

Analysis of Choroidal Thickness Using Spectral Domain Oct in Children with Unilateral Amblyopia in Riyadh, Saudi Arabia

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Abstract

To compare the subfoveal, parafoveal, and peripapillary choroidal thickness in amblyopic eyes with fellow and control eyes. Twelve control eyes, six fellow eyes, and six amblyopic eyes in this cross-sectional study. Choroidal thickness was measured by the enhanced-depth imaging technique of optical coherence tomography in all subjects. Choroidal thickness was measured at the subfoveal area and at 1000 μ m intervals to the nasal and temporal to the fovea up to 2000 μ m. The mean age was 8.75 ± 2.73 years in controls and 9.50 ± 2.81 years in amblyopic patients. Parafoveal choroidal thickness was thickest subfoveally, but thinnest nasally, in all three groups. The mean subfoveal choroidal thickness was 256 ± 40 μ m in control eyes, 226 ± 44 μ m in fellow eyes, and 270 ± 34 μ m in amblyopic eyes. It was thicker in amblyopic eyes but not significantly, P -value > 0.05 . There was no significant result in choroidal thickness between amblyopic, fellow, and control eyes.

Keywords: Unilateral amblyopia, Spectral domain, Choroidal thickness, Optometry

Introduction

Amblyopia

Amblyopia is a visual disorder where there is a decrease in visual acuity in one or both eyes (unilateral or bilateral) caused by binocular visual experience during the "critical period" (Progress in Brain Research, 1963). There are three periods when visual acuity and ocular dominance are developed. In the 3-5 years, acuity is measured by tests that exclude any crowding effects from less than 20/200 to nearly 20/20 (Early Visual Development: Normal and Abnormal, 2019).

The critical period depends on the process being examined at the anatomical level. The retina extends into the lateral geniculate nucleus, which projects into the primary visual cortex, then into other regions of the occipital cortex, and eventually into the sensory areas of the parietal and temporal cortex (LeVay *et al.*, 1980). Cells at the system's higher levels have a critical period that

lasts longer. For example, monocular deprivation can change the ocular dominance of cells in layers II, III, V, and VI of the primary visual cortex after establishing the ocular dominance of cells in layer IV (LeVay *et al.*, 1980; Toigawa *et al.*, 2010). Monocular deprivation affects several visual functions, with critical periods occurring early for functions treated at lower system levels. For example, monocular deprivation in the macaque monkey affects absolute sensitivity to light before the age of 3 months, sensitivity to wavelength and light increases before the age of 6 months, sensitivity to high-frequency contrast before the age of 18 months, and binocular summation before the age of 24 months (Harwerth *et al.*, 1986; Yawman, 2007).

Etiology

Amblyopia is a major problem in public health. In children and young adults, it is the most common cause of monocular vision loss (Williams, 2018). Amblyopia may be caused by several factors. Strabismus (ocular misalignment or heterotropia) causes the retinal images to be dissimilar. Uncorrected refractive errors (anisometropia) or visual axis obstructions (cataracts) it leads to unequal clarity of images. The most common contributing factor is strabismus. Deviating eye consistently leads to amblyopia, which may turn outward (exotropia) (**Figure 1**), inward (esotropia), or vertically (hypotropia, hypertropia). Deviations are detected in latent strabismus (heterophoria) only when one eye is occluded is rarely associated with amblyopia (Zhang & Wildsoet, 2015). The second most common factor contributing to amblyopia is '11' refractive error, which can be hard to detect.

Amblyopia is classified into two types arising from refractive errors: anisometropic and isometropic. Anisometropic amblyopia occurs when both eyes have different refractive errors, leading to the image being out of focus on one retina, impairing the visual pathway development in the affected eye. The most common refractive error that causes amblyopia is bilateral hyperopia (farsightedness). Isometropic amblyopia occurs when both eyes have the same refractive errors. Severe refractive errors can cause bilateral isometropic amblyopia in both eyes, even if symmetric, particularly if optical correction is delayed (Zhang & Wildsoet, 2015).

The least common factor is congenital opacity that causes amblyopia deprivation. Corneal lesions, ptosis, cataract, and distort the retinal image formation. Amblyopia of deprivation can affect one or both eyes and can take place within two to four

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months. Occlusion amblyopia is excessive therapeutic patching is a type of deprivation amblyopia (Zhang & Wildsoet, 2015).



Figure 1. child with exotropia of the right eye

Diagnosis

Amblyopia is diagnosed when there is evidence of decreased visual acuity that physical anomalies cannot describe. Structural eye disorder should be excluded, including optic nerve or macular defects, media opacity, and central visual pathway abnormalities. The assessment starts by providing an eye history based on the patient's age and parental observations (Zhang & Wildsoet, 2015). The parent or patient should be questioned about any obvious turns of the eye, the habit of closing one eye, depth difficulty, perceptual deficits, or school problems. The eye and visual examination should include a 1- monocular and binocular distance and near visual acuity using a whole chart, an isolated line, and an isolated letter to screen for crowding, 2- a dry and wet refraction to screen for latent hyperopia, and 3- analysis of monocular fixation to screen for eccentric fixation. 4- vergence, version, and sensorimotor fusion to screen for strabismus. 5- monocular and binocular oculomotor dysfunction testing motility. 6- accommodating amplitudes and accommodating dysfunction screening services, and 7- ocular safety, including color vision and dilated context screening for ocular disease or anatomical abnormalities that may result in reduced visual acuity (Zeiss *et al.*, 2018).

Impact of Amblyopia

Previous studies have examined the impact of amblyopia in children. The impact of amblyopia and the potential for reduced quality of life, the lifetime risk of bilateral vision impairment is almost double that for amblyopes than for controls, being as high as 18% for amblyopes compared to 10% for non-amblyopes (Corbett & Haines, 2018). Amblyopia does not have a significant impact on the outcomes of education, health, or society (Carreiro, 2009). Children with amblyopia do arithmetic, reading comprehension and visual and motor skills as well as their peers in age-appropriate assessments, and are usually less likely to have major behavioral problems or changes at home or school than those without amblyopia, while Adult amblyopes with moderate to severe visual acuity deficits (6/18 or worse) were more likely to report a road accident as the driver who caused hospital injuries (Spaide *et al.*, 2008; Carreiro, 2009). Increased readability for children with amblyopia compared to those who have normal development in view is reported; nevertheless, the prevalence of specific reading disabilities is similar to that of the general population among amblyopia (Mrejen & Spaide, 2013). Amblyopic children have fewer motor skills than children with normal vision. These studies generally describe how amblyopia has an adverse effect on real-

world visual-motor skills important for daily work, like reaching and capturing, drawing, writing, and manual skills (Dobson, 1993; Ikuno *et al.*, 2011).

Prevalence

Worldwide, the prevalence of amblyopia is approximately 1%-5%. The World Health Organization (WHO) estimates that 19 million children under the age of 15 are visually impaired, 12 million of them are impaired due to uncorrected refractive errors and amblyopia (von Noorden, 1990). In different parts of the world, the prevalence of amblyopia varies,

with the highest incidence in Europe (Ahn *et al.*, 2025; Castellano-Rioja, 2025; Cavero & Ferraz, 2025; Khalil & Nassar, 2025; Rani & Gehrke, 2025; Rivas & Molina, 2025; Shen & Bao, 2025; Silik, 2025). Geographical location and criteria for the definition of amblyopia are among the factors that contribute to the differences across the globe (Daw, 1998).

The prevalence of amblyopia in the US was less than (2%),

National population projections indicate that there are approximately 677,000 cases of manifest strabismus among children aged 6-71 months and 271,000 cases of amblyopia among children aged 30-71 months. The prevalence of amblyopia in Saudi Arabia were (1.85%) in Abha, anisometric and strabismic amblyopia were (47%) and (13%) with deprivation amblyopia (LeVay *et al.*, 1980), (3.90%) in Qassim, anisometric amblyopia was (77.72%) and strabismic amblyopia was (5.44%) (Daw *et al.*, 1992) and in Jeddah the prevalence was (1.3%), anisometric was (69%) and strabismic was (6%) (Harwerth *et al.*, 1986).

Treatment

Treatment is based on the cause of amblyopia and should be initiated at an early period (critical period). During this period, the various forms of deprivation listed above may reduce acuity, leading to amblyopia. Nevertheless, amblyopia is not limited to the first 3 to 5 years of life, but may result from strabismus or anisometropia at any age, between several months and 7 or 8 years of age (Levi & Polat, 1996). Therefore, three stages of acuity can be explained: the period of visual acuity development (birth to 3-5 years), the duration during which deprivation is significant to cause amblyopia (from a few months to 7 or 8 years of age), and the period during which amblyopia can be recovered (adolescent or even adult deprivation time) (LeVay *et al.*, 1980). The retina develops into the lateral geniculate nucleus, which projects into the primary visual cortex, then into other parts of the occipital cortex, and eventually into the sensory regions of the parietal and temporal cortex. Cells at the system's higher levels have a critical period that lasts longer. For example, monocular deprivation may alter the ocular dominance of cells in layers II, III, V, and VI of the primary visual cortex after establishing the ocular dominance of cells in layer IV (Ing, 1983; von Noorden, 1990).

In relation to stereopsis, stereopsis will never be achieved unless amblyopia is treated, eyes are aligned, and binocular fusion and function are achieved before the end of the critical period for stereopsis. Clinical data suggested that this occurs before the age of 24 months (Jampolsky, 1978; Held & Birch, 1980; Birch &

Hale, 1996). Stereoscopic acuity reaches between 2 and 5 months of age, 60 minutes of arc, and increases rapidly within the following month (Birch & Hale, 1996). There is a slower rise from 6 months to 3 years. It is expected that the stereopsis can be destroyed over a period of more than three years and recovered over an even longer period (Gregg & Parks, 1992; Ciner *et al.*, 1996). In an extreme case of unilateral cataract, a long-term patching regimen on the day after birth induces 20/25 visual acuity of the treated eye in a person aged 8 years and 50 seconds of stereoacuity in the arc (Helveston, 1993). Also, intervening in congenital esotropia at about 4 months of age may have a good rationale (Wright *et al.*, 1994), as this is the age at which stereopsis is rapidly developing. Two out of 7 patients treated at this age had stereoacuity greater than 60 seconds of arc at 5 to 8 years of age (American Academy of Ophthalmology, n.d.).

Detecting amblyopia, it depends on early recognition of factors, including a significant decrease in visual acuity. There are some screening tests to evaluate amblyopia: red reflex test, ocular motility, and visual assessment (Robaei *et al.*, 2006). The treatment goal is to provide a focused retinal image with appropriate optical correction, which can be done by patching the better eye to enhance the brain's ability to use the blurred image. In patients with visual deprivation, the derivative factors should be removed medically or surgically. Spectacles are the first line of treatment in anisometropic amblyopia, or, less commonly, contact lenses. Cycloplegic agent atropine sulfate can be used to enhance the use of the amblyopic eye. A drop of atropine applied to the better eye will reduce the accommodative ability, will be reduced and the eye receives a blurred image (Rahi *et al.*, 2006). Although atropine is just as effective as patches for the treatment of amblyopia, it is less controllable than patches because the effects of atropine last up to 2 weeks and rarely cause a decrease in the eye (Wilson & Welch, 2013). It is an acceptable form of treatment for certain children and their parents. This is known as reverse amblyopia. Therefore, every 2-3 weeks, a child with an atropine penalty must be observed to monitor vision closely in both eyes. The risk of reversal amblyopia and the increased number of clinical visits are the main reasons why atropine penalization is not routinely used as the initial amblyopia treatment (Wilson & Welch, 2013).

As a practical consideration, most strabismologists agree that it is necessary to improve acuity in the amblyopic eye by patching or other means before aligning the eyes. Otherwise, after alignment, the patient will not maintain their eyes straight. There are many other sensory tasks after this procedure that can be treated by several orthoptic techniques. Such functions include single-letter acuity, binocular function, stereopsis, depth perception, sensitivity to contrast, position perception, vernier acuity, crowding phenomenon (acuity in line of letters close to each other) (Koklanis *et al.*, 2006).

Also, the eye structures, such as the choroid, could be affected by amblyopia. Although the foveal or parafoveal choroidal thickness varies significantly regardless of the depth and type of amblyopia.

Choroid

The choroid is a vascular, thin, and loose connective tissue that lies between the retinal pigment epithelium (RPE) and sclera, which

arises very early in development from the loose vascular layer of mesenchyme that surrounds the optic cup. The main function of the choroid is to provide a nourishing blood supply to the outer layers of the retina. The choroid is too pigmented so that it may absorb the light that has entered the eye and passed through the retina (O'Connor *et al.*, 2010). Recent studies showed the choroidal role in ocular focus adjustment, including emmetropization, and thus eye growth regulation (Suttle *et al.*, 2011). It has three layers: choriocapillaris, stroma, and lamina fusca (from inner to outer). Each layer has specific functions. The choriocapillaris is responsible for supplying the nutrients to the (RPE) and the outer third of the retina. The choroidal stroma includes dendritic melanocytes, fibroblasts, and mast cells. The lamina fusca serves as a thin, web-like attachment between the choroid and sclera. The choroidal vasculature is supplied by the long and short posterior ciliary arteries and the anterior ciliary arteries. Drainage occurs via the vortex vessels (Hashimoto *et al.*, 2017). Cerebrospinal fluid (CSF) is produced from choroid epithelial cells by selective transport of materials from the connective tissue extracellular space and choroidal capillaries. Large molecules are transported in pinocytotic vesicles from the basal to the apical surface of the epithelium and exocytosed into the CSF (Hashimoto *et al.*, 2017).

Chloride, magnesium, and sodium have a higher concentration in CSF, while potassium, calcium, glucose, proteins, albumin, and uric acid have lower concentrations (Corbett & Haines, 2018). The choroid is innervated by the long and short ciliary nerves, which pass through the choroid and transmit sensory fibers to the cornea, iris, and ciliary body, while

The short ciliary nerves originated from the ciliary ganglion and carry sensory (from nasociliary), sympathetic, and parasympathetic fibers (derived predominantly from nerve III, but also from VII). Amblyopia leads to changes in choroidal blood flow (CBF) and central choroidal thickness (CCT) (Brown & Regillo, 2007) and therefore will affect the retina by changing changes in retinal vessels density and retinal thickness, macular vessel density in the superficial capillary plexuses of foveal and parafoveal is lower in children with amblyopia, while the thicknesses of the inner and outer retinas at either the fovea or the parafovea showed no significant differences between the amblyopic and control children.

The choroid is affected by many diseases, including Vogt-Koyanagi-Harada syndrome (VKH), sarcoidosis, sympathetic ophthalmia, toxoplasmosis, Bechet's disease, and panuveitis. As the choroid is placed under RPE, many medically available imaging tools, including the fundus fluorescein angiogram (FFA), the B-scan ultrasound, and the optical coherence tomography (OCT), only provide a partial description of the structure and function. This is primarily due to a loss of signal and light on the highly reflective RPE surface that blocks most choroidal signals (LeVay *et al.*, 1980).

Optical Coherence Tomography (OCT)

To create cross-sectional images, OCT uses the principle of low-coherence interferometry to obtain in-depth information from different retinal structures. It is an extremely useful tool for

imaging and identifying different retinal layers and helps identify retinal pathology. However, OCT cannot penetrate the retinal pigment epithelium (RPE), and it is limited to imaging the retina and optic nerve head.

Enhanced depth imaging (EDI) enables imaging of the deeper structures, including the choroid. It provides detailed choroid information by moving the zero-delay point, the point of maximum sensitivity to the OCT signal. Placing the zero delay point closer to the choroid than the internal retinal layers leads to a better representation of the choroid and allows for high accuracy and reproducibility quantitative measurement of its thickness (**Figure 2**) (Daw *et al.*, 1992; Friedman *et al.*, 2009).

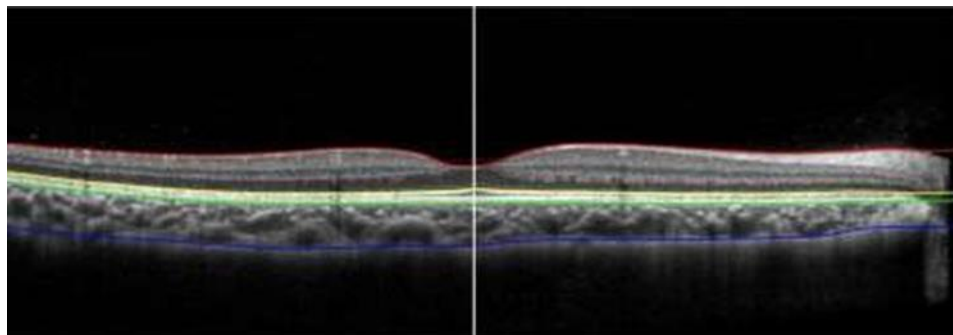


Figure 2. Shows the choroidal and retinal layers. Choroidal thickness measured from RPE (green) to choroidoscleral interface (CSI) (blue). The center of the fovea is determined manually as the thinnest part of the retina (white).

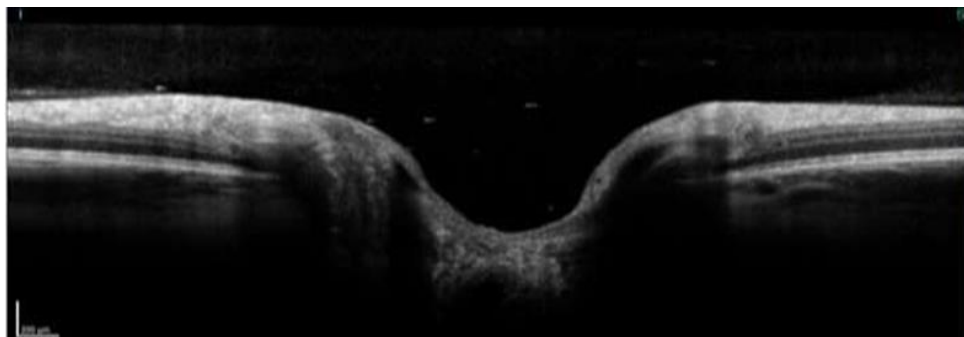


Figure 3. healthy optic nerve

Literature Review

Fujiwara *et al.* in (2012) measured subfoveal choroidal thickness in normal Japanese eyes and found that subfoveal choroidal thickness was affected by age and refractive error; it was decreased in thickness every 10 years by 20 μm (Fujiwara *et al.*, 2012). Another study by Bidaut *et al.* in (2013) measured the choroidal thickness in healthy children, and they found that the choroidal thickness was increased with age. Jinling *et al.* in (2014) Ebru *et al.* Ozgur *et al.* in (2015), and Zha *et al.* in (2019), used spectral-domain OCT to measure the choroidal thickness, subfoveal choroids in amblyopia subjects and found significantly thickening in both anisometropic and strabismic amblyopic eyes than those of the corresponding group of fellow eyes and control eyes.

In 2015, Feride *et al.* did a prospective study to evaluate the choroidal thickness and peripapillary retinal nerve fiber layer

OCT imaging is widely used for macula, optic nerve, and retinal nerve fiber layer (RNFL) imaging and helps analyze the morphology and quantify changes in different disease states. For example, the automated retinal thickness measurements produced by the SD-OCT systems are medically used to track disease progressions such as wet age-related macular degeneration (AMD) and macular edema from various causes, including diabetes and occlusion of retinal veins. The ability to detect fluid in the retina and the thickness changes caused by fluid help guide medical decisions about treatment (Aldebasi, 2015).

(RNFL) thickness in adults' amblyopic eyes. The choroidal thickness was thicker in the amblyopic eye than in the fellow eye, and there were no significant differences in RNFL thickness between amblyopic and fellow eyes (Kantarci *et al.*, 2015). Another study in 2017 by Arzu *et al.* to compare the retina and optic disc between amblyopic and non-amblyopic eyes. RNFL thickness, macular thickness, macular volume, axial length, or optic disc area between amblyopic and non-amblyopic eyes showed no significant differences (Taşkıran Çömez *et al.*, 2017). In 2017, Kaderli *et al.* did a study of the correlation of hyperopia and choroidal thickness, vessel diameter, and area, and they found that the macular choroidal thickness was thicker in hyperopic patients than in controls, so the choroidal thickness was affected by refractive error (Kaderli *et al.*, 2017).

Materials and Methods

Aim of Study

To compare the subfoveal, parafoveal, and peripapillary choroidal thickness in amblyopic eyes with fellow and control eyes (Essah *et al.*, 2024; Souza *et al.*, 2024; Cuenca-Martínez *et al.*, 2025; Hart & Reed, 2025; Rojas & Paredes, 2025).

Hypothesis

It was hypothesized that the choroid would be thicker due to the effect of amblyopia.

Significance of the Study

It contributed to understanding the effect of amblyopia on choroidal thickness and the role of the choroid in emmetropization (Danchin *et al.*, 2024; Hillman, 2024; Rivera & Carter, 2024; Braun *et al.*, 2025; Eid *et al.*, 2025).

Subjects

A cross-sectional comparative study involved 12 patients with unilateral amblyopia and healthy children, aged 6 to 17 years, recruited from the Elite hospital. Informed consent and detailed demographic data on each patient, including age, sex, and ocular and medical history, were obtained from the parents. All patients underwent a comprehensive eye examination, including refractive error (spherical equivalent (SE), best-corrected visual acuity (BCVA) (measured with Snellen chart adjusted at 6m), assessment of ocular motility and alignment, measurement of the intraocular pressure, slit-lamp and indirect fundus examination, and cycloplegic refraction after pupil dilation with cyclopentolate 1% drops administered three times, anterior segment, and fundus examination were normal in both eyes.

Inclusion Criteria

- 1- Amblyopia is caused by either hyperopic anisometropia or strabismus.
- 2- Anisometropia will be diagnosed in those patients whose spherical equivalent difference between the eyes is 2.0 D or greater.
- 3- Patients having manifest strabismus on cover testing or a history of strabismus surgery will be diagnosed as having strabismic amblyopia.
- 4- The depth of amblyopia in the affected eye of each patient will depend on BCVA in amblyopic eyes as better than 0.3, 0.1 to

0.3, or worse than 0.1 on the Snellen chart, categorized as “mild,” “moderate,” or “severe” respectively.

Exclusion Criteria

- 1- Patients with organic eye disease, a history of intraocular surgery, cataract, glaucoma, laser treatment, retinal, or optic nerve disorders.
- 2- Children are not sufficiently cooperative for Optical Coherence Tomography (OCT) examination.
- 3- Eyes with a refractive spherical equivalent (myopic or hyperopic) of 5 diopters (D) or greater or with high astigmatism (greater than 3 D).

Procedure

The Optical Coherence Tomography device (Mocean 4000, MOPTIM, Shenzhen Moptim Imaging Technology Co., Ltd.) was used for both central macular thickness and choroidal thickness measurements. The central macular thickness was measured automatically using OCT retinal mapping software. The choroid was observed by EDI-OCT, and choroidal thickness was measured manually after the EDI image was obtained by using calipers to measure the distance from the outer border of the retinal pigment epithelium to the inner surface of the sclera. The choroidal thickness was measured at the sub-foveal area and at 1000 and 2000 μm intervals temporal and nasal to the fovea.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics software version 19.0 (SPSS Inc., Chicago, IL). The results were reported as mean \pm standard deviation (SD).

Demographic data, clinical characteristics, and Choroidal thickness measurements of the amblyopic, fellow, and control eyes were compared by using one-way analysis of variance (ANOVA). A P value of < 0.05 was considered statistically significant.

Results and Discussion

A total of 24 eyes were included: 6 Patients with anisometropic amblyopia and 6 age- matched healthy controls (Agrawal *et al.*, 2024; Bona & Lozano, 2024; Khan *et al.*, 2024; Qiao *et al.*, 2024; Snodin & McCrossen, 2024; Ha *et al.*, 2025; Yilmaz & Erkol, 2025). The demographic data and clinical characteristics of the subjects are summarized in **Table 1**.

Table 1. Demographic data, BCVA and SE of amblyopic and controls subjects

Characteristic	Control eyes	Fellow eyes	Amblyopic eyes
Age, Mean \pm SD	8.75 \pm 2.73	9.50 \pm 2.81	9.50 \pm 2.81
Male, n	8	5	5
BCVA, Mean \pm SD	0	0.08 \pm 0.05	0.36 \pm 0.26
SE, (D)	+2.50 \pm 1.50	+3.50 \pm 1.00	+4.00 \pm 2.50

SD= stander deviation, SE= spherical equivalent, D= diopters

The population of the control group included 4 males and 2 females, and the amblyopic group included 5 males and 1 female. Their mean age was 8.75 ± 2.73 years in controls and 9.50

± 2.81 years in amblyopic patients. The mean BCVA was 0 in control eyes, 0.08 ± 0.05 in fellow eyes, and 0.36 ± 0.26 in amblyopic eyes. The mean BCVA was significantly worse in amblyopic eyes than in fellow and control eyes. The mean spherical equivalent was

$+2.50 \pm 1.50$ D in control eyes, $+3.50 \pm 1.00$ D in fellow eyes, and $+4.00 \pm 2.50$ D in amblyopic eyes.

Table 2. CT of Control, Fellow and Amblyopic eyes

Control eyes	T2000 257±40	T1000 247±46	Subfoveal 256±40	N1000 243±44	N2000 248±36
Fellow eyes	264±35	242±34	226±44	238±32	234±29
Amblyopic eyes	280±30	257±36	270±34	254±45	269±44
P values (one-way ANOVA)	0.50	0.80	0.16	0.80	0.28

P value < 0.05

Table 2 displayed the mean \pm SD of the three groups at different locations of the choroid.

Anisometropia is one of the main causes of amblyopia, and insufficient understanding of the anisometropic amblyopia mechanism. Visual acuity loss and binocular vision distribution are associated with unilateral amblyopia. Psychophysical studies of amblyopia have indeed revealed a wide range of visual deficits associated with amblyopia that are not limited to impaired visual acuity and binocular function (Hamm *et al.*, 2014). Though the choroid's role in regulating eye physiology is well known, the choroidal thickness changes in several diseases, such as amblyopia, are still unknown. The main function of the choroid is to provide a nourishing blood supply to the outer layers of the retina (O'Connor *et al.*, 2010).

The choroidal thickness of normal subjects was measured in previous studies. In Fujiwara *et al.* study, the mean subfoveal choroidal thickness for adults was 265.5 ± 82.4 μ m (Fujiwara *et al.*, 2012). the mean subfoveal choroidal thickness for children was 341.96 ± 74.7 reported by Bidaut-Garnier and colleagues (Bidaut Garnier *et al.*, 2013). In our study, the mean subfoveal choroidal thickness of the control eyes was 256 ± 40 . In our study, the anisometropic amblyopic eye was thicker than the fellow eyes and control eyes in all locations of choroidal thickness, but not significantly. Our results do not agree with previous studies; this could be due to the small sample size of the amblyopic cases involved in our study compared to controls. Also, the severity of amblyopia may affect choroidal thickness; in our study, they had mild amblyopia, while in previous studies, they had all classifications of amblyopia.

Most of the previous studies showed changes in choroidal thickness in anisometropic eyes (Xu *et al.*, 2014; Aygit *et al.*, 2015; Kara *et al.*, 2015). Jinling and colleagues compared the choroidal thickness of the amblyopic eyes with fellow and control eyes in 37 patients with unilateral amblyopia and found that the subfoveal choroidal thickness of amblyopic eyes was thicker than that of

Choroidal thickness measurements at different locations between the three groups are shown in **Table 2**. Parafoveal choroidal thickness was thickest subfoveally, but thinnest nasally, in all three groups. The mean subfoveal choroidal thickness was 256 ± 40 in control eyes, 226 ± 44 in fellow eyes, and 270 ± 34 in amblyopic eyes. It was thicker in amblyopic eyes but not significantly ($P > 0.05$). Choroidal thickness was thicker in control eyes than in fellow eyes at the fovea and 1000- μ m intervals nasal and temporal to the fovea, although no significant difference emerged between the two groups ($P > .05$).

fellow and control eyes (Xu *et al.*, 2014). Ebru *et al.* study included anisometropic and strabismic amblyopia compared with fellow and control eyes; the mean subfoveal choroidal thickness of anisometropic eyes was 362 ± 82 , which was thicker than in fellow and control eyes. While the strabismic amblyopic eyes choroidal thickness was thicker in subfoveal also in at point N500 and N1000 (Aygit *et al.*, 2015). Also in Ozgur *et al.* study, they compared the choroidal thickness of the amblyopic eyes with fellow eyes and controls eyes in 17 patients with hyperopic anisometropia amblyopia and found that subfoveal and at 750- μ m intervals, temporal and nasal to the fovea was thicker in amblyopic than control eyes, and only at 750- μ m nasal was thicker when compared with fellow eyes (Kara *et al.*, 2015).

Limitation

There are limitations to this study. First, the small sample size can mean that outcomes were statistically not significant in this study, and may not be accurate in the broader context. Second, the narrow range of participant age may affect the results of the study.

Conclusion

The subfoveal choroidal thickness was thicker in anisometropic amblyopic eyes than in fellow and control eyes, but not significant. Further studies are needed to determine the effect of amblyopic treatment on choroidal thickness and to determine the relationship between the choroid and amblyopia.

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Conflict of interest: None

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