

Case Report

A case of reverse amblyopia in a myopic anisometropic patient: an atypical presentation

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Abstract

We herein report a case of a 4-year-old female patient who presented with anisometropic amblyopia with initial visual acuity recorded at 20/400 OD and 20/100 OS. The patient was recommended for patching. Eighteen months later, the patient presented with visual acuity of 20/60 OD and 20/80 and reverse amblyopia was noted. In settings of amblyopia, where alternate patching may be used, it is most likely that reverse amblyopia, if present, will affect the more myopic eye. However, unexpectedly, in this case, reverse amblyopia occurred in the less myopic eye. With discontinuation of occlusion therapy and continued use of optical correction, the patients reverse amblyopia resolved and the visual equity equalized. To our knowledge, this is the first case described in the literature demonstrating such an occurrence. Awareness of this rare presentation by clinicians is of great importance to aid in correctly diagnosing and treating such patients.

Keywords: reverse amblyopia; amblyopia; anisometropia; myopia

Introduction

Amblyopia is one of the most common causes of visual impairment in children. It affects ~4% of individuals in this age group [1]. Several etiologies underpin the development of amblyopia, primarily including strabismus, refractive errors, and visual deprivation. Refractive errors can be categorized into two types: isometropia and anisometropia. Isometropia is defined as the presence of symmetrical refractive errors in both eyes, while anisometropia is the presence of significant asymmetrical refractive errors, regardless of the nature of said errors [2, 3]. The mainstay treatment for anisometropic amblyopia is refractive error correction, which can be performed alone or in combination with partial occlusion therapy, with both treatment modalities being highly effective if treatment is initiated early on [4, 5]. Excessive occlusion therapy, however, either by patching or penalizing the sound eye, may lead to an unwanted complication in the form of reverse amblyopia. We herein report a case of a 4-year-old female patient with anisometropic amblyopia who unusually developed reverse amblyopia in the less myopic eye.

Case presentation

A 4-year-old female patient presented to the pediatric ophthalmology clinic with decreased vision in both eyes on 24 February 2019. The patients initially noted their concerns regarding the

patients decreased vision 1 year prior, where glasses and occlusion therapy were prescribed but compliance was not maintained. In the current presentation, her best corrected visual acuity was found to be 20/400 in the right eye (OD) and 20/100 in the left eye (OS), with maintained fixation in the left eye for both near and distant targets, and no deviation of either eye. Slit lamp and fundus examination were within normal limits. Cycloplegic refraction was $-11.00 - 3.50 \times 15$ OD and $-4.00 - 3.25 \times 10$ OS. The patient was given full cycloplegic correction and was advised part-time occlusion (PTO) for 6 hr/day. In the 1 month follow-up appointment, it was observed that the patient's visual acuity was 20/100 OD and 20/60 OS. Though the patient still did not fully adhere to the prescribed glasses and PTO regiment. Contact lenses were offered as an alternative option to the glasses in addition to continuing PTO for 6 hr/day. The patient did not attend the ensuing three appointments due to the COVID-19 pandemic lockdown. At the next follow-up visit, 18 months later, the patient was noted by the parents to be compliant with glasses and PTO, while deciding not to use the contact lenses, her best corrected visual acuity at this point was 20/60 OD and 20/80 OS. Her cycloplegic refraction was $-11.50 - 3.50 \times 10$ OD and $-4.50 - 3.50 \times 5$ OS. Full cycloplegic refraction was given, and alternate PTO was initiated for 4 hr/day. Three months later, the patient's visual acuity was 20/30 OD and 20/50 OS. On examination of this visit, the patient was noted to have reverse amblyopia. As such, alternate PTO was discontinued, and the patient was advised to carry out PTO of

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only the right eye for 4 hr/day. Her cycloplegic refraction was rechecked, and a full correction was given at $-10.50 - 3.50 \times 10$ OD and $-5.00 - 4.50 \times 5$ OS. At the patient's next 3-month follow-up appointment, the visual acuity remained the same, and thus, the plan was to continue using the same glasses and discontinue the right eye PTO. At the patient's last visit, the visual acuity became 20/22 OD and 20/22 OS. PTO was still discontinued, and the same glasses were continued; the patient was discharged from the clinic.

Discussion

Amblyopia is one of the main causes of preventable visual loss in children. One Pediatric Eye Disease Investigator Group (PEDIG) study showed that anisometropia was a contributing factor in >50% of patients presenting for initial evaluation of amblyopia [6]. The degree of anisometropia necessary in myopic patients to cause amblyopia has been reported to be around -2.00 diopters; the patient in the current study had anisomyopia of -11.00 diopters.

Recommendations regarding the management of severe amblyopia have been discussed in the Amblyopia Treatment Studies (ATS). Optical correction as a monotherapy is a reasonable initial approach for patients with anisometropic or strabismus induced amblyopia with improvements in visual acuity demonstrated in 70% of patients and complete resolution in more than 40% of patients [7]. However, occlusion therapy must be considered if patients showed no improvement with refractive correction alone for 3–5 months. Occlusion therapy may be prescribed as part-time patching or as pharmacological penalization with atropine. Full-time patching is typically not required, and in fact, is best to avoid in order to prevent complications such as reverse amblyopia. Prescriptions of patching should be around 2 hr for moderate amblyopia and 6 hr for severe amblyopia, though some patients with severe amblyopia respond to as little as 2 hr of patching. The use of adhesive patches is strongly recommended, especially in younger patients, to reduce the likelihood of peaking. The use of atropine sulfate 1% leads to cycloplegia, ultimately resulting in a blurry image in the dominant eye. In an ATS that evaluated the effectiveness of atropine versus patching, both treatment groups demonstrated similar visual acuity improvements in the amblyopic eye; however, improvements in visual acuity were slower in the atropine penalization group [7]. In patients who are not compliant to both aforementioned occlusion therapies, the use of Bangerter filters may be warranted. Recently, some novel approaches include the use of digital therapeutic virtual reality (VR) headsets as a dichoptic treatment for amblyopia, which has been shown to offer an engaging user experience. In October 2021, Luminopia One became the first VR headset approved by the United States Food and Drug Association (FDA) for improvement of visual acuity in amblyopic patients with anisometropia or mild strabismus [8].

Compliance with glasses and PTO is often a challenge in anisometropic amblyopia. Parents counseling and education regarding the condition, the importance of adherence to therapy, and the risk of recurrence are essential in ensuring good patient outcomes. Moreover, continued glasses wear is crucial until visual maturity is achieved.

Reverse amblyopia can occur with patching or the use of atropine sulfate; however, the combined use of said methods increases the risk significantly. Generally, cases of reverse

amblyopia resolve over time after discontinuation of therapy. In some rare cases, reverse amblyopia may be permanent and refractory to treatment attempts. In settings of amblyopia where alternate patching may be used, it is most likely that reverse amblyopia, if present, will affect the more myopic eye. However, unexpectedly, as in the case of the patient described in this study, reverse amblyopia occurred in the less myopic eye. To our knowledge, this is the first case described in the literature demonstrating such an occurrence. Luckily, in the case of our patient, the amblyopia resolved after discontinuation of PTO, and visual acuity was subsequently equalized in both eyes.

Conflict of interest statement

The authors declare that there is no conflict of interest regarding the publication of this article. Submitting authors are responsible for coauthors declaring their interests.

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Data availability

The data used to support the findings of this study are included within the article.

Patient consent

Written consent to publish the case report was waived as this report does not contain any personal information that could lead to the identification of the patient and is sufficiently anonymized according to International Committee of Medical Journal Editors guidelines.

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