

# Fundus features of high myopia in young adults: a three-year follow-up

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**Foundation item:** Nanchang Science and Technology Support Program (No. 2012-37-7)

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Received:2017-02-09 Accepted:2017-03-31

## 中青年高度近视患者三年眼底形态特征变化研究

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**基金项目:** 南昌市科技支撑计划(No. 2012-37-7)

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### 摘要

**目的:** 评估中青年高度近视眼近视弧和视网膜形态的3a变化。

**方法:** 回顾性研究。收集22例32眼35~45岁过-9.00D的高度近视眼, 对比3a前、3a后视盘、近视弧、脉络膜萎缩弧、近视弧种类、平均视网膜厚度和视网膜总体积的变化。

**结果:** 经统计3年前、后视盘面积变化差异无统计学意义( $t=0.95$ ,  $P=0.35$ ); 3年后近视弧和脉络膜萎缩弧面积分别增加 $0.69\pm 0.71\text{mm}^2$ 、 $0.57\pm 0.97\text{mm}^2$ , 差异有统计学意义( $t=-3.99$ ,  $P=0.001$ ;  $t=-2.33$ ,  $P=0.03$ )。3年前、后近视弧种类、平均视网膜厚度和视网膜总体积变化差异无统计学意义( $P>0.05$ )。

**结论:** 大于-9.00DS的中青年高度近视患者三年主要改变指标是近视弧和脉络膜萎缩弧面积的增加, 可作为临床随访监测的形态学指标。

**关键词:** 近视弧; 脉络膜萎缩弧; 高度近视

**引用:** 刘莉莉, 刘维锋. 中青年高度近视患者三年眼底形态特征变化研究. 国际眼科杂志 2017;17(5):825-828

### Abstract

• **AIM:** To evaluate changes in peripapillary atrophy (PPA) and retinal in young adults with high myopia (HM) for three years.

• **METHODS:** A total of 22 HM patients ( $n=32$  eyes,  $>-9$  D), 35-45y, were enrolled in this self-controlled retrospective review. The following parameters were measured at baseline and 3-year follow-up visits: area of optic nerve head (ONH); area of peripapillary atrophy (PPA); area of peripapillary chorioretinal atrophy (PCA); type of PPA; average retinal thickness (ART); and total central retinal volume (TCRV).

• **RESULTS:** There were no changes in the area of ONH ( $t=0.95$ ,  $P=0.35$ ) between baseline and 3-year follow-up visits. In contrast, the areas of PPA and PCA were significantly greater ( $0.69\pm 0.71$  and  $0.57\pm 0.97\text{mm}^2$ , respectively) at the 3-year follow-up versus baseline ( $t=-3.99$ ,  $P=0.001$  and  $t=-2.33$ ,  $P=0.03$ , respectively) visits. There were no changes in the type of the PPA. ART and TCRV did not differ significantly at the 3-year follow-up versus baseline visits ( $P>0.05$ ).

• **CONCLUSION:** Increased areas of PCA and PPA are the main fundus features of HM ( $>-9$  D) in young adults. PPA and PCA should be important morphological parameters during follow-up for HM in clinic.

• **KEYWORDS:** peripapillary atrophy, peripapillary chorioretinal atrophy, high myopia

DOI:10.3980/j.issn.1672-5123.2017.5.06

**Citation:** Liu LL, Liu WF. Fundus features of high myopia in young adults: a three-year follow-up. *Guoji Yanke Zazhi (Int Eye Sci)* 2017;17(5):825-828

### INTRODUCTION

Age contributes considerably to the progression of high myopia (HM)<sup>[1]</sup>. A number of 30-year follow-up studies of persons <40y-of-age with congenital HM reported preservation of good visual acuity (VA)<sup>[2-3]</sup>, while studies of HM persons >40y-of-age have reported generally poor VA<sup>[4-5]</sup>. Such findings suggest that 40y-of-age represents a transformative stage, with formation of myopic maculopathy that compromises VA. Therefore, 35-45y represents an important stage in the progression of HM.

Myopic maculopathy is the most common complication of HM. Research shows that 88.9% -96.3% of the VA of persons with myopic maculopathy decreases to <20/200 within a 5-10y period<sup>[6]</sup>. Peripapillary chorioretinal atrophy (PCA) and

peripapillary atrophy (PPA) are seen frequently in HM eyes<sup>[1,7-8]</sup>. In fact, PPA may be regarded as a prognosticator of development of pathological myopia in later life<sup>[9]</sup>. An important question is that of how PCA and PPA change in HM in young adults. Which parameters to observe and how long do we follow-up for these case in clinic. To answer this, the present study was designed to evaluate fundus characteristics of HM eyes (> -9 D) in persons 35-45y of age at baseline and 3-year follow-up visits.

**SUBJECTS AND METHODS**

A total of 22 patients (n=32 eyes) with HM were enrolled in this study, which was conducted from May 2008 to August 2013. There were 17 women (n=23 eyes) and five men (n=9 eyes). Ages ranged from 35 to 45y (mean, 39.76±5.32y). Spherical equivalents (SEs) ranged from -9 to -18D (mean, -16.46 D). Inclusion criteria comprised having well-defined macular optical coherence tomographic (OCT) images. Exclusion criteria comprised evidence of any retinal pathology other than myopia or systemic diseases, as evaluated at the baseline visit. Follow-up times ranged from 35 to 63mo (mean, 44.29±11.61mo).

Axial lengths (ALs) were measured five times in each eye using an IOL Master (Carl Zeiss Meditec). The mean of ALs was calculated.

Fundus images were captured using a 3D-OCT (Topcon Meditec, Tokyo, Japan). The foveola was located and centered. The scan area was 6×6 mm. Parameters of the scan area included average 1-mm central retinal thickness (CRT); average 2.5mm paracentral retinal thickness (PRT) in four sectors, including nasal, superior, temporal, and inferior in the second ring plus the third ring; and total 6mm central retinal volume (TCRV) (Figure 1).

Areas of the various parameters were automatically analyzed by the 3D-OCT 2000 clinical autoanalyzer module. Parameters (Figure 2) included area of optic nerve head (ONH); total area of peripapillary atrophy (T-PPA); area of peripapillary atrophy (PPA) area, i. e., T-PPA minus ONH area; area of peripapillary chorioretinal atrophy (PCA).

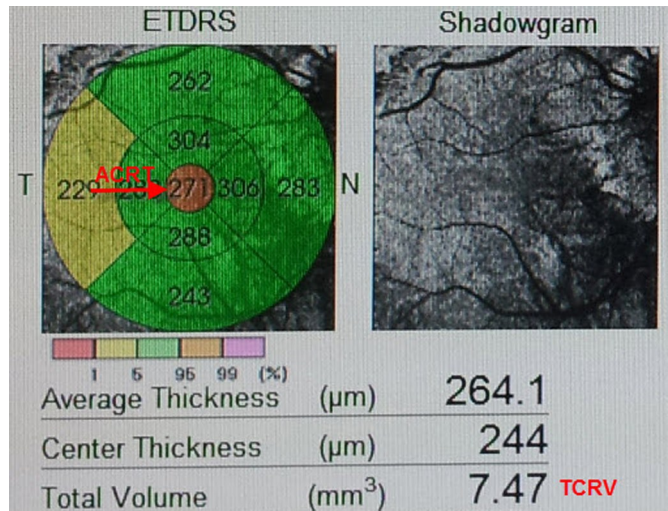
The PPA types were peripapillary halo (PH) and peripapillary crescent (PC). The PPA encompassing the circumference of the ONH was classified as PH; the rest of PPA was classified as PC.

The parameters were a normal distribution. A paired-sample t-test was performed using version 13.0 SPSS software, (SPSS, Chicago, IL, USA). A two-sided P-value of <0.05 was considered statistically significant.

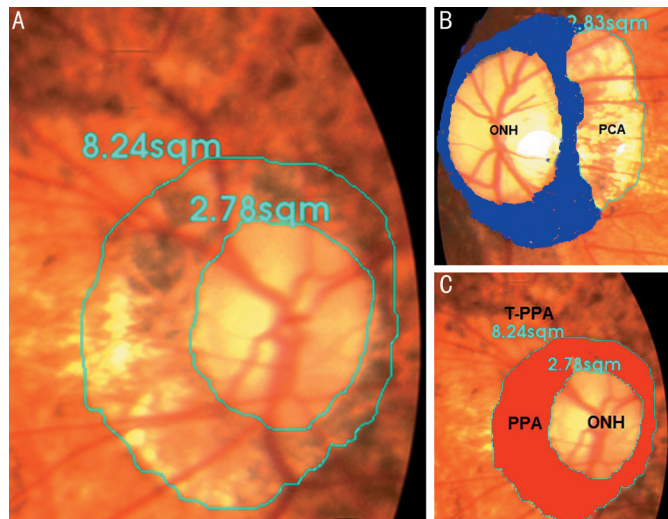
**RESULTS**

A total of 32 HM eyes had uncorrected VA (UCVA) of 1.32±0.42 LogMAR units, Best-corrected VA (BCVA) ranged from 0 to 0.7 logMAR (mean, 0.17±0.18 logMAR).

There were no changes in BCVA, SE, ONH from baseline to 3-year follow-up visits (all P>0.05). There were significant difference for increase in AL PPA and PCA at the 3-year visit



**Figure 1** Average 1 mm center retina thickness (ACRT), average 2.5 mm sector (the second ring plus the third ring) in the nasal, superior, temple, inferior retina thickness (ART), and total 6 mm center retina volume (TCRV).



**Figure 2** Fundus of HM A: PPA of HM; B: Area of the total peripapillary atrophy (T-PPA); Area of the optic nerve head (ONH); Area of peripapillary atrophy (PPA=T-PPA minus ONH; red area); C: Area of the peripapillary chorioretinal.

compare to baseline ( $t = -3.31, P = 0.021$ ;  $t = -3.99, P = 0.001$ ;  $t = -2.33, P = 0.03$ , respectively) (Table 1) The type of the PPA varied: 15 (47%) eyes had PC and 17 (53%) eyes had PH at baseline. Seventeen PH eyes didn't progress into PC at the 3-year follow-up visit. Morphological changes of the retina included no significant differences in 1-mm ACRT, quarterly average retinal thickness (RT), or TCRV between baseline and 3-year follow-up (all  $P > 0.05$ ) (Table 2).

**DISCUSSION**

The clinical characteristics of HM patients include PPA, tilting of the ONH, staphyloma and myopic maculopathy. Recent studies have shown PPA to be one of the early signs of myopia, appearing earlier than do macular changes<sup>[9-10]</sup>. PPA

**Table 1 The parameters between baseline and after three years**

Parameters	Baseline	After three years	Difference value	<i>t</i>	<i>P</i>	$\bar{x} \pm s$
BCVA (logMAR)	0.17±0.18	0.17±0.19	0.00±0.07	-0.16	0.86	
SE (D)	-16.46±0.57	-17.00±1.56	0.58±1.23	0.81	0.49	
AL (mm)	29.08±0.94	29.43±1.19	-0.34±0.25	-3.31	0.021	
ONH area (mm <sup>2</sup> )	2.88±0.89	2.81±0.78	0.06±0.28	0.95	0.35	
PPA area (mm <sup>2</sup> )	5.47±3.20	6.16±3.77	-0.69±0.71	-3.99	0.001	
PCA area (mm <sup>2</sup> )	1.76±2.02	2.33±2.51	-0.57±0.97	-2.33	0.034	

**Table 2 Morphological of retina between baseline and after three years**

Parameters	Baseline	After three years	Difference value	<i>t</i>	<i>P</i>	$\bar{x} \pm s$
1 mm ACRT (um)	243.26±53.90	257.93±31.46	-14.66±48.31	-1.17	0.25	
nasal sector ART (um)	286.26±22.20	280.56±26.34	5.70±20.28	1.08	0.29	
inferior sector ART (um)	284.13±63.95	285.10±85.69	-0.96±37.78	-0.09	0.92	
temple sector ART (um)	271.00±42.62	262.46±45.85	8.53±15.38	2.14	0.05	
superior sector ART (um)	276.06±13.02	271.40±13.39	4.66±17.29	1.04	0.31	
TCRV (mm <sup>3</sup> )	7.72±0.92	7.64±1.19	0.08±0.56	0.49	0.63	

is an important and easily observable prognosticator for progression to HM.

The age at which HM shows no progression has been reported to be 30.9±15.6y<sup>[10]</sup> and that for progression of maculopathy, 38.3±16.2y<sup>[11]</sup>. Liu *et al*<sup>[12]</sup> concluded that 48y of age is when HM maculopathy occurs. This show that the age of progression of HM maybe occur from 38 to 48y. This stage is important period to observe in clinic for HM cases. Accordingly, 35–45y of age of HM enrolled this study.

No changes in the area of the ONH and increase in the area of PPA and PCA for 3–year follow-up. This showed PPA and PCA maybe a prognostic indicator of progression in HM. But there were no changes in retinal macular thickness. This finding further supports the theory that only a small area continues to escalate in area between the temporal margin of the ONH and the fovea<sup>[13–14]</sup>.

Longer AL with greater PPA at the three-year follow-up visit versus baseline see Table 1. The same state as Nonaka *et al*<sup>[15]</sup> In the present study, no change in PPA type. The mean age of HM persons with PH was 10y greater than those with PC, but the difference in mean AL between the two groups was only 0.2 mm and is, therefore, not statistically significant<sup>[15]</sup>. This means that PPA type is not associated with AL, but is associated with age.

In our clinic, posterior staphyloma is another morphological characteristic that is considered to be an important sign of the progression of HM. There was no change in BCVAs at the 3y follow-up compared with baseline. VA is associated with maculopathy and decreases slowly<sup>[10,12]</sup>. VA is a very important sign when monitoring HM maculopathy. The relationships among the PPA, posterior staphyloma, and VA should continue to be observed.

In summary, there were no changes in BCVA, SE, area of ONH, average RT, or TCRV from baseline to 3–year follow-

up visits, while AL, PCA, and PPA increased. In total, these were the main fundus characteristics for -9DS young HM adults at the 44-month follow-up visit. PPA and PCA should be important morphological parameters during follow-up for HM in clinic.

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## 热烈祝贺《国际眼科杂志(中文刊)》被世界著名 检索系统 DOAJ 收录

本刊讯 本刊编辑部于2017年1月24日收到 The DOAJ Team 的邮件,正式通知 *Guoji Yanke Zazhi*《国际眼科杂志》已被 DOAJ 重新收录。

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