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Original article

Binocular vision in glaucoma[☆]

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ABSTRACT

Objective: To describe the possible impairment of binocular vision in primary open angle glaucoma (POAG) patients.

Method: A cross-sectional study was conducted on 58 glaucoma patients, 76 ocular hypertensives and 82 normal subjects. They were examined with a battery of binocular tests consisting of the measurement of phoria angles, amplitudes of fusion (AF), near point of convergence (NPC) assessment, an evaluation of suppression (Worth test), stereoacuity according to Titmus, and TNO tests.

Results: The patients with glaucoma showed significantly increased phoria angles, especially in near vision, compared with the ocular hypertensives and controls ($p=0.000$). AF were reduced mainly in near distances compared to hypertensives and controls ($p=0.000$). The NPC of glaucoma was higher than the other two groups ($p=0.000$). No differences were found in the near-distance suppression test between the three groups ($p=0.682$), but there were differences in the distance vision of patients with glaucoma compared to hypertensives (OR=3.867, 95% CI; 1.260–11.862; $p=0.008$) and controls (OR=5.831, 95% CI; 2.229–15.252; $p=0.000$). The stereoacuity of patients with glaucoma was reduced in both tests ($p=0.001$).

Conclusions: POAG is mostly associated with, an increased exophoria in near vision, a decreased AF in near vision, a far-distance NPC, central suppression in far-vision, and a loss of stereoacuity. These changes do not seem to appear early as they were not observed in hypertensive patients versus controls.

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La visión binocular en el glaucoma

RESUMEN

Objetivo: Describir posibles alteraciones de la visión binocular en sujetos afectados de glaucoma primario de ángulo abierto (GPAA).

Método: Estudio de diseño transversal. Se incluyó a 58 sujetos glaucomatosos, 76 hipertensos oculares y 82 controles. En estos pacientes se estudiaron los ángulos de foria, las amplitudes de fusión (AF) en visión lejana y cercana, el punto próximo de convergencia (PPC), la supresión cercana y lejana mediante el test de Worth y la estereoagudeza según los tests de Titmus y TNO.

Palabras clave:

Visión binocular

Glaucoma

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Resultados: Los glaucomatosos presentaron un aumento significativo de los ángulos de foria sobre todo en visión cercana, frente a los hipertensos y controles ($p=0,000$). Las AF estaban reducidas, principalmente la cercana, con respecto a hipertensos y controles ($p=0,000$). El PPC de los glaucomatosos fue mayor que el de los otros dos grupos ($p=0,000$). No se hallaron diferencias en el test de la supresión cercana entre los tres grupos ($p=0,682$), pero sí en la lejana de los glaucomas con respecto de los hipertensos (OR = 3867; IC del 95%, 1260-11,862; $p=0,008$) y a los controles (OR = 5831; IC del 95%, 2229-15,252; $p=0,000$). La estereoagudeza de los glaucomatosos se encontraba reducida en ambos tests ($p=0,001$).

Conclusiones: El GPAA se asocia principalmente a un aumento de la exoforia cercana, a una disminución de la AF en la visión cercana, a un alejamiento del PPC, a la aparición de supresión central en visión lejana y a una pérdida de estereoagudeza. Estas alteraciones no parecen ser precoces, ya que no se observaron en los hipertensos frente a los controles.

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Introduction

Chronic open angle glaucoma (POAG) is a relatively frequent ocular disease affecting 2% of the adult population over 40.¹ In addition, this prevalence increases with age.² Glaucoma continues to be one of the main causes of blindness in the world, including highly industrialized countries.³ It is a chronic and initially asymptomatic disease that causes irreversible vision loss in a slowly progressive manner. It has been observed that from not very advanced stages of the disease patients experience limitations in daily activities related to vision,⁴ involving a significant reduction in their quality of life.⁵

Generally, POAG affects both eyes either symmetrically or asymmetrically. It is assumed that glaucoma damage in each eye hinders sensory integration of monocular visual stimuli and this involves the deterioration of binocular vision. Even though onset is very gradual, this loss of binocularity could contribute to explain the physical limitations observed in patients due to its negative impact on visual performance.

This paper studies the possible binocular vision alterations in POAG subjects.

Subjects, materials and methods

The study was designed as cross-sectional. All subjects included in the study were in the Health Area 9 of the Community of Madrid and were selected consecutively by order of appearance in the period comprised between March 2006 and December 2010. Each subject signed an informed consent in order to participate in the study.

Overall, 216 subjects were recruited of which 58 were classified as glaucoma patients, 76 as ocular hypertensive (OHT group) and 82 non-glaucoma or hypertense subjects (control group). The glaucoma group included patients with clinic and diagnostic of uni- or bilateral POAG with reliable campimetry and a mean deviation (MD) better than -12 dB in the worst eye and with intraocular asymmetries under 6 dB. The subjects fulfilling one or more of the following criteria were excluded: non-glaucoma optic neuropathy history, amblyopia, strabismus in childhood or acquired in adulthood, presence of opacities, recent intraocular surgery (under 2 months), corneal refractive surgery and existence

of large refractive defects or anisometropia. The control group included subjects with intraocular pressure (IOP) under 21 mmHg, without hypotensor treatment in the absence of acquired papillary damage and without campimetric deterioration. The inclusion criteria for the control group were also applied to the OHT group with the exception of IOP which should be 21 mmHg or over without hypotensor treatment.

All selected subjects underwent a complete ophthalmological assessment, with visual acuity assessed in the logMAR scale, spherical equivalent, central corneal pachymetry in microns (μm) and IOP. In addition, they underwent campimetry with the 24-2 algorithm of the Humphrey II 740 field analyzer (Humphrey Instruments, Dublin, USA) and a specific assessment of binocular vision comprising: (a) horizontal phoria angles (HFA) in near and far vision by means of the red lens test and prism bar; (b) fusion amplitude (FA) in near and far vision, measuring the fusion rupture point in divergence and convergence with prism bar; (c) near convergence point (NCP) measured in centimeters, utilizing a morphoscopic steadily as fixing object; (d) sensory suppression determined with the Worth light test in far and near vision; (e) stereoacuity evaluation by means of Titmus test (Stereo Optical Co. Inc., Chicago, IL, USA) and TNO test (Laméris Tech, Nieuwegein, Holland).

Statistical analysis

A descriptive analysis was performed, verifying quantitative variables against normal values by means of the Kolmogorov-Smirnov (K-S) test. For paired variables (right and left eye), such as logMAR VA, spherical equivalent, central corneal pachymetry and MD, the mean value was taken as the study variables. The ANOVA variance analysis was applied for simultaneously comparing the mean quantitative variables of the 3 groups, while in the case of non-normal distributions the Kruskal-Wallis nonparametric test was applied. For quantitative variables comparisons the Chi square test was utilized.

A p value under 0.05 was taken as statistically significant. The statistical analysis was carried out with the SPSS Statistics software version 15.0 (SPSS Inc., Chicago, IL, USA) for Windows.

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