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PSEUDOMYOPIA IN YOUNG ADULTS, A REPORT OF THREE CASES FROM A SINGLE TERTIARY FACILITY IN IBADAN, NIGERIA

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ABSTRACT

Pseudomyopia is a myopic shift in the refractive power of the eye due to overstimulation of the mechanism of accommodation. It is most common among children and may occur in all types of refractive errors, especially in hyperopia. The usual symptoms of pseudomyopia include asthenopia, intermittent blurry vision and sometimes diplopia. The management starts with recognition, which involves a high index of suspicion, cycloplegic refraction and relaxation of accommodation. This case series describes the management of three young adult female patients who presented with clinical features of pseudomyopia, with a focus on identifying predisposing risk factors and establishing the diagnosis.

Keywords: Pseudomyopia, Accommodative spasm, Refractive error, Cycloplegic refraction

INTRODUCTION

Pseudomyopia represents false (apparent) myopia which results from increased refractive power of the eye due to excessive stimulation of the accommodative mechanism.[1] Pseudomyopia has been observed among all types of refractive errors, but especially among uncorrected hyperopes.[1]

Accommodation, which is the ability of the eye to adjust focal points, is required for the formation of clear images on the retina.[2] To focus on a near object, there is contraction of the ciliary muscles, relaxation of the suspensory ligaments and increased curvature of the lens, leading to a reduced anterior chamber depth and an apparent increase in axial length. These mechanisms lead to increased dioptric power, and the reverse occurs for objects at infinity.[2] In contrast, the ciliary muscle is continually contracted in pseudomyopia, even for objects at infinity, resulting in symptoms and signs of asthenopia experienced by the affected individual.[3] Epidemiologically, pseudomyopia occurs more commonly in children,[4] and its prevalence reduces with increasing age.[5] Pseudomyopia may mimic myopia and is therefore likely underreported, requiring a high index of suspicion to make a diagnosis.[6] This case series reports three cases seen among young adult females and seeks to increase awareness of the symptoms and diagnosis of pseudomyopia, especially among young people with poor visual hygiene.

CASE REPORTS

Case 1

An 18-year-old female presented to the ophthalmology clinic of the University College Hospital, Ibadan, with a three-week history of blurry distant vision. She had no history of trauma, ocular aches, redness or tearing. There was no history of poor near vision or ocular deviation. She was a known spectacle wearer (dioptric power of +0.50 DS in both eyes), prescribed two years prior to this current visit. There was no history of use of topical or systemic medications, and her past medical history was not significant.

On examination, she had unaided distant visual acuity of 6/9 on the right and 6/9+2 on the left; normal anterior segments; and orthophoria in all directions of gaze. Other findings included round and reactive pupils of about 4mm bilaterally, pink healthy neuroretinal rim, cup-disc ratio (CDR) of 0.5×0.4 bilaterally, normal vessels and macula. Near point of convergence (NPC) was 30cm while near point of accommodation (NPA) was 26cm, both were receded for her age. A dry (noncycloplegic) refraction revealed: -4.00DS/-1.00DC axis 180^0 in the right eye (RE) and -3.00 DS/-0.50DC axis 180^0 in the left eye (LE), with improvement to a best corrected visual acuity of 6/5 bilaterally. Pseudomyopia was suspected as a diagnosis and the patient underwent a cycloplegic refraction after twice-daily instillation of 1% Atropine for three days.

The net cycloplegic refraction was +0.50DS/-0.75 DC axis 180^0 RE and +0.50DS/-0.75 DC axis 175^0 LE. An assessment of pseudomyopia, probably due to accommodation insufficiency (accommodative spasm from overexertion to focus), was made. On subjective post-cyclo refraction, she accepted plano/-0.75DC axis 175^0 RE and plano/-0.75DC axis 165^0 LE. A near addition of +1.00DS for near work was also prescribed. This gave a corrected distant and near visual acuity of 6/5 and N5, respectively, in both eyes. A repeat NPA measured 8 cm, and the repeat NPC was 8 cm, both of which are normal for her age. The patient has been comfortable with spectacles with no further complaints as at the 8-month follow-up visit with corrected visual acuity of 6/5 in both eyes and essentially normal ophthalmic examinations.

Case 2

A 19-year-old female presented with a recurrent history of blurry distant vision in both eyes of 2 weeks' duration. She also gave a history of occasional aches but no history of poor near vision. On further probing of her visual hygiene, there was a history of frequent night reading of novels on her laptop in the dark. She also gave a history of several hours of uninterrupted use of smartphones, especially at night. She had never worn spectacles, and there was no history of ocular or head trauma. She was not on any systemic or ocular medications. Her presenting unaided distant visual acuity was 6/9 in both eyes and N5 for near. Her NPA was 10cm and the NPC was 8cm, both within normal limits for her age. She was orthophoric in all directions of gaze, and her pupils were 3 mm, round and reactive. Fundoscopy revealed pink discs with CDR 0.4 x 0.4, normal vessels and macula bilaterally. Noncycloplegic refraction was: -5.25DS RE and -4.75DS LE. An assessment of pseudomyopia was made. She had a cycloplegic refraction after twice-daily instillation of 1% Atropine for three days, with resulting net values of: +1.00DS/-0.75DC axis 180^0 RE and +1.25DS/-0.75DC axis 180^0 LE. A subjective post atropine refraction done 2 weeks afterwards revealed: +0.75DS/-0.75DC axis 180 RE and +1.00DS/-0.75DC axis 180^0 LE, with near addition of +2.00DS. This gave a corrected distant and near visual acuity of 6/5 and N5 respectively in both eyes, which was subsequently prescribed as bifocal spectacles. The patient was counselled to avoid excessive near work, excessive screen time, to constantly wear the prescribed spectacles and keep to scheduled appointments. A follow-up visit at 4 months revealed that she had less frequent symptoms, although the patient admitted to poor compliance with spectacle wear.

Case 3

A 22-year-old female presented to the clinic with a one-year history of difficulty with near tasks and blurry vision in the last one month. There was a history of increased demand for near work as she was preparing for school examinations. There was no history of ocular aches, headaches, or tearing at the first visit. She gave a history of reading with poor lighting. She was not a known spectacle wearer neither was she on any ocular or systemic medication. On examination, unaided distant visual acuity was 6/5 in both eyes while near visual acuity was N10 at 33cm. Her NPA at 10cm, was normal for her age, but NPC was 12 cm, showing poor convergence. There was mild exophoria at near. She had essentially normal anterior and posterior segment findings.

Fusional amplitude (FA) range assessments were carried out. Her fusional convergence was 16^{Δ} BO for near and 2^{Δ} BO for distance (reduced; normal is 25^{Δ} near and $15\text{-}20^{\Delta}$ for distance); fusional divergence was 6^{Δ} BI for near and 8^{Δ} BI for distance (reduced for near; normal is 12^{Δ} for near and $6\text{-}10^{\Delta}$ for distance).

Dry refraction at this visit was plano in both eyes. A diagnosis of probable convergence insufficiency was made, and she was commenced on pencil pushups exercises. At a follow-up visit 6 weeks later, she reported initial improvement with pencil push-up exercise but noticed recurrent blurry distant and near vision with associated frontal headaches. Distant visual acuity at this visit was $6/12^{+1}$RE and $6/9^{-1}$LE. A repeat dry refraction revealed: -4.00DS/-0.50DC axis 10^0 RE and -2.50DS/-0.75DC axis 165^0 LE with improvement to 6/9 and 6/6 on the right and left, respectively. She was then scheduled for a cycloplegic refraction after twice-daily instillation of 1% Atropine for three days. The net cycloplegic refraction was +2.00DS/-0.50DC axis 90^0 RE and +1.50DS/-0.25DC axis 90^0 LE.

Based on these findings, an assessment of accommodative spasm was made. She was counselled regarding the diagnosis and educated on appropriate visual hygiene practices. She was scheduled for a subjective post-cycloplegic test, which was carried out 2 weeks later due to the ongoing school examinations. Her refraction was -0.75DS/-0.50DC axis 10^0 and -1.00DS/-0.50DC axis 170^0 LE with visual acuity of 6/9 and $6/9^{+3}$ in the right and left, respectively. In view of findings suggestive of pseudomyopia at this refraction, she was commenced on gutt 1% Atropine once daily for a week with bifocals (add +3.00 for near work). At both the six weeks and six months follow-up visits, her visual acuity was 6/5 in both eyes and she was more comfortable with the prescribed spectacles and reported resolution of symptoms.

DISCUSSION

Pseudomyopia refers to a refractive state in which there is a spherical equivalent (SE) of less than -0.50 diopters (D) before cycloplegia and more than -0.50D after cycloplegia.[6] The difference between the two values gives the estimate of pseudomyopia.[1] It occurs following excessive accommodation, either due to overstimulation of the ciliary muscle or spasm of the ciliary muscle. A study by Tharwart *et al.*[7] in Egypt clearly demonstrates this effect of cycloplegia on myopic values at refraction in children. In that study, they reported that 50% of preschool children were classified with mild myopia pre cycloplegia but reduced to 29% after cycloplegia. However, it is imperative to note that tenacious accommodation is uncommon as children grow older unless there are accommodative disorders.

Pseudomyopia could be as a result of several diverse risk factors, such as disorders of accommodation, including accommodative spasm or accommodative insufficiency.[8] Other known risk factors include night myopia due to dim illumination,[9] excessive near work,[10] uncorrected hyperopia/ latent hyperopia, intermittent exophoria or exotropia,[11] emotional/psychological/ mental stress, iridocyclitis-ciliary spasm, traumatic/ infectious causes (brain stem injuries, closed head trauma, ocular trauma),[12] post refractive surgeries for myopia – Laser Assisted in Situ keratomileusis (LASIK)/photokeratectomy,[13] drug induced e.g. ecothiophate, bimatoprost[14] and illicit substance use. We report three young adult female patients with pseudomyopia; risk factors identified were excessive near work, reading in dim illumination, intermittent exophoria and accommodative spasm.

The common symptoms related to pseudomyopia include nonspecific symptoms of ocular discomfort, variable presenting distant visual acuity, headaches, brow aches, diplopia, eye strain, photophobia and dizziness.[1] Some of these symptoms and signs as well as intermittent bilateral blurring of vision, were observed among all the patients in this case series.

A thorough clinical history is important in people with such symptoms, as well as detailed ophthalmic examination such as dry and cycloplegic refraction, slit lamp examination, ocular motility, and squint assessment to make a diagnosis, especially in the presence of discordance between visual acuity and refraction values. A cycloplegic refraction is key factor in making a diagnosis, because in pseudomyopia, there is a complete disparity between cycloplegic and non-cycloplegic refraction called gap refraction.[1] Patients may also manifest with variable visual acuity when assessed multiple times and variable retinoscopy reflexes, which was not observed in this case series.[15]

Poor vision hygiene and prolonged near work were common risk factors in our cases. Other risks identified were stress of preparing for examinations in one of the patients and intermittent exophoria in another patient. Although an earlier study identified psychogenic cause as the commonest factor among the cohort of patients with accommodative spasms which was corroborated from the history obtained and visual field analysis,[16] it was difficult to compare our findings with theirs as we had a small sample of cases. None of our cases had any history of use of illicit substances nor a history of head injury nor refractive surgeries.

The goal of management of pseudomyopia is to relax accommodation and eliminate the pseudomyopia.[10,17] Management options from literature reviews are observation, pharmacological treatment with the use of cycloplegics such as cyclopentolate, homatropine or atropine to relieve ciliary spasm and the prescription of plus spectacles. Optical fogging to relax accommodation has been demonstrated by some authors. Manna *et al,*[18] in a mini review encouraged the use of modified optical fogging, a non-invasive therapy to relax accommodation and this is also corroborated by Lin *et al.*[19]

In addition, uncorrected refractive errors should be corrected after cycloplegic refractions. Some patients may require plus lenses, bifocal correction with or without the addition of pharmacologic (cycloplegic) agents.[17] Other management approaches include home and office vision therapy to improve fusional vergences[20] as well as psychosocial counselling and adoption of good visual hygiene.[8] In a case study by Isiaka,[21] describing accommodation excess in a young male, multiple sessions of vision therapy was employed as the primary treatment with good outcome. According to Chhetri *et al,*[22] significant improvement and stable accommodation are evident after vision therapy.

Because most young children routinely undergo cycloplegic refraction at their initial evaluation, pseudomyopia may not be frequently diagnosed in them, although it is said to be more common in them.[5] In contrast, young adults such as those in our case series usually do not undergo cycloplegic refraction initially, and thus it is imperative to differentiate pseudomyopia from real myopia in this age group. This is particularly crucial because the prescription of spectacles based on the pseudomyopia values is actually more likely to worsen their symptoms. Devkota et al[23] in a case series of three younger Nepalese females, emphasized the

need to improve awareness of the diagnosis of pseudomyopia among clinicians and school screening professional in order to reduce misdiagnosis and encourage proper management of pseudomyopia in the school age group.

With timely identification and intervention, pseudomyopia can be reversed to the prior refractive state of emmetropia or hyperopia, however without treatment, it may progress to myopia. Therefore, pseudomyopia as an independent risk factor for myopia requires a high index of suspicion for diagnosis and treatment. In addition, in this era of personal smartphones amongst young adults, pseudomyopia may be more frequently observed in them, and it is important to provide counselling on the regulation and adoption of proper visual hygiene while using digital devices.

A limitation of this case report is that examinations were not pre-planned and not carried out by a single clinician. In addition, biometry and visual field analysis were not done for these patients to further support the diagnosis, exclude or corroborate psychogenic factor as a notable cause of pseudomyopia. Prospective large sample size studies with continuous follow up are required to corroborate management of pesudomyopia.

CONCLUSION

Our case series highlights the importance of maintaining a high index of suspicion for pseudomyopia in young adults at each clinical encounter and underscores the essential role of cycloplegic refraction in the accurate diagnosis of this condition.

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