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Case Report

The Case of Refractive Error with Accommodative Insufficiency in a 12-Year Old Pupil

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Abstract

A 12-year old girl presented with blurry vision at distant, severe eyestrain and watery eyes after 10-15 minutes of reading. She had had this problem for quite some time and she estimated it at 2 years. There was no reported medical or ocular history. An assessment of the anterior segment of the eyes, ocular media and posterior segment of the eyes was unremarkable, as it revealed no anomalies. Distant Visual acuity in both eyes was 20/80 and near Visual Acuity was N10. The refractive state of the eye was determined using subjective refraction, following retinoscopy. Binocular vision assessment showed abnormal Amplitude of Accommodation (AA), Accommodative Convergence per diopter of Accommodation (AC/A ratio), Positive Relative Accommodation (PRA), Monocular Accommodation Facility (MAF), Binocular Accommodation Facility (BAF). On the bases of patient's complaints and the findings obtained, a diagnosis of refractive error (compound myopic astigmatism) with accommodative insufficiency was made. The full subjective correction was dispensed and Accommodative therapy-Home-based Pencil Push up (HBPP) therapy was recommended.

Keywords: *Refractive Error; Binocular Vision; Accommodation; Accommodative Insufficiency*

Abbreviations

AA: Amplitude of Accommodation; AC/A: Accommodative Convergence per Accommodation; NPC: Near Point of Convergence; PFV: Positive Fusional Vergence; PRA: Positive Relative Accommodation; NRA: Negative Relative Accommodation; MAF: Monocular Accommodation Facility; Binocular Accommodation Facility (BAF); OD: Right Eye; OS: Left Eye

Introduction

Accommodative insufficiency is the most common accommodative dysfunction and it occurs when the amplitude of accommodation (AA) is lower than expected for a patient's age and not due to sclerosis of the crystalline lens [1]. Commonest amongst the symptoms of this condition include tiredness when reading, headaches, blurred vision and eyestrain. Others experience concentration deficits and motion sickness [1,2].

Children with accommodative insufficiency may struggle with schoolwork and may try to avoid reading whenever possible because they typically experience eye fatigue when carrying out close work for a sustained period [3].

Insufficient accommodation usually results from either delayed vision development in children, or in situations of visual stress in adolescents and adults. Certain drugs such as antidepressants and systemic diseases such as diabetes may trigger some forms of accommodative insufficiency. The condition is sometimes associated with another disorder known as Convergence Insufficiency. In Convergence Insufficiency, the eyes do not move inward effectively to allow accurate focusing on near objects. This causes asthenopia, a situation in which people experience discomfort and difficulties performing the kinds of tasks where close focusing is necessary [2].

Refractive errors have an effect on accommodation and accommodation also impacts on convergence. Hyperopes accommodate more than emmetropes and emmetropes also accommodate more than myopes. Thus, myopes do exert the least effort as far as accommodation is concerned. It can, therefore, be posited that myopia can potentially reduce one's amplitude of accommodation and consequently affect near work [4].

Case Presentation

In the early hours of the day on February 11, 2016, at the Sight for Africa Eye Clinic in Darkuman, which is located in the Greater Accra Region of Ghana, a 12-year old girl, who was accompanied by her grandfather, presented with blurry vision at distant, severe eyestrain and watery eyes after 10-15 minutes of reading. She had had this problem for about 2 years according to her estimation. Although she admitted not seeing from far, she had never worn spectacles in her lifetime and this was her first time visiting an eye clinic. According to her, she adapts by sitting at the front row in class, even though it still comes with some level of eyestrain. She does not enjoy reading because of the associated discomfort. "My problem is becoming worse every single day and I am really bothered about it", she said.

She had no history of any medical problem and she was not on any medication.

Differential Diagnoses

The differential diagnoses included Refractive Error, Convergence Insufficiency, Pseudo convergence Insufficiency, CN III palsy, Accommodative Lag and Accommodative Insufficiency.

Ocular Examination

An ocular health assessment of the patient revealed normal pupils and normal intraocular pressures in both eyes. All extraocular muscles were in good function, likewise saccadic and pursuit movements. There was no noticeable nystagmus. Slit lamp examination showed a transparent ocular media and unremarkable anterior segments in both eyes. Fundoscopy revealed no anomaly of the retina. Other visual findings were as follows:

Entrance Visual Acuity: 20/80 OD, 20/80 OS
Pinhole Visual Acuity: 20/30 OD, 20/30 OS
Near Visual Acuity: N10 (with strain and tearing after a short while)
Retinoscopy: OD -1.25/-1.00X90; OS -1.25/-0.50X90
Subjective Refraction: OD 20/80 -1.50/-0.75X90 20/20; OS 20/80 -1.25/-0.50X90 20/20

NPC	20 cm
AA	6D
Distance phoria	2 exo
Near Phoria	12 exo
Gradient AC/A	2:1
Calculated AC/A	1.6:1
PFV @ near	4/12/4
Vergence facility	6 cpm (slow with BO)
NRA	+2.50
PRA	-1.00
MAF	2 cpm, fails minus
BAF	4 cpm, fails minus

Table 1: *Binocular Vision Assessment on First Visit.*

Diagnosis

A diagnosis of refractive error (compound myopic astigmatism) with accommodative insufficiency was made.

Plan of Management

The full subjective prescription was dispensed and Accommodative therapy-Home-based Pencil Push up (HBPP) therapy was recommended - 10 minutes exercise three times a day. The patient was the scheduled for review in three weeks.

Review (On Second Visit)

Patient reported that her vision is now excellent with her spectacle correction and she wears it to school every day, adding that, she can afford to sit at the back and yet, see clearly, all that her teacher writes on the marker board. She also mentioned that she now enjoys reading without tearing or fatiguing.

Her grandfather was quick to add that she had been taking her push-up exercises seriously and that he can't recall a day that her granddaughter forewent this exercise.

The ocular findings on the review day were as follows:

Entrance Visual Acuity: 20/80 OD, 20/80 OS
Visual Acuity with Glasses: 20/20 OD, 20/20 OS
Near Visual Acuity: N6 (less strain)
External Ocular Assessment and Fundoscopy: Unremarkable in both eyes.

NPC	10cm
AA	12.50D
Distance phoria	Ortho
Near Phoria	4 exo
Gradient AC/A	4:1
Calculated AC/A	3.6:1
PFV @ near	10/18/12
Vergence facility	10 cpm
NRA	+2.50
PRA	-2.00
MAF	6 cpm
BAF	10 cpm

Table 2: *Binocular Vision Assessment on Second Visit.*

Discussion

One could easily tell from the history that the little girl's symptoms were inextricably linked with the use of her eyes suggesting a physiological rather than an anatomical etiology.

The entrance Visual Acuity and results from the refraction were indicative of a refractive error.

The findings from the Binocular Vision Assessment mimics convergence insufficiency and thus could easily be confused with true convergence insufficiency. The key parameters for arriving at this diagnosis were the AA and other tests such as PRA, MAF and BAF that probed the ability to stimulate accommodation. In true convergence insufficiency, these findings are normal.

Owing to the minimal accommodation exerted by the patient to identify a stimulus, the amount of near point exophoria increased and the PFV decreased. The NPC increased or receded and the AC/A ratio was low due to the accommodation-convergence relationship.

Her accommodative insufficiency may in part, be as a result of her refractive error since myopes accommodate less as compared to hyperopes and emmetropes. Hence, dispensing of her full subjective prescription did not only enhance her distant vision, but also, stimulated her accommodative cues. Added lenses were not recommended because of the low AC/A ratio.

Incorporating vision therapy into the management plan positively impacted on the little girl's situation. In just three weeks, she reported of complete relief of all symptoms and she now enjoys reading and doing other near work.

Conclusion

Patients with accommodative insufficiency often complain of blurred vision, difficulty reading, irritability, poor concentration, and/or headaches. Such symptoms can be relieved by methods to stimulate or activate rapid accommodative responses without evidence of fatigue. This can be achieved by using minus lenses where the patient is short-sighted and/or accommodative therapy. The purpose of accommodative therapy is to increase the amplitude, speed, accuracy, and ease of accommodative response.

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