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OCT Measurement of Peripapillary RNFL Thickness in Unilateral Amblyopic Eyes

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Abstract

Background: Amblyopia is also called lazy eye, it is a faintness in the central vision of the eye, without an organic cause, or in a way that is not commensurate with the organic imperfection in the eye.

Aim: The study aimed to evaluate the efficacy of OCT technique in the diagnosis of RNFL thickness in amblyopic patients.

Material and method: A prospective cross-sectional hospital based study was performed in Al-Najaf Al-Ashraf province/Iraq through the period from January to September/2014. The study involves 30 patients (16 male and 14 female) with the age ranging from (10-40) years who suffering from unilateral amblyopia.

Result: The thickness of inferior peripapillary RNFL was recorded thinner than those of normal eyes significantly with p-value ≤ 0.05. But, peripapillary RNFL thickness in nasal, superior and temporal types have no significant differences when compared with normal eyes.

Conclusion: In brief, our results suggested that the peripapillary RNFL thickening was significantly affected in strabismic and anisometropic amblyopia. Further, instrumental and histo-pathological studies are required to confirm the differences between amblyopic and normal eyes.

Keywords: Amblyopia, RNFL, OCT

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Introduction

Amblyopia is also called lazy eye, it is a faintness in the central vision of the eye, without an organic cause, or in a way that is not commensurate with the organic imperfection in the eye(1,2) if any. It frequently does not affect peripheral vision and it cannot be repaired with lenses. The illness affects 1-5% of people especially children before the age of six years and It represents the most common cause of ophthalmic problems in children. In amblyopia, the visual stimulus is not entirely transmitted through the optic nerve to the brain (3,4,5). The current study aimed to evaluates the efficacy of OCT technique in the diagnosis of RNFL thickness in amblyopic patients.
The Disease is a developmental problem in the brain and it is not a neurological, organic, or internal problem of the eyeball, manner in mind that organic problems may lead to amblyopia which lasts after the organic problem resolve (6,7).

Causes of amblyopia can be divided into the following two parts: 1- Organic amblyopia: which results from the loss of transparency of the lenses, as in cataracts. 2- Functional amblyopia, which results from functional diseases such as strabismus and refractive diseases. It is responsible for more unilateral vision reduction in children onest than all other causes combined(2,8,9,10).

Amblyopia is classified according to the cause into several types including Strabismus amblyopia is a child wears an eye patch to improve amblyopia. Squint is a disease in which the eyes are lined up asymmetrically (meaning that one of the eyes is not directed to the object to be looked at), resulting in the strabismus that the sight in the eye in which one prefers to see is normal (2,13). But it could happen that the sight is abnormal in the other eye. Amblyopia of anisometropia is a disease in which the refractive defect is not equal between the eyes; For example, there is a difference in myopia or farsightedness between the eyes and this change in refraction may cause double vision or asthenia. Refractive amblyopia is less severe than amblyopia, and it can have less pronounced symptoms, which makes it easy to misdiagnose it by doctors. Obstructive amblyopia when the occlusion of the eyelid obstructs the vision of the eye, as occurs in the drooping of the eyelid. Cataract amblyopia is darkens the lens of the eye and loses its transparency, which leads to poor visual stimuli coming from the eye, which leads to a defect in the development of the brain on vision (12,14,15).

Treatment of amblyopia involves the following: Eliminate (if needed) any obstacle to vision such as cataract. Correct any significant refractive error. Force use of the poorer eye by limiting the use of the better eye either by part-time which is defined as occlusion for 2-6 hrs. per day or full time occlusion has been shown to achieve the same results as the prescription of the full time occlusion. Or maybe by placing atropine drops in the healthy eye. The study aimed to determine the thickness of the peripapillary retinal nerve fiber layer of the eye with unilateral amblyopia by oct and to compare with the normal fellow eyes (16,17,18,19).

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Methodology

A prospective cross-sectional hospital based study was performed in Al-Sadder medical city at Al-Najaf Al-Ashraf province through the period from January to September/2014. The study involves 30 patients (16 male and 14 female) with the age ranging from (10-40) years who suffering from unilateral amblyopia, 20 of them have anisometropic amblyopia and the other suffers from strabismus. The specific information was collected from patients, full ophthalmic examination was done for both eyes, as the fellow eye was taken as a control group, the examination includes the visual acuity and best correct visual acuity, refraction error, slit lamp biomicroscopy, intra ocular pressure measurement using air-buff tonometer (Topcon), extra ocular movement, dilated fundoscope examination and oct examination.

Patients with intra ocular disease, myopic retinal degeneration, intra ocular surgery, glaucoma, cataract, laser treatment or retinal disorder and those not cooperative to oct examination were excluded from this study. Oct technique involves the dilatation of the eye by 1 drop of 1% tropicamide. After 30 min., thickness of RTNL was measured by oct system (model 2000, 3d oct, Topcon). The examiner focused beam on the fundus by infrared camera. For each eye, 3.45 mm RFNL centered in area of the optic disc.

In this study, measurement from total area was obtained in micrometer units. Average superior, inferior, nasal and temporal RNFL thickness were detected by circular scan. All oct measurements were performed by the same technician. In every case, the right eye was always measured first, followed by the left eye.

Statistical analysis was done by SPSS version 20 (statistical package for social science ver. 20). Mean deviation and the standard deviation were used, T-test is used to the comparison between normal and amblyopic eyes and the results were consider significant under p value < 0.05.

Results

A total of 30 unilateral amblyopic patients (16 male and 14 female) were included in this research, among them 20 patients endure from anisometropic amblyopia and 10 with strabismic amblyopia. The mean age of anisometropia patients was (24.8 years± 9.7), minimum11 years and maximum 40 years. The patients with squint have a mean age (19.1 years±8.9), minimum 10 years and maximum 39 years as shown in Table 1.

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Table 1- General features of study sample.

Feature		No.	%
Age group	less than 20	11	36.7
	20-30	12	40
	21-40	7	23.3
Gender	Male	16	53.3
	Female	14	46.7
Group	Anisometropia	20	66.7
	Squint	10	33.3
Occupation	Student t	15	50
	Free worker	9	30
	Housewife	5	16.7
	Teacher	1	3.3
Refractive error	Myopia	5	25
	Hypermetropia	13	65
	Hypermetropic astigmatism	2	10
Total		20	100%

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Table 2: Basic clinical data from with anisometropic amblyopia.

Age	BCVA	Superior		Inferior		Nasal		Temporal	
		Normal	Amblyopic	Normal	Amblyopic	Normal	Amblyopic	Normal	Amblyopic
11	6/36	126	111	138	125	55	65	81	73
13	6/18	141	129	144	144	76	102	89	75
13	6/18	134	117	113	130	76	70	66	86
13	6/18	141	129	144	144	76	102	89	75
18	6/60	121	110	118	105	76	84	96	69
20	6/18	130	107	150	123	122	72	90	129
20	6/24	119	113	133	124	80	59	72	69
20	6/24	119	113	133	124	80	59	72	69
21	6/18	104	118	112	121	72	105	94	74
22	6/24	126	105	156	121	122	70	90	129
22	6/18	128	128	125	123	87	94	84	121
25	6/18	125	100	115	99	75	34	89	75
25	6/24	129	125	135	123	73	85	88	84
27	6/36	108	87	115	119	75	62	68	83
33	c.f 2m	134	143	131	33	51	71	62	55
35	c.f 1m	142	51	126	66	97	41	69	44
38	6/24	69	61	114	84	67	41	63	59
40	6/18	130	107	120	113	82	65	87	82
40	6/24	116	117	138	142	96	123	122	84
40	6/24	120	131	108	126	73	99	96	81

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Table 3: Basic clinical data from patients with strabismic amblyopia.

Age	BCVA	Superior		Inferior		Nasal		Temporal	
		normal	amblyopic	normal	amblyopic	normal	amblyopic	Normal	Amblyopic
10	6/18	114	120	121	75	83	70	87	**67**
11	6/36	127	106	119	118	81	64	56	**72**
12	6/12	136	127	118	119	64	81	73	**56**
13	6/36	102	137	121	124	74	74	84	**53**
18	c.f 4m	147	115	113	117	73	85	145	**65**
19	6/24	121	97	111	99	68	25	88	**79**
20	c.f 1m	142	1	126	66	97	41	69	**44**
21	6/60	103	80	117	119	70	57	61	**86**
28	6/12	120	120	156	135	32	72	77	**99**
39	6/60	103	26	116	40	63	57	61	**86**

In our study, we found that the inferior and superior thickening of peripapillary RNFL among patients suffering from anisometropic amblyopic eyes is thinner significantly than the normal eyes under p-value 0.02 and 0.03 respectively. While, the temporal and nasal peripapillary RNFL thickness has no statistical differences among patients with p-value ≤ of 0.05,as shown in table 4.

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Table 4: comparison by mean and SD between normal and amblyopic eyes for patients with anisometropia with p-value.

Peripapillary NFL quadrant.	Normal eye (mean±SD)	Amblyopic eye (mean±SD)	P value
Superior	**123.1±16.3**	**110.1±22.4**	**0.02**
Inferior	**128.4±13.9**	**114.5±26.9**	**0.03**
Nasal	**80.6±17.8**	**75.2±23.8**	**0.4**
Temporal	**83.4±14.6**	**77.4±27.7**	**0.4**

The thickness of inferior peripapillary RNFL was recorded thinner than those of normal eyes significantly with p-value ≤ of 0.05. But, peripapillary RNFL thickness in nasal, superior and temporal types have no significant differences when compared them with normal eyes as showed in Table 5.

Table 5: comparison by mean and SD between normal and amblyopic eyes for patients with squint with p-value.

Peripapillary NFL quadrant.	Normal eye (mean±SD)	Amblyopic eye (mean±SD)	P value
Superior	121.5±16.5	97.9±35.6	0.08
Inferior	121.8±12.7	101.2±30.7	0.049
Nasal	70.5±16.9	62.6±18.4	0.421
Temporal	80.1±25.5	70.7±17.1	0.412

Discussion

Amblyopia may have different effects at various levels of the visual pathway. The data reports that the cells in the nucleus of the lateral geniculate may undergo atrophy due to amblyopic eye receiving input. Several studies reveal that the retinal ganglion cell modification can be caused by light deprivation such as diminution of mean nuclear volume, cell loss, thinning in the internal layer of plexiform and reduction in the size of optic nerve area (20,21). The Changes in the retina were investigated by several imaging devices like OCT studies which measure the thickness of RNTL and its help in reporting different findings (20). Repka et al., (2009) studied the peripapillary thickness of RNTL by OCT of fellow and amblyopic eyes in anisometropic amblyopia and they no found differences in the thickness of RNTL (22). Altintas et al., (2005) studied this subject and they showed that reported thickness was 2.5 µm but this has no statistical differences between both types of the disease (23).

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Several studies were done to compare the thickness of RNFL in the amblyopia eyes, some of the researchers found no important differences in the thickness of anisometropic and strabismic amblyopia (24,25). While, other researchers found different outcomes in the RNFL thickness where some of them indicate the anisometropic eye was thicker than in strabismic amblyopia when compare with sound eye (26,27,28), Dickman et al., (2012) show that the strabismic eye has more thickness in amblyopia than the sound eye (22). While Micheal et al. (2006) show the slightly thinner in RNFL of anisometropic and strabismic amblyopia than in sound eye (29). Therefore, the subjects remain controversial and these differences between the studies may be related to types of tools, periods of investigations, races and socio-economic status of different populations.

SD-OCT was used to compression between the global and quadrants thickness of RNFL of normal fellow eyes and strabismic and anisometropic amblyopia, we found that the superior and inferior peripapillary thickness in groups of anisometropic eye was thinner with significant differences comparing with normal fellow eyes. But, those of nasal and temporal RNFL thickness has no differences, inferior peripapillary RNFL thickening was significantly thinner in strabismic eye. While, superior, temporal and nasal RNFL thickening were no statistically different.

Our result is agreements with Baddini et al., (2001) and Micheal et al.,(2006) (25,29). But, its differs from those reported by Repka et al., (2009), Atlentis et al., (2005), Dickman et al., (2012) and Yoon et al., (2005). OCT at present a commonly used tool in ophthalmology where the data provides automatically but the data includes persons at 18 years and older and limited use in children (28,29,30), these differences among the studies may belong to race, age, axial length and disc area.

Using of various algorithms between time and spectral OCT and the presence of different versions of the device (30,31) lead to misleading in a comparison between devices. The variations of macular thickness were measured in normal subjects based on refractive and age were reported. Some of these studies have shown a reduction in macular thickness with age, whereas others have found no significant correlation. More recent studies were used third generation stratus OCT shown macular volume and thickness 50 be related to refractive error/axial length in normal subjects, as in histopathological studies (32,33,34,35,36). In our study, there are some limitations namely, the small number of patients and the lack of a control group of non-amblyopic healthy patients. First, the number of patients in the study is comparable to those reported in most papers in the field, however, a larger study I warranted to confirm our results.

Conclusion

Our results suggested that the peripapillary RNFL thickening was significantly effected in strabismic and anisometropic amblyopia. Further, instrumental ahd histopathological studies are required to confirm the differences between amblyopic and normal eyes
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قياس OCT لسمك RNFL Peripapillary في العيون الغامضة من جانب واحد

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دبلوم طب وجراحه العيون

نبذة مختصرة

الخلفية: يسمى الغمش أيضًا بالعين الكسولة، وهو ضعف في الرؤية المركزية للعين، بدون سبب عضوي، أو بشكل لا يتناسب مع النقص العضوي في العين.

الهدف: هدفت الدراسة إلى تقييم فعالية تقنية OCT في تشخيص سماكة RNFL في مرضى الغمش.

المادة والطريقة: تم إجراء دراسة مستعرضة مستعرضة مستقبلية في محافظة النجف الأشرف / العراق خلال الفترة من كانون الثاني إلى أيلول / 2014. اشتملت الدراسة على 30 مريضاً (16 ذكر و 14 أنثى) تتراوح أعمارهم بين (10-40) سنة يعانون من الحول من جانب واحد.

النتيجة: تم تسجيل سماكة RNFL أقل سمكًا من تلك الخاصة بالعيون العادية مع قيمة p normal 0.05. ولكن، لا يوجد فروق ذات دلالة إحصائية لسمك RNFL حول الأنف في الأنواع الأنفية والعلوية والزمانية عند مقارنتها بالعيون الطبيعية.

الخلاصة: باختصار، أشارت نتائجنا إلى أن سماكة RNFL حول الحول قد تأثرت بشكل كبير في الحول والحول المتباين. علاوة على ذلك، هناك حاجة لدراسات مفيدة ونسيجية مرضية لتأكيد الاختلافات بين العيون الغامضة والعادية.