Journal français d'ophtalmologie (2018) xxx, xxx—xxx

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ORIGINAL ARTICLE

Chromatic and achromatic visual fields in relation to choroidal thickness in patients with high myopia: A pilot study

Champs visuels chromatiques et achromatiques en relation avec l'épaisseur choroïdienne chez les patients atteints de myopie élevée : une étude pilote

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Received 20 January 2017; accepted 4 July 2017

KEYWORDS
Choroidal thickness;
Contrast sensitivity;
High myopia;
Vision field;
Visual pathway

Summary
Purpose. — To analyse the relationship between the choroidal thickness and the visual perception of patients with high myopia but without retinal damage.
Methods. — All patients underwent ophthalmic evaluation including a slit lamp examination and dilated ophthalmoscopy, subjective refraction, best corrected visual acuity, axial length, optical coherence tomography, contrast sensitivity function and sensitivity of the visual pathways.
Results. — We included eleven eyes of subjects with high myopia. There are statistical correlations between choroidal thickness and almost all the contrast sensitivity values. The sensitivity of magnocellular and koniocellular pathways is the most affected, and the homogeneity of the sensibility of the magnocellular pathway depends on the choroidal thickness; when the thickness decreases, the sensitivity impairment extends from the center to the periphery of the visual field.
Conclusions. — Patients with high myopia without any fundus changes have visual impairments. We have found that choroidal thickness correlates with perceptual parameters such as contrast sensitivity or mean defect and pattern standard deviation of the visual fields of some visual pathways. Our study shows that the magnocellular and koniocellular pathways are the most affected, so that these patients have impairment in motion perception and blue-yellow contrast perception.

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https://doi.org/10.1016/j.jfo.2017.07.006
0181-5512/

MOTS CLÉS
Épaisseur choroïdienne ;
Sensibilité au contraste ;
Myopie élevée ;
Champ de vision ;
Voie visuelle

Résumé
Objectif. — Analyser la relation entre l'épaisseur choroïdienne et la perception visuelle des patients atteints de myopie forte sans lésion rétinienne évidente.
Méthodes. — Tous les patients ont subi une évaluation ophtalmique comprenant un examen par lampe à fente et une ophtalmoscopie dilatée, une réfraction subjective, la meilleure acuité visuelle corrigée, la longueur axiale, une tomographie par cohérence optique, la fonction de sensibilité au contraste et la sensibilité des voies visuelles.
Résultats. — Nous avons inclus onze yeux de sujets souffrant de myopie élevée. Il existe des corrélations statistiques entre l'épaisseur choroïdienne et presque toutes les valeurs de sensibilité au contraste. Les sensibilités des mécanismes magnocellulaires et koniocellulaires sont les plus affectées. L'homogénéité de la sensibilité du mécanisme magnocellulaire dépend de l'épaisseur choroïdienne, lorsque l'épaisseur diminue, la détérioration de la sensibilité se prolonge du centre à la périphérie du champ visuel.
Conclusions. — Les patients atteints d'une myopie élevée sans modifications du fond de l'œil ont des déficiences visuelles. Nous avons trouvé que l'épaisseur choroïdienne est en corrélation avec des paramètres perceptuels tels que la sensibilité au contraste ou le défaut moyen et l'écart-type du motif des champs visuels de certains mécanismes visuels. Notre étude montre que les voies magnocellulaire et koniocellulaire sont les plus touchés, de sorte que ces patients ont une altération du mouvement et de la perception de contraste bleu-jaune.

Introduction

High myopia is associated with a progressive elongation of the ocular globe. Excessive elongation causes various complications, such as lacquer cracks, choroidal neovascularisation and choroidal atrophy [1]. Choroidal atrophy increases with choroidal thinning, which leads to photoreceptor death and, as a consequence, loss of central vision due to the interruption of oxygen and nutrients flow to the retinal cells [2].

Recently, direct choroidal layer visualisation and measurement of the choroidal thickness was achieved through enhanced depth imaging (EDI) using spectral-domain optical coherence tomography (OCT) [3—5].

Some studies that relate visual function to choroidal thickness in high myopic eyes show that visual acuity (VA) diminishes when choroidal thickness is reduced [6,7] and that the sensitivity of the visual field, measured by microperimetry or Goldmann kinetic perimetry, is impaired in patients with high myopia[8—10]. In addition, measurements with the microperimeter has shown an inverse relationship between the subfoveal choroidal thickness and the mean retinal sensitivity [8,9].

No studies were found on contrast sensitivity (CS) related to choroidal thickness, however one study shown that in patients with high myopia CS is affected at higher frequencies [11]. Mäntyjärvi and Tuppurainen conclude that high myopes without central retina detachment seem to have an altered colour perception, in the blue-yellow mechanism [12].

It is well known that the first stages of visual perception are mediated by three parallel pathways called the magnocellular, parvocellular and koniocellular pathways, each of which code different visual information. Achromatic information is processed by both the magnocellular and parvocellular pathways, although the first is more sensitive to low-spatial frequency and high-temporal frequency achromatic stimulus and mediates movement perception. The second mechanism is the more sensitive to stationary stimuli and mediates shape perception and vision of spatial detail [13—17]. Chromatic information is processed by the red-green and blue-yellow opponent mechanisms, parvocellular and koniocellular, respectively [18]. No studies have determined which of these three visual mechanisms is the most affected in patients with high myopia, nor have they analysed in detail the relationship between the visual quality of these patients and choroidal thickness. The purpose of this study was to analyse whether choroidal thickness is related to the sensitivity of the visual mechanisms and to the visual quality of these patients, assessed by means of their VA, achromatic contrast sensitivity function (CSF) and sensitivity of the magnocellular, parvocellular and koniocellular visual pathways.

Methods

This is a prospective observational pilot study performed at the FISABIO-Oftalmología Médica (FOM) clinic. We included eleven eyes from subjects suffering from high myopia (defined as having a spherical equivalent [SE] of −6D or higher). Patients with cataract, amblyopia, glaucoma, uveitis, diabetic retinopathy, retinal vascular abnormalities, drusen, patchy chorioretinal atrophy (severe myopic

Please cite this article in press as: García-Domene MC, et al. Chromatic and achromatic visual fields in relation to choroidal thickness in patients with high myopia: A pilot study. J Fr Ophtalmol (2018), https://doi.org/10.1016/j.jfo.2017.07.006