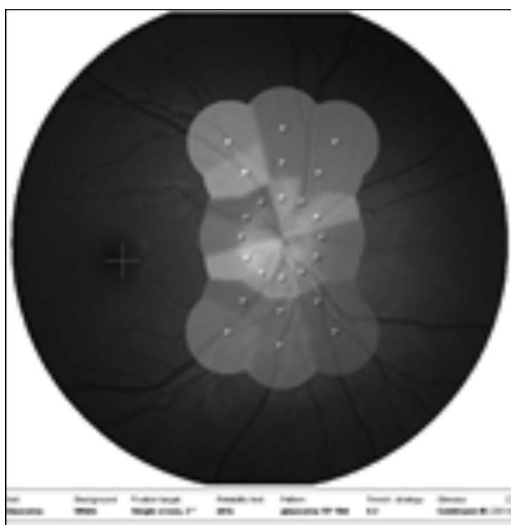


Fig. 3. Peripapillary microperimetry.

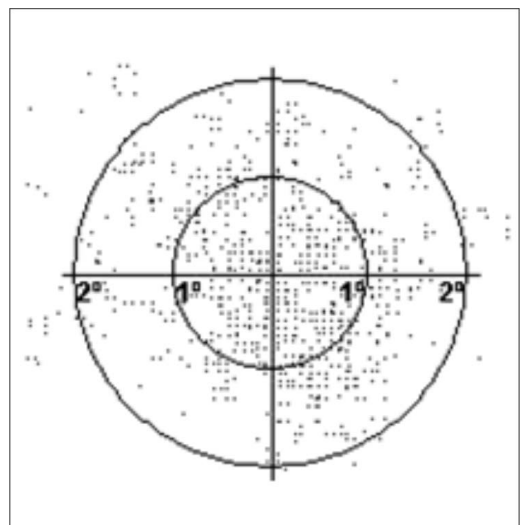


Fig. 6. Blue points represents the distribution of fixation map within 2° of the central field of vision.

CONCLUSIONS

In the modern, ageing society, patients with central vision disorders are far from uncommon. It is certain that visual acuity assessment with standardized tables is not enough to subjectively assess the field of vision disorders reported by patients. Microperimetry is a perfect addition to testing the quality of vision, assessment of disease progression and finally effectiveness of therapy. For visually impaired patients, this examination allows a precise fixation and central vision quality determination, demonstration of subjective disorders in the field of vision.

We have been working with the MP-1 microperimeter in the Ophthalmology Clinic in Katowice for

more than 3 years. We can ascertain that its advantages are precision, repeatability and the follow-up function which allows for monitoring of changes in time. Its drawback is a relatively long examination time in selected strategies (fatigue effect) and high cost of the device. Currently, there is a very interesting offer – a possibility of connecting spectral OCT examination with microperimetry examination (currently available Spectral OCT/SLO™ OPKO Health, Inc.) what adds new diagnostic tools, combining structural and functional retinal examinations in one device, to the field of ophthalmological image diagnostics.

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