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Analysis of Variations in Central Macular Thickness in Patients with Myopia Using Spectral Domain Optical Coherence Tomography

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Abstract

Aim: To investigate the variation in average retinal thickness in macular region in otherwise normal young myopic subjects by using optical coherence tomography (OCT). *Methods:* One hundred and thirty ophthalmologically normal men 20 to 24 years of age with myopia (spherical equivalent, - 0.25 to -14.25 D) underwent examination of one randomly selected eye. Tests performed were - Visual acuity, BCVA with refraction, slit lamp examination, IOP by applanation tonometry, gonioscopy, A-scan ultrasound, fundus examination, visual field testing by HFA, and optic disc photography. Exclusion criteria were visual acuity better than 6/9, previous intraocular surgery, intraocular pressure >21 mm Hg or other ocular diseases. Three horizontal transfixation and three vertical transfixation OCT scans of 6 mm each were conducted on each eye by a single investigator. Neurosensory retinal thicknesses was measured, and the overall average, maximum, and minimum retinal thicknesses were analyzed. *Results:* The average retinal thickness of the macula does not vary with myopia. However, the parafovea was thinner and the fovea thicker with myopia.

Keywords: Myopia; OCT; Retina; Average Retinal Thickness; Elongated eye; Myopic Retina.

Introduction

Optical coherence tomography (OCT) is a newer noninvasive technique which can easily be used for the measurement of retinal thickness and RNFL thickness or foveal thickness by using time delays in the reflected or backscattered light by utilizing the principle of interferometry [1,2]. It is increasingly being used in a clinical practice as well as researches for imaging the lesions located in the macula, such as increased macular thickness in diabetic macular edema [3]. OCT also has a role to play in the clinical assessment of glaucoma, as studies have proved macular as well as peripapillary thinning that occurs in glaucomatous eyes [4-6].

The prevalence of myopia is continuously increasing in East Asia. This trend has been well documented in Taiwan [7] and Singapore [8]. Estimation of the proportion of this refractive error in the young population of Singapore ranges from about 30% to 65%. According to the histopathologists Yanoff and Fine [11], in pathological myopia (generally greater than -6.00 D), the retinal thinning occurs and it degenerates, mostly at the posterior pole. These changes in the retina with increasing myopia and axial length can be studied easily by retinal thickness measurements on OCT. The purpose of our study was to investigate the variation in macular retinal thickness in otherwise normal young myopic subjects by using optical coherence tomography (OCT).

Aim

To investigate the variation in macular retinal

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thickness in otherwise normal young myopic subjects by using optical coherence tomography (OCT).

Material and Methods

A prospective observational study was carried out on 130 myopic eyes; with the varying degrees of myopia. Cases were randomly selected from the patients attending Ophthalmology OPD, PDVVPF's Medical College.

Inclusion Criteria

1. Subjects attending Ophthalmology OPD for refraction and did not have any other ocular abnormality apart from optic disc and peripapillary changes associated with myopia.

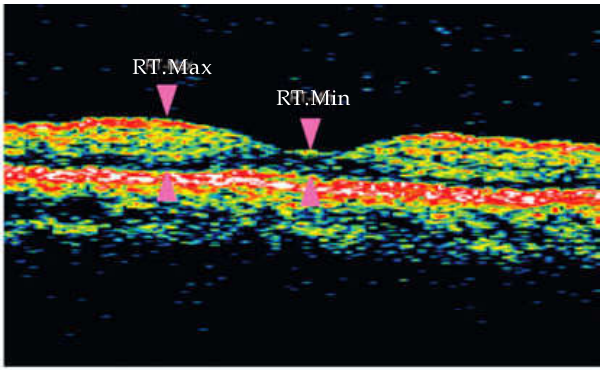
Exclusion Criteria

1. Best corrected visual acuity worse than 6/9.
2. Previous intraocular or refractive surgery.
3. IOP greater than 21 mm Hg.
4. Gonioscopic findings: angle closure, evidence of pseudoexfoliation, uveitis, or pigment dispersion syndrome.
5. Corneal or media opacities, retinal disease or neurologic conditions that could affect visual fields.
6. In addition, a history of glaucoma in a first-degree relative and a history of glaucoma or any other optic neuropathy were excluded.
7. In an earlier conducted studies, correlation with automated static perimetry was performed and the results were available [12].

After informed consent was signed, all participants underwent the following examinations:

- Visual acuity (BCVA),
- Slit lamp biomicroscopy
- Subjective refraction
- Goldmann applanation tonometry
- Gonioscopy
- Automated refraction
- Ophthalmoscopy - Direct and 90D
- Ultrasonic A Scan Biometer (APPASAMY)
- Humphrey (central 24-2 threshold) visual field examination.
- CMT was assessed in all patients using spectral domain OCT (3D OCT maestro).
- Pupils were dilated to at least 5-mm diameter during the OCT examination.
- All eyes axial lengths and refractive errors were recorded.
- Scan length was adjusted to 6 mm before scanning, to allow for correction of scan size.
- Retinal thickness was measured automatically with the retinal thickness algorithm built into version 4.1 of the OCT software, which automatically determines the anterior and posterior borders of the ILM and RPE respectively.
- Horizontal and vertical 6-mm scans centered against the point of fixation of each eye were taken by the same operator. Three good-quality horizontal and three good-quality vertical scans were retained for analysis.

Two points of maximum retinal thickness (RT-Max) measured on either side of the fovea were recorded from each scan.



From the direction of the scan, it was also possible to correspond the point to the area of the macula—that is, superior, inferior, temporal, or nasal to the fovea. These were termed RT-Max (sup), RT-Max (inf), RT-Max (temp), and RT-Max (nas), respectively. The point of minimum retinal thickness measurement, which is presumed to correspond to the fovea (RT-Min), was also recorded.

Results

- *Study Population Details*

The average macular retinal thickness (overall) was 230.9+/- 10.5 m and was not significantly related to the degree of myopia.

The mean maximum retinal thickness (at the parafovea) was 278.4+/- 13.0 m, and was not

correlated to the spherical equivalent.

The mean minimum retinal thickness (at the foveola) was 141.1 +/- 19.1 m, and this was positively correlated with *spherical* equivalent (*P 0.0002).*

The retina was thicker at the superior and nasal parafovea compared to the inferior or temporal parafovea.

Table 1: Patient data

Total Number of Studied	**130**
Averag age of patient (year +/-SD)	21.2 +/- 1.1
Range of age in years	19 to 24 years
mean spherical equivalent	-5.9+/-3.5 D
range of spherical equivalent	-0.25 to -14.25 D
mean axial length	26mm +/- 1.43

Table 2: Spherical Equivalent in study subjects

Spherical Equivalent	**No. of Study Subjects**
-0.25 to -4D	46 (55%)
.4 to -8D	49 (38%)
Greater than -8 D	35 (27%)

Table 3: Macular Thickness

Macular Thickness	**Mean**	**SD**	**Spherical Equivalent**	**p**
Average thickness (overall)	230.9 (229.1 to 232.7)	10.5	0.11 (0.63 to 0.42)	0.69
RT - max	278.4 (276.1 to 280.7)	13 .0	0.23 (0.42 to 0.88)	0.48
RT-max (SUP)	288.3 (284.8 to 291.8)	20.2	0.74 (0.15 to 1.63)	0 .10
RT-max (inf)	278.4 (275.5 to 281.3)	16.3	0.54 (0.21 to 1.29)	0. 16
RT-max (temp)	262.2 (259.6 to 264.8)	14.6	0.26 (0.37 to 0.89)	0. 42
RT-max (nas)	284.2 (281.2 to 287.2)	17.1	0.21 (0.58 to 0.99)	0. 60
RT-min	141.1 (137.8 to 144.5)	19.1	1.78 (2.68 to 0.87)	0. 0002

Discussion

This study has shown that in a young healthy cohort of myopic subjects, overall average macular retinal thickness does not vary with increasing myopia or axial length.

This is in agreement with recent reports in which OCT was used to investigate retinal thickness variations in myopia [13].

In one another study, chorioretinal overall atrophy at posterior pole was found to be more common in eyes with long axial length [14]. We concluded that this disparity in our findings are related to the different methods used for the measurement of retinal thickness, but the method used by us i.e. OCT results are shown to be highly reproducible [15] are more sensitive for detection of subtle and regional variations in retinal thickness as compared to histological mounts. They are more susceptible to the shrinkage plus processing artifacts. One more study [16] showed increased chances of chorioretinal degenerative changes in the peripheral fundus in patient with myopia. Unfortunately, it is not possible to measure accurate peripheral retinal thickness at present with the tool of OCT. One report with ultrasound and Fourier analysis had proved that the midperipheral retina in myopic eyes was thinner as compared to the emmetropic eyes [17]. If this is the case, then retinal thinning in myopia may be more common in the peripheral retina. In a similar study group, Asrani et al [18]. Concluded that an average retinal thickness at the posterior pole was of 229 micron. These comparable values of mean macular thickness found in all these studies suggests that there may not be great variation in average retinal thickness with age [18,19], though one paper that on OCT reported macular retinal thinning occurred with increasing age. 20- The mean thickness of the thinnest retinal point was 141.1 micron to 19.1 micron, that was similar to the mean thickness of the foveola of 142 to 18 micron, as measured by Gobel et al [21].

Conclusion

- Average retinal thickness of the macula does not vary with myopia.

- However, the parafovea was thinner and the fovea thicker with myopia

References

1. Hee MR, Izatt JA, Swanson EA, et al. Optical coherence tomography of the human retina. Arch Ophthalmol. 1995;113:325–332.
2. Huang D, Swanson EA, Lin CP, et al. Optical coherence tomography. Science. 1991;254:1178–1181.
3. Hee MR, Puliafito CA, Duker JS, et al. Topography of diabetic macular edema with optical coherence tomography. Ophthalmology. 1998;105:360–370.
4. Guedes V, Schuman JS, Hertzmark E, et al. Optical coherence tomography measurement of macular and nerve fiber layer thickness in normal and glaucomatous human eyes. Ophthalmology. 2003;110:177–189.
5. Hoh ST, Greenfield DS, Mistlberger A, et al. Optical coherence tomography and scanning laser polarimetry in normal, ocular hypertensive, and glaucomatous eyes. Am J Ophthalmol. 2000;129: 129–135.
6. Tanito M, Itai N, Ohira A, Chihara E. Reduction of posterior pole retinal thickness in glaucoma detected using the retinal thickness analyzer. Ophthalmology. 2004;111:265–275.
7. Lin LL, Shih YF, Hsiao CK, et al. Epidemiologic study of the prevalence and severity of myopia among schoolchildren in Taiwan in 2000. J Formos Med Assoc. 2001;100:684–691.
8. Wong TY, Foster PJ, Hee J, et al. Prevalence and risk factors for refractive errors in adult Chinese in Singapore. Invest Ophthalmol Vis Sci. 2000;41: 2486–2494.
9. Au Eong KG, Tay TH, Lim MK. Race, culture and Myopia in 110,236 young Singaporean males. Singapore Med J. 1993;34: 29–32.
10. Tay MT, Au Eong KG, Ng CY, Lim MK. Myopia and educational attainment in 421,116 young Singaporean males. Ann Acad Med Singapore. 1992;21:785–791.
11. Yanoff M, Fine BS. Ocular Pathology: A Text and Atlas. 3rd ed. JB Lippincott; 1989;408.
12. Aung T, Foster PJ, Seah SK, et al. Automated static perimetry: the influence of myopia and its method of correction. Ophthalmology. 2001;108:290–295.
13. Wakitani Y, Sasoh M, Sugimoto M, et al. Macular thickness measurements in healthy subjects with different axial lengths using optical coherence tomography. Retina. 2003;23:177–182.
14. Curtin BJ, Karlin DB. Axial length measurements and fundus changes of the myopic eye. Am J Ophthalmol. 1971;1:42–53.
15. Massin P, Vicaut E, Haouchine B, et al. Reproducibility of retinal mapping using optical coherence tomography. Arch Ophthalmol. 2001;119: 1135–1142.
16. Karlin DB, Curtin BJ. Peripheral chorioretinal lesions and axial length of the myopic eye. Am J Ophthalmol. 1976;81:625–635.
17. Chujo S, Kobayashi Y, Emi K, et al. The biometry of each thickness of the human retina, choroid and sclera by using ultrasound and Fourier analysis: high myopia. (in Japanese). Nippon Ganka Gakkai Zasshi. 1983;87:70–73.
18. Asrani S, Zou S, d'Anna S, et al. Noninvasive mapping of the normal retinal thickness at the posterior pole. Ophthalmology. 1999;106:269–273.
19. Landau D, Schneidman EM, Jacobovitz T, Rozenman Y. Quantitative in vivo retinal thickness measurements in healthy subjects. Ophthalmology. 1997;104:639–642.
20. Kanai K, Abe T, Murayama K, Yoneya S. Retinal thickness and changes with age (in Japanese). Nippon Ganka Gakkai Zasshi. 2002;106:162–165.
21. Gobel W, Hartmann F, Haigis W. Determination of retinal thickness in relation to the age and axial length using optical coherence tomography (in German). Ophthalmologe. 2001;98:157–162.