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Testing of the Retinal Visual Acuity in High Myops with Cataracts

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ABSTRACT

In the presence of the media opacities and extreme ametropia, especially in high myopia, often arises a question of expected visual acuity, e.g. after cataract extraction because of the possible degenerative changes of the choroid and retina. In the measurements were enrolled 15 patients between 45 and 60 years of age, 9 female and 6 male. We have tested preoperative retinal visual acuity by the interferometer. One month postoperatively visual acuity was measured by Snellen international charts at a distance of 6 m. Both measurements are calculated using log MAR scale. Measurements were paired and the differences are calculated and analyzed for the significance. No significance was found ($p > 0.05$). It was concluded that measured differences were incidental and interferometer measurements are reliable in predicting post cataract visual acuity in high myopia

Key words: Retinal visual acuity, high myopia, vision prediction after cataract surgery

Introduction

In the presence of media opacities and especially in high myopia because of choroid and retinal degenerative changes, the clinical question often arises as to which macular function can be expected under the assumption of normal optical image formation. Simple tests such as light projection and color discrimination cannot provide adequate information about macular function. Various entoptic phenomena (Purkinje vascular phenomenon, fovea chagrin) are available as qualitative subjective tests. Interferometers provide quantitative approach for assessing information about macular function¹.

Retinal spatial resolution could be defined independently of the optical imaging in the eye and it is dependent of the spatial density of the receptors. This is called retinal visual acuity or potential visual acuity and respectively in some instances predicted visual acuity^{1,2}.

A phenomenon of interference could be produced independently of the optical imaging, simply by superimposing of the elements of the coherent irradiation. The elements of some wave front are coherent if they can interfere in the circumstances of superimposing. Under those circumstances a grating of light and dark is produced and it could be seen if it is falling on the screen, in our example that is retina.

Myopia is refractive anomaly with wide range of incidence in some isolated populations (1% to 32%)³. Low visual acuity in high myopia is often attributed to the extensive degenerative changes of the choroid and retina⁴. Retinal visual acuity measures potential visual acuity of the retina, visual pathways and visual cortex, accordingly perception, conduction and analysis of the visual impressions^{5,6}. This quality of the human visual apparatus often is covered by the opacities of the optical media, irregular imaging or disturbed relations among receptors by reason of pathology in the choroid and retina while receptors are preserved^{7,8}. The measurement of retinal visual acuity could elicit in some cases paradoxical measurements compared with standard subjective measurements with Snellen optotypes⁹.

Patients and Methods

In the period of 2010 and 2011 by the patients with high myopia (12–15 diopter of sphere equivalent and astigmatism less than 1 diopter) and cataracts according the LOCS III grading: P1-2, C1-2, N1-2¹⁰, we have tested preoperative retinal visual acuity by the interferometer (Rodenstock Retinometer, Figure 1.)¹¹. In the measure-

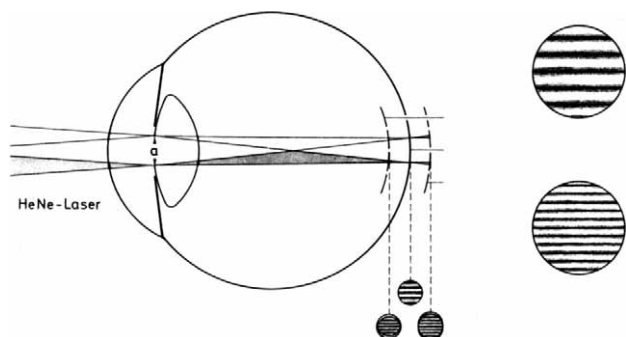


Fig. 1. Superimposing of the two bundles of light rays from two coherent sources, interference fringes are forming in the eye. Patient observes light and dark lines.

ments, 15 patients between 45 and 60 years of age, 9 female and 6 male, were enrolled. Cataract was operated by the phacoemulsification technique with temporal approach and 2.75 mm clear cornea incision and implantation of three piece foldable hydrophobic intraocular lens. One month postoperatively visual acuity was measured by Snellen international chart at a distance of 6 m. Both measurements (preoperative retinal visual acuity and postoperative Snellen visual acuity) are calculated using log MAR scale^{12,13}. In both measurements, a fractional criteria for acceptance of the responses were used^{14,15}. Results are t-tested for statistical significance as dependent small samples.

Results

Preoperative interferometer and postoperative Snellen measurements are showed on the Table 1. All measurements are calculated in log MAR units. For the ac-

ceptance of all responses a fractional criteria were used. Measurements were paired and the differences are calculated and analyzed for the significance. No significance was found ($P > 0.05$).

Discussion

In the presence of the media opacities and extreme ametropia, especially in high myopia, often arises a question of expected visual acuity e.g. after cataract extraction because of the possible degenerative changes of the choroid and retina. All paired measurements (retinal visual acuity and Snellen chart visual acuity) are calculated in log MAR units, what makes it suitable for comparative calculations^{12,13}. Measurements are accepted according fractional criteria^{14,15}. Enrolled patients were of age between 45 and 60. A visual acuity in humans is developing step by step from birth and achieves its maximum at the age of 25 and is degrading slowly with age, but remarkable degradation was observed after the age of 60^{16,17}.

By our patients in 4 cases preoperative measurements of the retinal visual acuity were better than the Snellen chart measurements postoperatively. Schraub et al.¹⁸, Mustaev et al¹⁹ and Guyton⁹ in a few cases have found misleading predictions of measurements of the retinal visual acuity.

In our patients we have found some paradoxical results of measurements but without essential clinical importance and we have found these measurements insignificant ($p > 0.05$). It was concluded that measured differences were incidental and the interferometer measurements are reliable in predicting post cataract visual acuity in high myopia.

TABLE 1
NUMBER OF PATIENTS AND PREOPERATIVE MEASUREMENTS OF RETINAL VISUAL ACUITY PAIRED WITH POSTOPERATIVE SNELLEN VISUAL ACUITY IN log MAR UNITS

Patient	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Retinal acuity	0.7	0.2	0.5	0.1	0.0	0.5	0.3	0.2	0.4	0.8	0.0	0.4	0.5	0.2	0.0
Snellen acuity	0.6	0.2	0.5	0.1	0.1	0.6	0.4	0.1	0.2	0.8	0.0	0.3	0.7	0.1	0.1

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MJERENJE RETINALNE OŠTRINE VIDA U VISOKO KRATKOVIDNIH S KATARAKTOM

SAŽETAK

U prisustvu opaciteta medija i visoke ametropije, osobito kod visoke miopije, postavlja se pitanje očekivane oštine vida, npr. nakon ekstrakcije katarakte zbog eventualnih degenerativnih promjena žilnice i mrežnice. Mjerenja su izvršena u 15 bolesnika u dobi 45–60 godina, 9 žena i 6 muškaraca. Mjerena je preoperativna retinalna oština interferometrijski. Mjesec dana nakon operacije katarakte, mjerena je oština vida Snellenovim optotipima na udaljenosti 6 m. Objekte mjerenja su preračunate u logMAR jedinice. Mjerenja su uspoređena i izračunate su razlike, te je analizirana signifikantnost nađenih razlika. Nije nađena signifikantna razlika mjerenja ($p > 0,05$). Zaključeno je da su izmjerene razlike unutar slučajnih varijacija, te da je interferometrijsko mjerenje preoperativne retinalne oštine vida pouzdano u prognoziranju postoperativne oštine vida nakon operacije katarakte u visoko kratkovidnih osoba.