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Case Report

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Conventional patching therapy of an anisometropic amblyopia in a teenager

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Abstract

Amblyopia, a common cause of unilateral visual impairment, has traditionally been treated in early childhood, with treatment considered ineffective beyond the critical period of visual maturation. This case report presents an 18-year-old male patient with anisometropic amblyopia who demonstrated significant visual improvement following a combination of optical correction and part-time occlusion therapy. Despite starting treatment after the conventional critical period, the patient experienced marked gains in visual acuity and stereopsis, challenging the notion that amblyopia patching treatment is ineffective in adolescence. This case underscores the importance of reassessing treatment timeline and considering continued therapeutic interventions beyond the traditionally accepted age limit.

Keywords: Amblyopia, Anisometropia, Adolescent, Patching

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INTRODUCTION

Amblyopia, characterised by a reduction in the best corrected visual acuity (BCVA) of at least 2-line interocular difference (IOD), is one of the leading causes of reversible unilateral visual impairment (VI) in children and adolescents. Its estimated prevalence is 1.36% [1] to 3.6% [2] in children and 1.07% in adolescents.[3] Amblyopia results from any condition that creates a significant visual disparity between the two eyes, with strabismus or anisometropia accounting for approximately 40% of

children aged 3 to 6.9 years with moderate amblyopia.[2] Anisometropia, defined by an IOD of at least 1 diopter in spherical equivalent,[4] arises from asymmetric eye growth, and can present as myopic, hyperopic, or astigmatic asymmetry, If left untreated, anisometropia can lead to visual complications such as aniseikonia and anisometropic amblyopia, both of which can cause decreased BCVA and impaired stereopsis.[5] Timely detection and intervention are crucial to mitigate permanent visual loss and to enhancing quality of life, and reducing or eliminating symptoms of visual discomfort. Without intervention, individuals with amblyopia face a projected total lifetime risk of at least 1.2% for VI or blindness in the non-amblyopic eye.[6] The prevalence of anisometropia increases from 1.27% at 5 years, increasing to 9.46% at 12 to 15 years among myopes and 12.64% among hyperopes.[7] The lower percentage of anisometropic amblyopia in the younger age groups led to the theory that it may develop later, or that early-onset anisometropia takes longer than strabismus to cause amblyopia.[2] This finding underscores the need to extend detection strategies beyond early childhood.

Traditionally, early intervention during the critical period of visual development has been the mainstay of amblyopia treatment, as it is believed to achieve an optimal visual outcome.[8] However, given evidence that neuroplasticity extends beyond early childhood, treatment may still be effective in adolescence and even adulthood.[2,9] Studies on anisometropia amblyopia and patching treatment predominantly focus on children with fewer studies involving adolescence, as it is believed that patching in older children and adults may lead to a reduction in binocular vision and stereopsis, and to psychosocial problems, such as loss of self-esteem.[10] In facilities without access to alternative options, this case report highlights a remarkable improvement of both visual acuity (VA) and stereopsis, in a teenager who received late intervention.

CASE REPORT

An 18-year-old male patient with a strong maternal family history of amblyopia, strabismus, and high refractive errors, first presented at age 11 years following a school health referral. At that time, unaided VA was 6/120 (N24) in the right eye (RE) and 6/6 (N4.5) in the left eye (LE). Subjective refraction showed significant improvement in the RE, with VA improving to 6/24-2 with a prescription of +4.00/-0.50 x 150. The LE remained stable on 6/6 with a refraction of Plano/-0.50 x 180. Stereopsis with Frisby recorded 110 seconds of arc. Despite significant hyperopia and astigmatism, and improvement of the RE vision, spectacles were not prescribed as the patient was asymptomatic.

At age 12, the patient's left VA declined from 6/6 to 6/12, prompting a spectacle prescription of +6.50/-2.25 × 155 for the RE and -0.75/-0.75 × 180 for the LE. This improved the RE VA to 6/24 (N24) and the LE VA to 6/12 (N4.5). Fundoscopic examination of the RE revealed a small, tilted hypermetropic disc. Due to the long-standing, untreated anisometropia and the patient's age, the prognosis was considered guarded. The patient continued to wear the prescribed spectacles full-time and was reviewed annually. Despite good compliance, BCVA in the RE showed only modest improvement, reaching 6/21 (N14) over four years, while the LE prescription increased slightly to -1.50/-1.50 × 5.

At age 16, the patient was referred to the orthoptist for further evaluation. The cover test showed orthophoria at both near and distance, with and without correction and Worth's Four Dot test confirmed binocular single vision. Depth perception with TNO stereopsis was recorded at 120 seconds of arc. A diagnosis of anisometropic amblyopia was made. (Additional materials can be found in the **Supplementary** text for further details on anisometropic amblyopia). After a thorough discussion with the patient and his parents, regarding a guarded visual prognosis, and obtaining consent, part-time total occlusion (PTTO) of the LE was initiated with ORTOPAD® (Trusetal Verbandstoffwerk GmbH, Germany), for three hours daily (**Figure 1**). At the start of treatment, his BCVA was 6/30 (N14) in the RE and 6/6 (N5) in the left, with a stereopsis of 120 seconds of arc.

After two months of good compliance with PTTO, near VA improved to N12 and depth perception improved to 60 seconds of arc, although the RE distance VA remained unchanged at 6/21. With bi-monthly monitoring, steady progress continued. By six months, near VA had further improved to N8, and stereopsis stabilised at 60 seconds of arc, while distance VA in the RE remained at 6/21. As the patient was preparing for a major examination, the duration of patching was reduced to one hour daily.

Fourteen months after initiating patching therapy, and following the prescription of a new pair of spectacles (RE +5.00/-2.50 × 155; LE -1.50/-1.50 × 5), the RE VA improved to 6/15 (N5), and the LE VA remained stable at 6/6 (N5). Stereopsis, as measured by the TNO test, showed a marginal improvement to between 60 and 30 seconds of arc.

Figure 1. The patient undergoing part-time occlusion therapy for anisometropic amblyopia, using an eye patch over the dominant eye to stimulate visual development in the weaker eye.

DISCUSSION

This case demonstrates that amblyopia treatment in adolescence can still lead to significant visual and binocular vision improvements through refractive correction by spectacles and conventional patching therapy, challenging the traditional belief that treatment is ineffective beyond early childhood. The patient began wearing spectacle at 12 years old and started part-time patching at 16 when VA plateaued. Despite the late intervention, success may be attributed to the evidence that the visual cortex retains some plasticity into adolescence,[8] the good adherence to patching therapy and frequent clinic visits were emphasised as these factors have been reported to be causes of treatment failure.[11]

The patient began wearing spectacle at 12 years old and started part-time patching at 16 when VA plateaued. Despite the late intervention, improvements may be attributed to the evidence that the visual cortex retains some plasticity into adolescence,[8] the good adherence to patching therapy and frequent clinic visits. The BCVA in the amblyopic RE improved from 6/30 (N14) to 6/15 (N5 after 14 months of patching the LE. Notably near VA and stereopsis showed marked improvement, from N14 and 120 seconds of arc to a normative level at N5 and 30-60 seconds of arcs respectively. Improvement in stereopsis is important, as it reflects the functional benefits in daily tasks that require depth perception, such as driving and navigating stairs.[12] It also provide greater career opportunities, particularly in fields that require fine motor skills and spatial judgment, such as aviation and surgery.[13] provides "visual insurance" in the event of future vision loss in the better eye, helping to preserve independence.[14]

While treatment is most effective in children under seven years of age,[2] older individuals, 13 to 17-year-old who have never undergone patching demonstrated a better outcome compared to those previously treated (47% compared to 16%).[12] This case reported a visual gain of 0.3 logMAR, (approximately three lines VA improvement) - a meaningful yet lower improvement compared to the 2.4 logMAR lines reported by PEDIG [13] after four months of two-hour daily patching. A plausible explanation for this discrepancy is the later initiation of intervention (12 years old) compared to younger than seven age groups. This highlights the importance of early detection and timely treatment while reinforcing that later intervention can still yield notable outcome.

CONCLUSION

This case report supports the growing body of evidence that treatment for amblyopia can be effective beyond the traditionally accepted critical period. The patient's significant visual improvement through consistent partial patching of the non-amblyopic eye demonstrates the potential for visual recovery even in older adolescents, suggesting the ongoing plasticity of the visual system. While further research is needed to assess feasibility and cost-effectiveness, extending vision screening beyond childhood may help identify older children who may benefit from timely intervention.

Abbreviations

BCVA	Best corrected visual acuity
IOD	Inter-ocular difference
VI	Visual impairment
VA	Visual acuity
RE	Right eye
LE	Left eye
PTTO	Part time total occlusion

Declarations

Conflict of interests

The authors declare no conflict of interests.

Consent

Consent has been obtained from patient for publication.

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Supplementary Texts

Anisometropic amblyopia occurs when there is a **refractive error difference of one dioptre or more** in spherical equivalent between the two eyes. This difference causes one eye to see clearly while the other sends a blurry image to the brain. As a result, the brain supresses the visual input from the eye with the greater refractive error and favours the eye that sees the clearer images (**Figure 2**). Over time, this disrupts normal visual development and lead to **permanent visual impairment**.

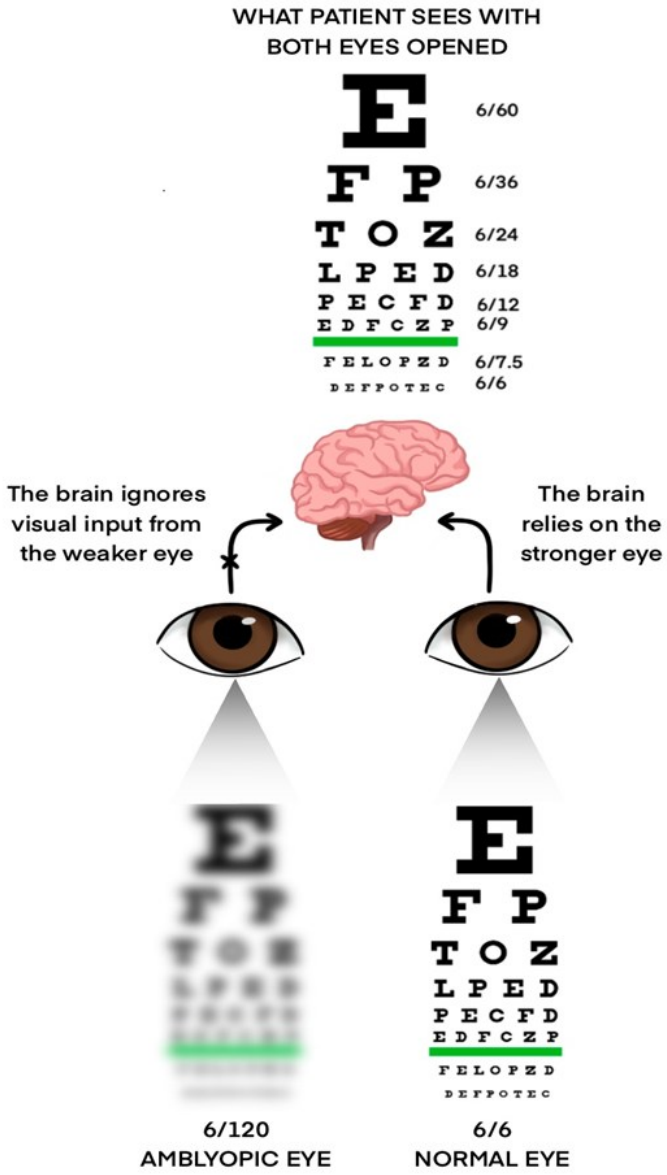

Figure 2: Illustration depicting the blurred image perceived by the weaker eye, typically the one with the higher refractive error. The brain suppresses the blurred input from the weaker eye in favour of the clearer image from the normal eye. In anisometropic amblyopia, both eyes appear outwardly normal. Illustration by Ginel SD.

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