

## Visual Functions Evaluation in Patients with Early Age-Related Macular Degeneration in the Period of Five Years

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**Introduction.** Age-related macular degeneration (AMD) is the term applied to ageing changes without any other obvious precipitating cause that occur in the central area of the retina in people aged 55 years and above [1]. Numerous risk factors have been reported: body aging together with pathological changes important in the pathogenesis of this disease: pathogenic oxidative stress, inflammatory processes, changes of the extracellular matrix, biological activity changes in the retinal pigment epithelium and genetic factors [2].

In a variety of central retinal diseases one of the earliest changes in visual processing is the impairment of normal colour vision. Frennesson et al established that colour contrast sensitivity may offer an additional possibility of predicting exudative AMD [3]. Eisner et al found that performance on the colour test was significantly impaired in AMD risk eyes compared to control eyes [4].

The aim of this research is to compare visual acuity and Munsell-Farnsworth 100 hue test in patients with age-related macular degeneration in the period of five years.

**Methods.** Twenty two patients with early age-related macular degeneration were investigated. In the investigation of patients visual acuity and computerised Farnsworth-Munsell 100 hue test (F-M 100 hue test) were performed in 2010 and in 2015 years once again. Non-corrected and the best-corrected visual acuity (measured in decimals from 0.1 to 1.0) was evaluated using Landolt's rings (C optotypes) by Snellen test types at a 5 meter distance from the chart. The computerised F-M 100 hue test requires arrangement of colour samples by tone. Majority of samples are of the same brightness and intensity in colour. Four boxes containing 85 plastic colour samples are provided. Two colour samples in each box are repeated and used as supportive colours, between which other colour samples have to be arranged so that a consistent transition of tones between the two supportive colours is achieved.

The colour samples are chosen in such manner as to cover the entire range of tones. The samples differ in tone but their colours are of approximately the same brightness and intensity. Two minutes are given for each box, though the speed of accomplishment of the test is not highly accentuated. A sequence number is assigned to each colour sample. The result is evaluated as the total amount of differences between the number of a colour sample chosen by a subject and the number of the colour sample actually belonging to the position. The degree of distinction of colours is assessed. The sensitivity of colours may be very high, i.e. the number of mistakes is up to 20; or normal average, i.e. the number of mistakes is up to 100; or disturbed, i.e. the number of mistakes is more than 100.

Statistical analysis was performed using the computer program SPSS / W 13.0 (Social sciences statistical package program for Windows, Inc., Chicago, Illinois, USA). The data are presented as real numbers (percent), the average values and standard deviations (SD). T test and the Mann-whitney U test were used for the comparison of two groups. Statistically significant difference was considered if  $P < 0.05$ .

**Results.** Eleven males (22 eyes) and eleven females (22 eyes) were evaluated. There were no differences between males and females age groups:  $62.85 \pm 9.88$  vs.  $63.15 \pm 9.9$ ;  $P = 0.1$ . The results of Munsell-Farnsworth 100 hue test and visual acuity are presented in Table 1.

**Table 1.** The Farnsworth-Munsell 100 hue test (F-M 100) and visual acuity results in patients with early age-related macular degeneration in five years period

Test	I group (measurement in 2010 years)	II group (measurement in 2015 years)	P value
Best corrected visual acuity	$0.82 \pm 0.16$	$0.76 \pm 0.11$	0.6268
F-M 100 test results	$172.23 \pm 10.73$	$194.68 \pm 12.34$	$< 0.001$

**Discussion.** Literature data analysing the effect of AMD on colour vision are inconsistent, therefore the purpose of this article is to assess how the presence of AMD is associated with the decreasing perception of colours and visual acuity in five years period. We did not find other researchers results analysing colour contrast sensitivity changes in the some year's period. Our results revealed, that Munsell-Farnsworth 100 test results in patients with early AMD were significantly worse ( $172.23 \pm 10.73$  vs.  $194.68 \pm 12.34$ ;  $P < 0.001$ ) in five years period, but results of visual acuity were not statistically significant worse.

It is known, that for detailed visual examination, various functions, such as cognitive perception, colour contrast sensitivity, health of the visual system and the central processing function are tested. Studies have shown that the assessment of the visual acuity testing by the typical Snellen chart using the

Landolt rings (C optotypes) alone is insufficient for the visual function testing because it provides limited information about the central vision, thus it is necessary to determine not only the visual acuity, but also the contrast sensitivity (5). Colour sensitivity is extremely sensitive (6). The Farnsworth-Munsell 100 hue and maximum colour contrast sensitivity tests are useful to determine this relationship. Our research revealed, that some scientists have found age-related macular degeneration increased the Farnsworth-Munsell 100 hue scores (7), others detected that the Farnsworth-Munsell 100 hue test was normal in all AMD patients (8). Kleiner et al also found that the impairment of the contrast sensitivity function increased with increasing drusen grade but according to their concept of drusen grade, drusen number, size, and degree of confluence were grouped together, so they were not able to analyse the influence of the different drusen characteristics on spatiotemporal contrast sensitivity (9).

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#### References

1. Ferris FL, 3rd, Wilkinson CP, Bird A, et al. Clinical classification of age-related macular degeneration // *Ophthalmology*. 2013. –P. 844–51.
2. Zarbin MA. Current concepts in the pathogenesis of age-related macular degeneration // *Arch Ophthalmol* 2004. –P. 598–614.
3. Frennesson C, Nilsson UL, Nilsson SE. Colour contrast sensitivity in patients with soft drusen, an early stage of ARM // *Doc Ophthalmol* 1995. –P. 377–86.
4. Eisner A, Fleming SA, Klein ML, Mauldin WM. Sensitivities in older eyes with good acuity: eyes whose fellow eye has exudative AMD // *Invest Ophthalmol Vis Sci* 1987. –P.1832-7.
5. Ginsburg AP. Contrast sensitivity and functional vision // *Int Ophthalmol Clin* 2003. –P. 5–16.
6. Margolis S. Electrodiagnosis and hereditary retinal disease. E-book <https://www.nyee.edu/pdf/okap-margolis.pdf>
7. Beirne RO, Lee McIlreavy, Zlatkova MB. The effect of age-related lens yellowing on the Farnsworth–Munsell 100 hue error score // *Ophthalmic and Physiological Optics* 2008. –P.448–56.
8. Midena E, Degli AC, Blarzino MC, et al. Macular Function Impairment in Eyes With Early Age-Related Macular Degeneration // *Investigative Ophthalmology & Visual Science* 1997. –P. 469–77.
9. Kleiner RC, Enger C, Alexander MF, Fine SL. Contrast sensitivity in age-related macular degeneration // *Arch Ophthalmol* 1988. –P. 55–57.

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The purpose of the work was to compare visual acuity and Munsell-Farnsworth 100 hue test in patients with early age-related macular degeneration in the period of five years. Twenty two patients with early age-related macular degeneration were investigated. In the investigation of patients visual acuity and computerised Farnsworth-Munsell 100 hue test (F-M 100 hue test) were performed in 2010 and in 2015 years once again. Non-corrected and the best-corrected visual acuity (measured in decimals from 0.1 to 1.0) was evaluated using Landolt's rings (C optotypes) by Snellen test types at a 5 meter distance from the chart. The Farnsworth-Munsell 100 hue test results were worse after five years comparing to results before five years ( $194.68 \pm 12.34$  vs.  $172.23 \pm 10.73$ ) and visual acuity results did not differ statistically significant. Farnsworth-Munsell 100 hue test sensitivity is extremely sensitive method which can detect visual function deterioration.