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ORIGINAL ARTICLE

Macular asymmetry analysis in sighting ocular dominance

Gökhan Pekel [a,*], Semra Acer [a], Fatih Özbakis [a], Ramazan Yagci [a], Nihat Sayin [b]

[a] *Department of Ophthalmology, Pamukkale University, Denizli, Turkey*
[b] *Department of Ophthalmology, Istanbul Kanuni Sultan Suleyman Training and Research Hospital, Istanbul, Turkey*

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Abstract Sighting ocular dominance is the preference of one eye over the other in terms of sighting. In this study, our aim was to examine differences in interocular and intraocular macular thickness, interocular fovea-optic disc angle, and foveal blood vessel asymmetries associated with sighting ocular dominance. Ninety eyes of 45 healthy young adults were included in this prospective, cross-sectional, and comparative study. Sighting ocular dominance was determined by a hole-in-the-card test. Macular thickness measurements were taken and posterior pole asymmetry analysis conducted with spectral domain optical coherence tomography. The optic disc—fovea angle and visible foveal blood vessel counts were calculated by using the posterior pole retinal images of optical coherence tomography. The mean age of the participants was 27.3 (standard deviation [SD] 6.6) years. There were 20 males and 25 females. The mean total macular area thickness, and mean macular thickness of the superior and inferior hemispheres of the dominant and nondominant eyes were similar ($p > 0.05$). Macular asymmetry analysis revealed no statistically significant interocular difference ($p > 0.05$). In the dominant eyes, the mean optic disc—fovea angle was 5.24° (SD 1.77), whereas it was 5.49° (SD 2.58) in the nondominant eyes ($p = 0.51$). The number of visible blood vessels passing through the fovea was similar in the dominant and nondominant eyes ($p > 0.05$). These results suggested that interocular and intraocular macular thickness differences, interocular fovea—optic disc angle differences, and number of visible foveal blood vessels are not associated with sighting ocular dominance.

Conflicts of interest: All authors declare no conflicts of interest.

* Corresponding author. Pamukkale University, Ophthalmology Department, Denizli 20070, Turkey.
E-mail address: gkhanpekel@yahoo.com (G. Pekel).

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Introduction

Posterior pole asymmetry analysis (PPAA) is a novel retinal imaging technique of the Spectralis optical coherence tomography (OCT) device that at once maps the posterior pole retinal thickness and performs asymmetry analysis between the eyes and between the hemispheres of each eye. It compares the thicknesses of 64 cells obtained from the macular areas of both eyes equivalent to a central 20° visual field [1—3]. Posterior pole images can also be used for optic disc—fovea angle measurements and retinal blood vessel examinations.

Ocular dominance is the superiority or preference of one eye over the other for sighting, sensory, and oculomotor tasks [4,5]. Although the importance of eye dominancy in daily life is not fully understood, it is clinically important in sports vision, vision therapy, and monovision treatments [6]. It has been reported that eye dominance might be related to cortical hemispheric specialization for visual attention [7]. People's dominant eye is frequently on the same side as the master hand, but the opposite is not rare.

Although ocular dominance has been studied for centuries, it continues to be a poorly understood phenomenon. The role of the brain in ocular dominance has some support, such as a finding that lesions of various cortical and subcortical tissues can cause unilateral spatial neglect [8]. Also, the first neurons of the visual pathway that encode binocular disparities are located in the visual cortex [9]. Higher-order centers of the brain beyond the visual cortex probably also exert some influence. It seems, however, that there are multiple determinants for sighting ocular dominance.

This study was motivated by recent reports revealing interocular quadrant macular thickness, refractive error, and axial length differences in sighting ocular dominance [10,11]. Because the macula is the retinal area concerned with central vision and is the primary determinant of visual output to the visual cortex, we hypothesized that it might complement the brain's primary role in the mechanism of ocular dominance. One of the aims of this study was to investigate the differences in interocular macular thickness, as well as the hemispheric differences of each eye in terms of sighting ocular dominance. In addition to this, we compared the optic disc—fovea angle of the dominant and nondominant eyes. We also examined interocular visible foveal blood vessel count differences.

Materials and methods

Ninety eyes of 45 healthy young adults were included in this prospective cross-sectional comparative study. The study was conducted in accordance with the ethical standards of the Declaration of Helsinki and was approved by the Institutional Ethical Committee.

Study population

Participants were aged from 19 to 41 years, and all had visual acuity of 20/20 or better for both eyes according to the Snellen chart examination. Exclusion criteria were any systemic diseases, a history of ocular surgery, ocular diseases (e.g., corneal opacity or irregularity, dry eye, amblyopia, anisometropia >0.50 diopters, glaucoma, and retinal abnormalities), on medications that might affect the eyes, and insufficient mental capacity to perform the tests. Participants exhibited refractive errors from -2.0 to $+2.0$ diopters spherical equivalent. Higher ametropies were excluded.

Ocular dominance detection

Sighting ocular dominance was determined by a hole-in-the-card test, in which each participant was given a card with a small hole in the center, instructed to hold it with both hands at a distance of approximately 40 cm from the eyes, and told to view a distant object through the hole with both eyes open. The researcher then alternates which eye is closed or the participant slowly draws the opening back to the head to determine which eye is viewing the object and is thus the dominant eye [6,12]. For each participant, the test was performed at least three times for confirmation. Participants with uncertain dominance were excluded. Fig. 1 shows the schematic representation of the visual process in sighting ocular dominance testing.

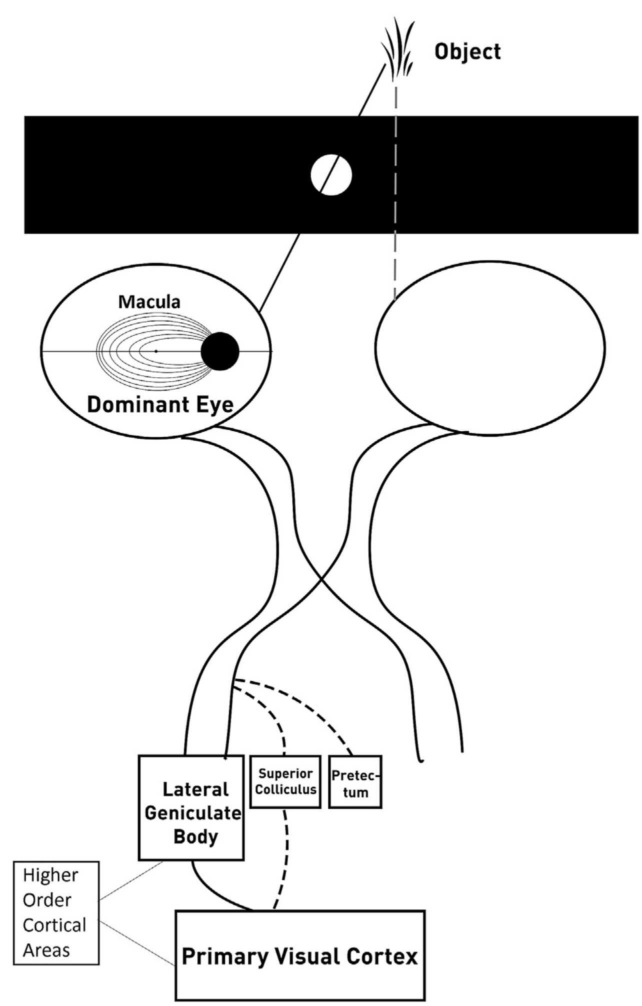

Figure 1. The schematic representation of the visual process in sighting ocular dominance testing.