



BEYOND THE DIOPTER: MYOPIA'S MARK ON THE RETINA AND CHOROID



Watch out for posterior segment complications in this patient population.

BY VYOMA SHINDE, OD

Myopia affects 30% of the global population and is predicted to reach nearly 50% by 2050.^{1,2} As the severity of myopia increases, certain mechanical and vascular stresses are placed on the posterior segment, which can intensify or contribute to various structural complications. While it may seem convenient and natural to use spherical equivalent as the standard clinical metric for judging myopia severity, it can also be helpful to evaluate axial length, which offers a more direct understanding of

structural risk. After all, just a 1-mm increase in axial length increases myopia by 3.00 D.³ This article reviews the changes that occur in the retina and choroid with varying levels of myopia and offers insights on risk stratification and early intervention.

LOW MYOPIA

In low myopia (-3.00 D or better, 24.5 mm to 25 mm), fundus appearance is typically similar to an emmetrope or low hyperope, but subtle changes can be observed. Early signs include mild tessellation (Figure 1), which reflects

thinning of the choroid and increased visibility of the choroidal vasculature beneath the retina.⁴ Occasionally, benign peripheral retinal findings or lattice may be seen. Foveal contour and retinal thickness are typically intact and within normal limits. Choroidal thickness remains relatively well-preserved at 250 μ m to 300 μ m.⁵ Clinically, these patients are at a low risk of serious complications; however, documenting axial length and obtaining baseline imaging is recommended to track progression and enable future comparisons.

MODERATE MYOPIA

Moderate myopia (-3.25 D to -6.00 D, 25 mm to 26.5 mm) typically presents with changes in the structure and vasculature of the retina and choroid compared with low myopia. For example, there may be more fundus tessellation, lattice degeneration, pavingstone degeneration (aka cobblestone degeneration), vitreo-retinal traction, pigmentary changes, and peripheral tears (Figure 2). While the fovea usually remains intact, perifoveal and parafoveal thinning of the retina can occur, resulting in reduced capillary density and blood flow to these regions. Choroidal thickness often drops to less than 200 μ m, which has been linked to both reduced choroidal blood flow and a higher risk of scleral remodeling.⁵

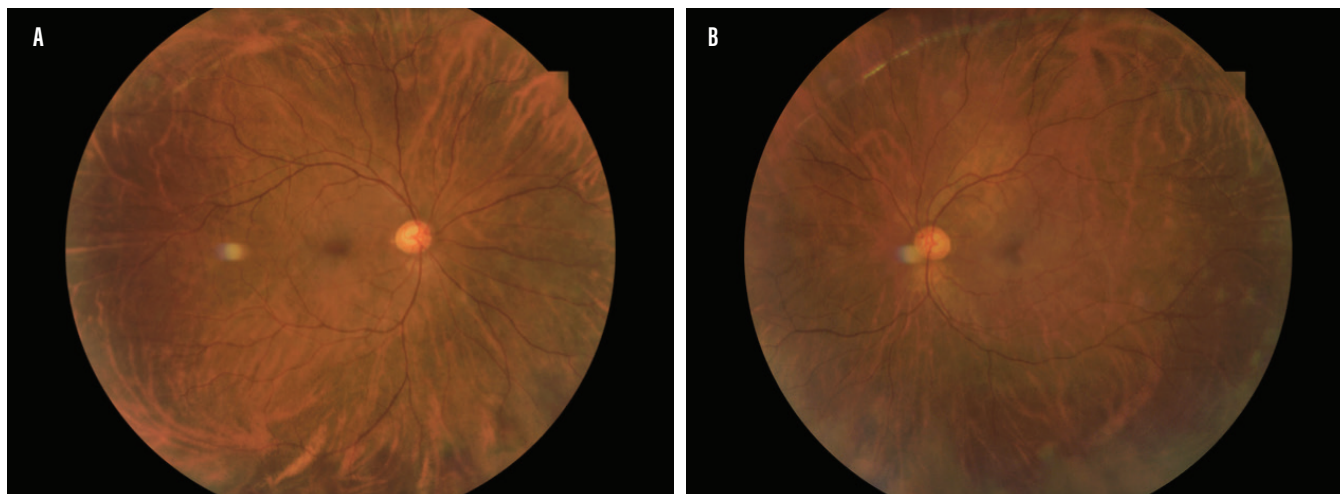


Figure 1. Fundus photography of the right (A, -2.00 D) and left (B, -0.50 D) eye of a patient with low myopia shows mild tessellation in the right eye and, to a lesser extent, the left eye.

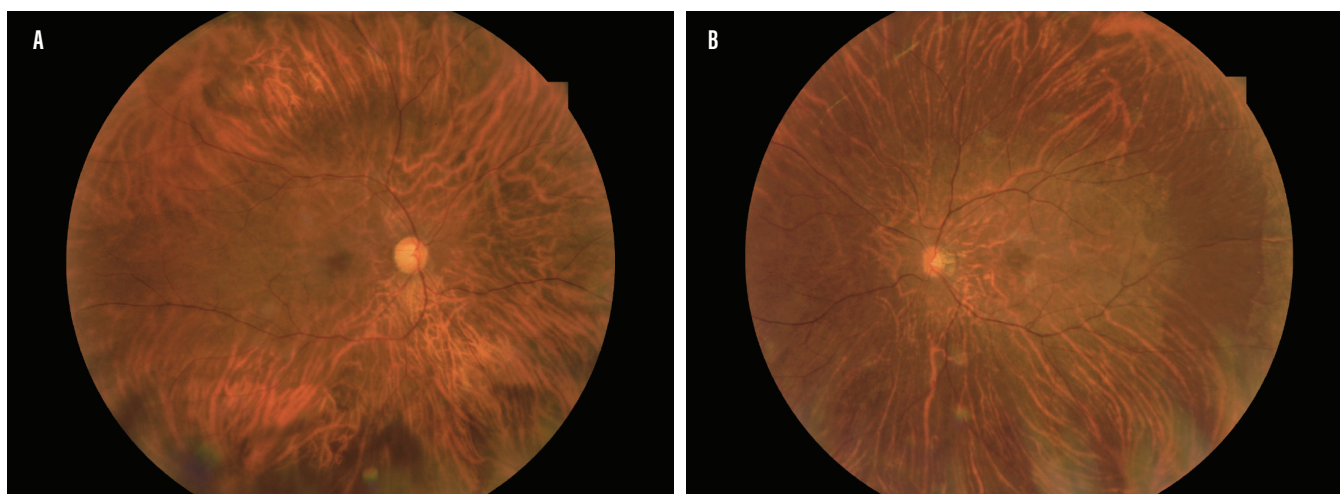


Figure 2. Fundus photography of the right (A, -4.00 D) and left (B, -7.00 D) eye of a patient with moderate myopia demonstrates increased tessellation of the fundus compared with Figure 1A, as well as the pigmentary changes beginning at the posterior pole, the thinner retina centrally, the myopic tilt, and the peripapillary atrophy of the nerve (B).

HIGH MYOPIA

Patients with high myopia (-6.00 D or worse, > 26.5 mm) are significantly more vulnerable to serious degenerative and tractional complications in the retina and choroid (Figure 3).⁶ Most patients at this stage develop a posterior staphyloma, which is a key indicator of long axial length and a weakened sclera. OCT findings often include retinoschisis, myopic foveoschisis, paravascular microfolds, and internal limiting membrane traction. Retinal breaks occur with greater frequency, including atrophic holes, tears from early posterior vitreous degeneration, operculated tears, and

other complications. Choroidal thickness at this stage often drops to less than 150 μm , diminishing support and perfusion to the outer retina.^{5,7} The myoid and ellipsoid zones within the photoreceptor layer become compromised due to mechanical stretch and ischemia.⁸

Patients with high myopia are managed with regular imaging and axial length tracking. Refer to an ophthalmologist if macular or peripheral retinal complications arise.

PATHOLOGICAL MYOPIA

Pathological myopia is the name for myopia so severe there

is a reduction in BCVA due to structural changes in the macula, rather than refractive error alone (typically > 28 mm). Although it is almost always seen in eyes with high myopia, its complications—especially posterior staphyloma (Figure 4)—can occur in eyes with moderate myopia.⁹ Other prominent characteristics include diffuse and patchy chorioretinal atrophy, lacquer cracks, Fuch spots, myopic macular holes, myopic maculopathy, and choroidal neovascular membranes.^{8,9} Retinal holes and tears occur in one of 15 patients, and retinal detachments occur in one in 20.¹⁰

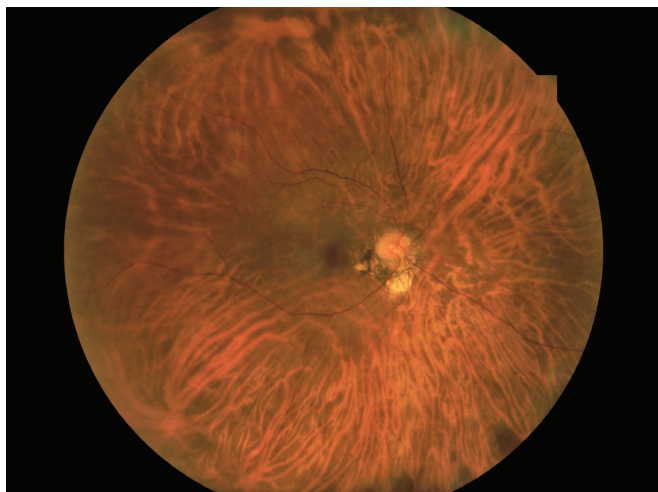


Figure 3. In the fundus photograph of the right eye of a patient with high myopia (-9.00 D), note the thin choroid and the deep atrophy and pigmentary changes around the optic disc.

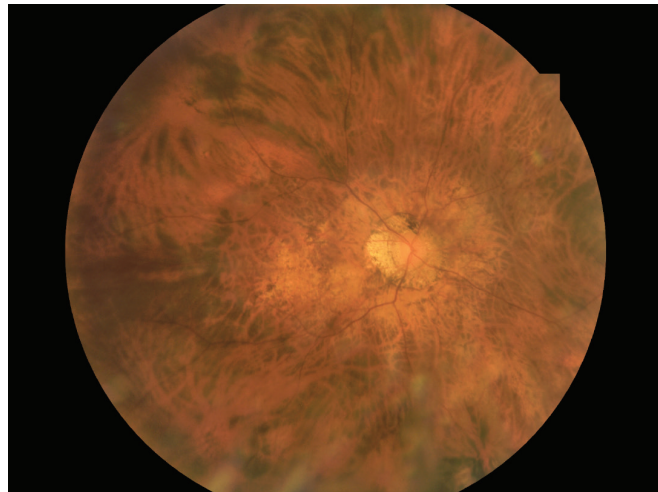


Figure 4. In the fundus photograph of the right eye of a patient with pathologic myopia (-22.00 D), note the posterior staphyloma and very thin choroid.

OCT may reveal disruption of the outer retina, including loss of the ellipsoid and myoid zones and signs of photoreceptor damage. The choroidal thickness in these patients is often severely thin ($\leq 100 \mu\text{m}$), which leads to significantly impaired perfusion and loss of retinal integrity.¹¹ Thus, these patients require close monitoring and may

benefit from multimodal imaging such as OCT angiography and autofluorescence. The meta-analysis of pathologic myopia classification system defines these changes into five categories (Table).⁸

MECHANISMS OF DAMAGE

The eye's ability to detect hyperopic and myopic defocus

rapidly shifts choroidal thickness and triggers downstream signals affecting scleral remodeling,¹² which is the initiating event in the progression of high myopia. The choroid and retina are affected next, following an outward-to-inward cascade. Recent studies show that choroidal thinning is not just a consequence, but also a predictor of myopia progression.^{9,13} As a result of improper vascularization and hypoxia, myopia accelerates, and nutrient delivery to the photoreceptors declines, damaging the outer segments, and ultimately, impairing visual function.

From the literature, it is clear that choroidal thickness is a sensitive early biomarker.^{9,13} In the clinic, it may be helpful to routinely monitor axial length—even in low myopes—and perform scans and fundus photography on moderate and high myopes. It is critical to educate high-risk patients about the symptoms of retinal detachment and vitreoretinal traction and the importance of early intervention.

BENEATH THE BLUR

As the prevalence of myopia increases worldwide, the structural consequences on the retina and choroid demand increased attention,

AT A GLANCE

- Increases in myopia severity cause certain mechanical and vascular stresses to be placed on the posterior segment, which can intensify or contribute to various structural complications.
- Patients with low myopia are clinically at low risk of serious complications, whereas those with moderate myopia typically present with changes in both the structure and vasculature of the retina and choroid, and those with high myopia are at a significantly higher risk of serious degenerative and tractional complications in the retina and choroid.
- Because choroidal thinning is not just a consequence, but also a predictor of myopia progression, it may be helpful to routinely monitor axial length and perform scans and fundus photography on moderate and high myopes.

TABLE . The Five Classification Categories of Pathologic Myopia

CATEGORY 0	CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4
Associated retinal changes	No lesions	Tessellation	Diffuse atrophy	Patchy atrophy
				Macular atrophy with plus lesions, including choroidal neovascular membranes, lacquer cracks, and Fuch spots

especially for patients who progress beyond moderate levels. Remember that posterior segment changes, from subtle choroidal thinning to retinal degeneration and staphyloma formation, are not simply incidental findings, but key indicators of disease progression and visual prognosis. Recognizing the specific anatomic shifts that occur at each stage of myopia can help you stratify risk, personalize follow-up intervals, and preserve the long-term retinal health of your patients with this type of refractive error. ■

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SEPTEMBER/OCTOBER 2025 | MODERNOPTOMETRY 25