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Unequal Eye: A Case of Unilateral High Myopia and Anisometropia Amblyopia

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Abstract: Myopia, or nearsightedness, is a common eye condition. Unilateral myopia, where only one eye is nearsighted, poses unique challenges. The causes are complex, involving both genetics and environment. Treatment options include glasses, contact lenses, and surgery. We reported a case of a 13-year-old girl with unilateral high myopia and anisometropic amblyopia in her right eye. Despite no family history of myopia, the patient developed severe myopia in her right eye at the age of 7. A comprehensive ocular assessment was conducted, along with auxiliary tests. The patient was diagnosed with unilateral high myopia and anisometropia amblyopia. Treatment included a combination of spectacle correction, soft contact lenses, atropine eye drops, and patching therapy. Unilateral high myopia requires a thorough evaluation. The difference in eye length between the two eyes contributed to the patient's nearsightedness. Treatment options include glasses, contact lenses, orthokeratology, and surgical procedures. The patient received a personalized treatment plan with regular follow-up to monitor progress and assess treatment efficacy. In conclusion, this case underscores the importance of early detection and aggressive management of high myopia in pediatric patients to prevent further visual deterioration and potential complications.
Keywords: unilateral high myopia; amblyopia; anisometropia; management myopia

INTRODUCTION

Myopia is a common eye condition affecting 22.9% of the global population, with a projected increase by 2050. Asia-Pacific countries have the highest prevalence of myopia, followed by East Asia, Southeast Asia, and North America. High myopia, characterized by a spherical equivalent of more than -5.00 diopters, is a less common subtype with a global prevalence of approximately 2.7% and is expected to increase dramatically to reach 9.8% by 2050.[1] Moreover, unilateral myopia is a refractive condition in which one eye shows significant myopia while the contralateral eye has a refraction closer to emmetropia.[2]

The causes of myopia are very complex, involving genetic and environmental factors. Although research has identified several risk factors, such as near visual activity and exposure to natural light, the exact mechanisms of myopia development are still not fully understood.[3]

Treatment for unilateral high myopia focuses on enhancing visual acuity and may include options like eyeglasses, contact lenses, occlusion therapy, or surgical interventions.[4-7] The anisometropia that often accompanies this condition can make correction with glasses difficult, therefore, contact lenses or surgery may be a better option.[8]

CASE REPORT

A 13-year-old girl complained of gradually losing vision in her right eye, which started when she was seven years old, to the ophthalmology clinic at Prof. R.D. Kandou General Hospital. She denied experiencing any related symptoms, including pain, redness, blurred vision, or wet eyes. The patient has a history of utilizing computers and reading books for extended periods. There was no family history of myopia, and never worn glasses or contact lenses. Her medical history, allergies, and medication use were unremarkable.

The ophthalmological assessment revealed a significant reduction in the patient's right eye vision, down to 2/60. However, with the addition of a -15.00 C-0.75x51º lens, her vision improved to 4/60. Cycloplegic retinoscopy revealed a best-corrected visual acuity of 6/60 in the right eye with a -14.50 D correction. In contrast, her left eye vision was normal at 6/6. Both eyes had normal intraocular pressure: 11 mmHg right, 13 mmHg left. Examination of the anterior segment of both eyes was unremarkable.

Additional assessments of the patient's eye alignment, employing the Hirschberg, cover-uncover, and alternate cover techniques, did not identify misalignment. Visual field testing revealed no irregularities, and eye movements were unrestricted in all directions. Worth's Four Dot test indicated suppression of the right eye. Stereopsis testing using the TNO test did not detect depth perception, and Ishihara testing confirmed normal color vision. Examination of the right eye's posterior segment revealed signs consistent with peripapillary atrophy, tigroid fundus, an oval optic disc with well-defined borders, and vital color. The left eye appeared normal (Figure 1).

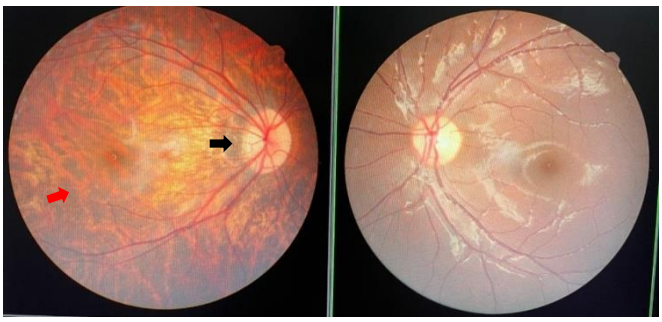

Figure 1. Examination of the posterior segment revealed peripapillary atrophy (black arrow) and tigroid fundus (red arrow)

Optical coherence tomography (OCT) of the right eye indicated an increased axial length, while the left eye exhibited unremarkable measurements (Figure 2).

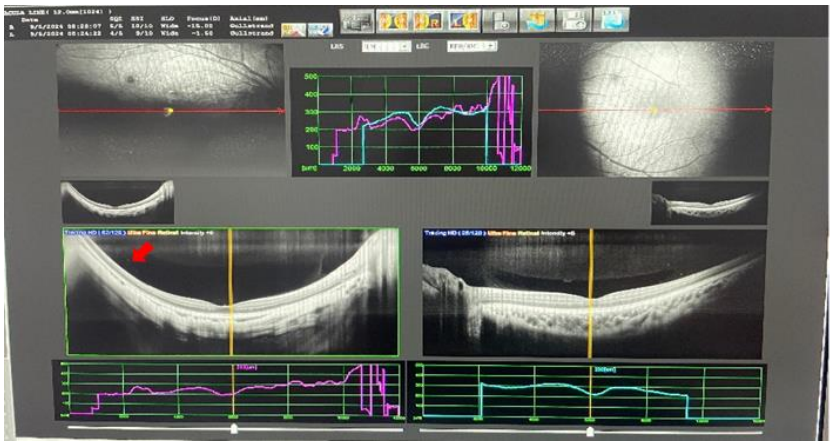

Figure 2. OCT of the right eye revealed elongation of the axial length

Further measurements confirmed that the right eye was significantly longer than the left, measuring 28.96 mm and 23.16 mm, respectively (Figure 3).

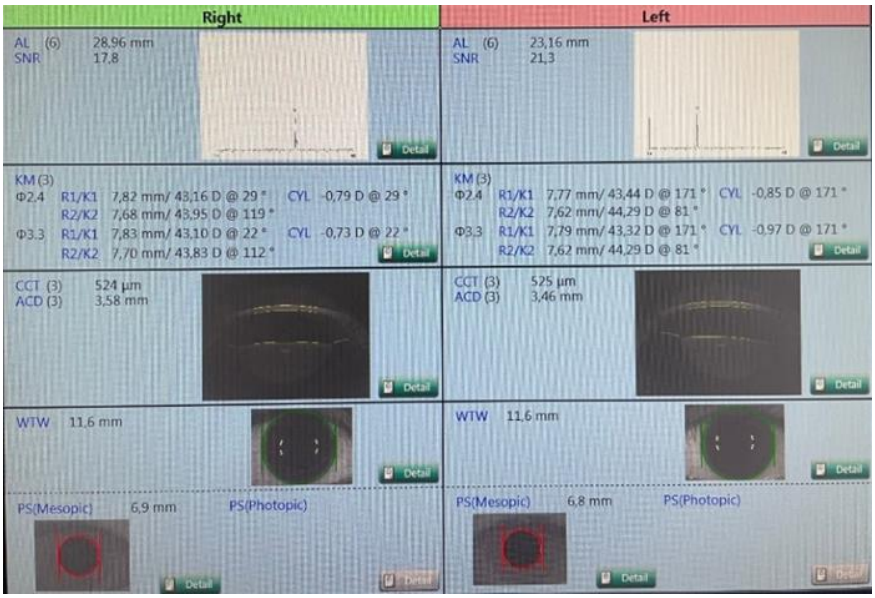

Figure 3. The biometric examination revealed that the axial length of the right eye was longer than that of the left eye

B-scan ultrasonography (USG) further demonstrated an elongated shape of the right eyeball, while the left eye appeared normal (Figure 4).

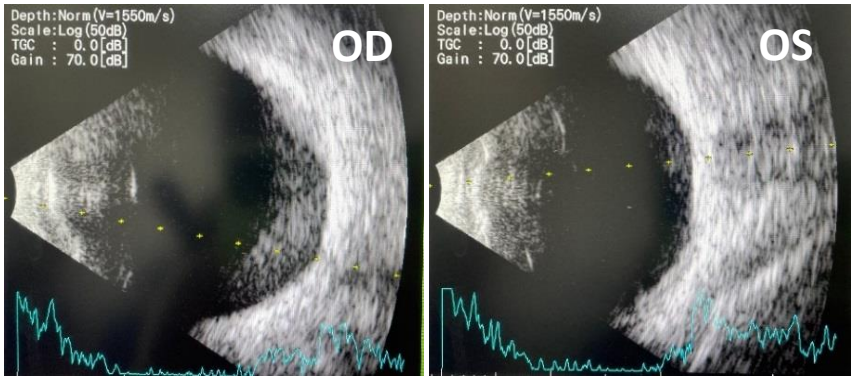

Figure 4. The B scan USG revealed an elongated shape of the right eye

The patient was diagnosed with high unilateral myopia and anisometropic amblyopia in the right eye, while the left eye is emmetropic. Management includes a combination of -4.50 diopter (D) glasses and -9.00 D soft contact lenses for the right eye and Plano lenses for the left eye. The patient uses atropine 0.01% eye drops in the right eye, one drop per day, and patches the left eye for two hours daily. The patient should limit screen time and avoid physically demanding activities. The patient has a follow-up appointment in four weeks.

DISCUSSION

Myopia, or nearsightedness, is the most prevalent refractive error affecting children and young adults. Due to a lack of awareness and associated stigma, it has become a significant concern.[9] High myopia is a spherical equivalent of -6.00 diopters or more or an axial length exceeding 26.5 millimeters. The global prevalence of myopia varies widely. Studies indicate that Asian children aged 5 to 17 have the highest rates (18.5%), followed by Hispanics (13.2%), African Americans (6.6%), and Caucasians (4.4%).[10] This patient's ethnicity is Javanese.

The etiology of myopia is multifactorial, involving both genetic and environmental influences. Individuals with a family history of myopia are at increased risk, while this patient lacks such a history.[11] Prolonged near-work and limited outdoor exposure contribute to myopia development.[12] Biomechanical factors, such as corneal hysteresis and ciliary body thickness, may also contribute to unilateral high myopia, often accompanied by anisometropia.[13] Weiss's research suggests that unilateral high myopia can result from various underlying conditions, including optic nerve disorders, central nervous system abnormalities, lens anomalies, and retinopathy of prematurity.[14] The exact cause of anisometropia in this patient remains undetermined.

Autorefractors provide objective measurements of refractive errors,[15] but retinoscopy is essential for accurate verification, especially in complex cases.[16] Regular maintenance of autorefractors ensures reliable readings.[15] Initial visual acuity in this patient is improved from 2/60 to 4/60 with autorefraction correction. Cycloplegic retinoscopy revealed a best-corrected visual acuity of 6/60. Strabismus, particularly exotropia, is common in patients with myopia. Anisometropia and keratoconus are also associated with myopia..[17] This patient had no strabismus. Slit lamp examination allows detailed evaluation of the anterior segment, including corneal thickness, anterior chamber depth, and iridocorneal angle. Oblique slit illumination helps detect corneal irregularities, such as those associated with keratoconus. Pentacam or optical biometers provide more precise measurements.[18] In cases of progressive myopia, slit lamp examination can reveal lens changes indicative of cataracts. A 90-D fundus lens enables examination of the inner eye without pupil dilation.[19] In this patient, the anterior segment of both eyes was unremarkable.

Unilateral high myopia necessitates a thorough evaluation. A-scan ultrasonography measures axial length, often elongated in myopic eyes. We also assessed your visual pathway function by testing your color vision, pupil response, visual field, and brain's response to visual stimuli (VEPs). Optical coherence tomography (OCT) detects optic nerve abnormalities, such as hypoplasia. Fundoscopy examines the macula, optic nerve, and retina. In this patient, ocular motility was normal. The Worth Four Dot test revealed a dominance of the left eye. Stereopsis testing revealed binocular vision impairment. Confrontational visual field and color vision tests were within normal limits. A significant difference in axial length was observed between the eyes during biometric analysis, with the right eye being measurably longer. B-scan ultrasonography confirmed this finding.

Management of high myopia can involve both non-surgical and surgical interventions. Eyeglasses and contact lenses represent the most common non-surgical options. Eyeglasses are frequently the preferred choice for vision correction, with accurate lens prescriptions, vertex distance, and pupil alignment being essential for optimal visual outcomes. Contact lenses offer another alternative and are available in rigid gas-permeable (RGP) and soft varieties. RGP

lenses typically comprise hydrophilic materials, whereas soft lenses comprise hydrogels such as HEMA, silicone hydrogel, or polyvinyl alcohol. Orthokeratology (OK) provides a non-surgical option where specialized contact lenses reshape the cornea overnight. Studies indicate that OK can reduce myopia progression by up to 40%, likely by preventing axial elongation. Atropine eye drops (0.01%) are another intervention, demonstrating up to 80% effectiveness in slowing myopia progression, though the precise mechanism remains unclear. Some research suggests that atropine may alter the scleral properties and reduce the impact of UV light on scleral collagen. For patients with profound myopia, procedures such as SMILE (small-incision lenticule extraction), LASIK (laser-assisted in situ keratomileusis), and PRK (photorefractive keratectomy) may be considered.[15] The patient received comprehensive care, including eyeglasses, contact lenses, atropine, and an eye patch, with regular follow-ups to evaluate treatment efficacy and address potential issues.

CONCLUSION

This case report highlights the multifaceted nature of unilateral high myopia, emphasizing the importance of a comprehensive ophthalmological examination and tailored treatment plan. The patient's Javanese ethnicity, lack of family history, and potential environmental factors contribute to the development of myopia. The diagnosis involved a combination of subjective and objective tests to assess visual acuity, refractive error, ocular motility, binocular vision, and underlying ocular structures. Treatment included eyeglasses, contact lenses, atropine eye drops (0.01%), and an eye patch, with regular follow-ups to monitor progress and address complications. This case underscores the importance of early intervention and ongoing care for patients with high myopia to optimize visual outcomes and prevent long-term complications.

Conflict of Interest

The authors confirm no conflict of interest in this study.

REFERENCES

1. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, et al. Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. Ophthalmology. 2016;123(5):1036-42. Doi: 10.1016/j.ophtha.2016.01.006.
2. Jiang Y, Xiao X, Sun W, Guo X, Li Z, Wang Y, et al. Clinical and genetic risk factors underlying severe consequence identified in 75 families with unilateral high myopia. J Transl Med. 2024;22(1):75. Doi: 10.1186/s12967-024-04886-5.
3. Martínez-Albert N, Bueno-Gimeno I, Gené-Sampedro A. Risk factors for myopia: a review. J Clin Med. 2023;12(18):6062. Doi: 10.3390/jcm12186062.
4. Freeman MI. Spectacles vs contact lenses in the correction of unilateral axial myopia. Arch Ophthalmol. 1992;110(2):180. Doi: 10.1001/archopht.1992.01080140036019.
5. Wang S, Zhang B, Liu Q, Zhou F, Chen Y, Xu J. Spectacle correction may affect refractive progression in children with unilateral myopic anisometropia: a retrospective study. Ophthalmic Physiol Opt. 2024;00(00):1–6. Available from: https://doi.org/10.1111/opo.13382.
6. Repka MX, Melia M, Eibschitz-Tsimhoni M, London R, Magoon E, Pediatric Eye Disease Investigator Group. The effect on refractive error of unilateral atropine as compared with patching for the treatment of amblyopia. J AAPOS. 2007;11(3):300-2. Doi: 10.1016/ j.jaapos.2006.09.017.
7. Hashem O, Sheha H. Ten-year outcomes of LASIK for pediatric myopic anisometropia. Clin Ophthalmol. 2022;16:4293-301. Doi: 10.2147/OPTH.S387302.
8. Swarbrick HA, Alharbi A, Lum E, Watt K. Changes in axial length and refractive error during overnight orthokeratology for myopia control. Invest Ophthalmol Vis Sci. 2011;52(14):2837-. Available from: https://iovs.arvojournals.org/article.aspx?articleid=2358251.
9. Baird PN, Saw SM, Lanca C, Guggenheim JA, Smith EL 3rd, Zhou X, et al. Myopia. Nat Rev Dis Primers. 2020;6(1):99. Doi: 10.1038/s41572-020-00223-2.

10. Chen Q, He J, Hu G, Xu X, Lv H, Yao Y, et al. Morphological characteristics and risk factors of myopic maculopathy in an older high myopia population—based on the new classification system (ATN). Am J Ophthalmol. 2019;208:356–66. Doi: 10.1016/j.ajo.2019.07.022.
11. Al Messabi SS, Dirani M, Mukhi-Marathe S. Adult onset unilateral high myopia in a female patient: a case report. Am J Ophthalmol Case Rep. 2020;20:100941. Doi: 10.1016/j.ajoc. 2020.100941.
12. Cooper J, Tkatchenko AV. A review of current concepts of the etiology and treatment of myopia. Eye Contact Lens. 2018;44(4):231–47. Doi: 10.1097/ICL.0000000000000499.
13. Varney K. Bringing unilateral high myopia into focus. Optometry & Visual Performance. 2018;6(3):130-4. Available from: https://www.ovpjournal.org/ovp-issue/volume-6--issue-3.
14. Weiss AH. Unilateral high myopia: optical components, associated factors, and visual outcomes. Br J Ophthalmol. 2003;87(8):1025-31. Doi: 10.1136/bjo.87.8.1025.
15. Subudhi P, Agarwal P. Myopia. [Updated 2023 Mar 31]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi. nlm.nih.gov/books/NBK580529/.
16. Arnon R, Rozen-Knisbacher I, Yahalomi T, Stanescu N, Niazov Y, Goldberg D, et al. Rise of the machines? Comparison of cycloplegic refraction using retinoscopy and the Retinomax K-Plus 5 in children. J Pediatr Ophthalmol Strabismus. 2022;59(6):380-7. Doi: 10.3928/01913913-20220712-01.
17. Tang SM, Chan RY, Bin LS, Rong SS, Lau HH, Lau WW, et al. Refractive errors and concomitant strabismus: a systematic review and meta-analysis. Sci Rep. 2016;6:35177. Doi: 10.1038/srep35177.
18. Clover J. Slit-Lamp Biomicroscopy. Cornea. 2018;37 (Suppl 1):S5-S6. Available from: https://journals.lww.com/corneajrnl/Fulltext/2018/37001/Slit_Lamp_Biomicroscopy.2.aspx.
19. Gellrich MM. A simple method for panretinal imaging with the slit lamp. Int Ophthalmol. 2016;36(6):775-80. Doi: 10.1007/s10792-016-0187-6.