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Management of High Myopic Anisometropic Amblyopia: Case Study

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Abstract: Anisometropic Amblyopic Myopia, characterized by significant refractive differences between the eyes, presents a challenging condition associated with vision impairment. This case study presented a 23-year-old female with Anisometropic Amblyopic Myopia, who were detailed her comprehensive nine-month management plan. The interventions included Spectacle Vision Dispensing (SVD) and Vision Therapy, combined with Spectacle Vision Correction Lenses (SVCLs) and occluder glasses. Low-dose atropine treatment was also integrated to slow myopia progression. Several parameter, including visual acuity, refraction, prescribed glasses, contact lenses, occluder glasses, keratometry, contrast sensitivity, stereo acuity, axial length, and intraocular pressure were assessed. The treatment regimen offered substantial improvements in visual acuity, contrast sensitivity, and stereo acuity, along with changes in refractive status and other ophthalmic parameters. This case highlights the potential for successful management of Anisometropic Amblyopic Myopia and high myopia through a multifaceted approach, offering valuable insights for evidence-based strategies in reducing high myopia prevalence and associated vision impairment.

Key points: Amblyopic Myopia, Visual acuity, Spectacle Vision Dispensing, Spectacle Vision Correction Lenses, Vision Therapy.

1. Introduction

Anisometropic Amblyopic Myopia is characterized by a unilateral visual impairment in which significant nearsightedness or farsightedness, as well as significant astigmatism, are present in only one eye, leading to a refractive imbalance between the patient's eyes [1]. This condition is a known cause of Amblyopia in children and young- to middle-aged adults [2, 3]. Numerous research studies have investigated Anisometropic amblyopia, examining the types of refractive errors, the incidence rates, factors that influence it, and potential treatment options [4-7]. Various approaches for treating Anisometropic amblyopia have been proposed [8]. The objective of this study to assess the available evidence concerning strategies for aniso-amblyopia and high myopia and to pinpoint knowledge gaps that require immediate attention. This will serve as a foundation for evidence-based strategies aimed at reducing the prevalence of high myopia and the vision impairment associated with it.

2. Case Presentation

A 23-year-old female presented for the treatment of Anisometropic Amblyopic Myopia. She reported experiencing blurred and distorted vision, impaired depth perception, and difficulty in coordinating her eyes. A noticeable observation was a droopy eyelid in her amblyopic eye. Her family history revealed a parental history of high myopia and the presence of Anisometropic

amblyopia in her sister, who also had nearsightedness in one eye. The initial examination of this patient took place, revealing her visual acuity (V.A) measurements as follows: OD (Right Eye) - 6/12 and OS (Left Eye) - CF3m. She was prescribed corrective lenses [OD: -0.75, -0.5 *175 (6/6)] and [OS: -4.00, -0.75 *165 (6/9P+3)], which she continued to use until her first management visit.

3. Case Management

The management of this case extended over a duration of 9 months, involving five crucial visits. To ensure a comprehensive and organized approach, a specialized report template was created for each visit to systematically collect relevant data and measurements (**Table 1**).

The management strategies employed for this case were multifaceted, covering a range of interventions. These included the utilization of Spectacle Vision Dispensing (SVD) in conjunction with Vision Therapy, incorporating elements of Convergence and Stereopsis (C.S. + 3D). Additionally, Spectacle Vision Correction Lenses (SVCLs) were introduced in tandem with Vision Therapy (C.S + 3D). Moreover, the treatment regimen included a structured plan that detailed specific activities over designated hours. This plan involved the consistent use of prescribed glasses (P. G) and contact lenses (P. CLs). Additionally, occluder glasses (OCC.G) were incorporated to aid in the vision therapy designed to address the patient's amblyopia. Vision therapy sessions were a vital component, focusing on activities aimed at enhancing eye coordination, convergence, and stereopsis. The patient meticulously allocated time to each therapeutic aspect: three hours for prescribed glasses, six hours for contact lenses, four hours for occluder glasses, two hours dedicated to vision therapy involving electronic games and exercises, and one hour for vision therapy with conventional games and exercises. This structured approach ensured a comprehensive and systematic implementation of the therapy plan, optimizing the patient's treatment outcomes. Cyclopentolate eye drops were administered to conduct cyclo-refraction, a diagnostic procedure used to assess the eye's refractive error and obtain accurate measurements. In an effort to manage the progression of myopia, low-dose atropine treatment at 0.01% was also integrated into the plan. This treatment was administered twice during the management period, each time for a week, with the aim of slowing the progression of myopia and optimizing the patient's visual outcomes.

4. Results

The results from various assessments and measurements over the course of the patient's management are as follows:

4.1. Visual Acuity

At the first visit, the patient exhibited a UCVA (uncorrected visual acuity) of 1.00 for the right eye (OD) and +1.30 for the left eye (OS). The BCVA (best-corrected visual acuity) was 0.20 for OD and 0.30 for OS. By second visit, UCVA remained the same, but BCVA improved to 0.20 for both eyes. On third visit, there was further improvement in UCVA for OD, reaching 0.60, and BCVA remained at 0.20. For OS, UCVA was +1.20, and BCVA had two levels: 0.20 with high contrast sensitivity (C.S) and 0.30 with low C.S. Subsequent assessments on fourth and fifth visit revealed significant improvement in visual acuity. For OD, UCVA reached 0.60, with a BCVA of 0.00. For OS, UCVA was 1.00, with a BCVA of 0.00 (**Table 1**).

4.2. Refraction

Refraction measurements remained consistent throughout the assessment period. The right eye (OD) exhibited -4.50 diopters with astigmatism at -1.00 *180 for auto refraction, dry refraction, and cyclo-refraction. The left eye (OS) presented with -12.50 diopters and astigmatism at -1.50 *165 for these refraction methods (**Table 2**).

4.3. P.G (Prescribed Glasses)

The prescribed glasses for both eyes remained constant, with a prescription of -4.00 diopters with astigmatism at -0.50 *180 for OD and -6.00 diopters with astigmatism at -1.00 *165 for OS (**Table 3**).

4.4. P. CLs (Prescribed Contact Lenses)

The prescribed contact lenses for OD were -4.00 diopters, while for OS, they were -10.0 diopters (**Table 4**).

4.5. Occluder Glasses (OCC.G)

Occluder glasses were "PLANE" for OD and exhibited a prescription of -10.0 diopters with astigmatism at -1.0 *165 for OS (**Table 5**).

4.6. Keratometer

Keratometry measurements for both eyes remained consistent, with K1 at 41.00 and K2 at 42.00 for OD, and K1 at 41.00 and K2 at 42.25 for OS (**Table 6**).

4.7. Contrast Sensitivity and Stereo Acuity

Contrast sensitivity improved from 1.97% to 0.259% during the therapy, while stereo acuity progressed from 400 seconds to a normal 50 seconds (**Table 7**).

4.8. Axial Length Measurement

Axial length measurements showed variation, with OD measuring 23.98 mm on first visit and 24.18 mm on fourth visit. For OS, it measured 26.1mm on first visit and reached to 26.60 mm on fourth visit (**Table 8**).

4.9. Intraocular Pressure (IOP) Reading

Intraocular pressure readings indicated a decrease for both eyes (OD and OS) over the assessment period. On first visit, OD had an IOP of 13, and OS had an IOP of 20. By third visit, OD's IOP was 15, and OS's IOP remained at 20. On fourth visit, OD had an IOP of 12, and OS had an IOP of 19 (**Table 9**).

These results illustrate the dynamic changes in various ophthalmic parameters over the management period, reflecting improvements in visual acuity, refractive status, and other critical measures. The summary of the patient's follow-up results for both eyes (OS and OD) across multiple assessments demonstrate the dynamic changes in various ophthalmic parameters (**Table 10A** and **B**), indicating positive progress and successful management of the condition.

5. Discussion

Functional amblyopia is the leading cause of monocular vision impairment in children and young adults [9]. Various human factors, including age and environmental conditions, contribute to the progression of amblyopia [10]. Another significant element that affects amblyopia is whether the individual wears glasses on a full-time basis or not. This practical consideration might have a restricting impact on the condition [11].

The fundamental aspect of an effective amblyopia treatment approach involves the deliberate arrangement of the patient's surroundings to encourage the intentional utilization of their amblyopic eye for the purpose of actively seeking, identifying, and extracting relevant visual stimuli that will guide their cognitive processes and behaviors [12]. This can be accomplished by the utilization of optimal spectacle or contact lens correction [8]. Research conducted on the treatment of amblyopia provides compelling evidence regarding the efficacy of diverse therapeutic interventions, with particular attention given to occlusion therapy [13]. Research studies have also demonstrated the effectiveness and safety of utilizing atropine penalization occlusion as a means of managing myopia and amblyopia [14, 15]. In relation to the age and functional amblyopia, it has been observed that therapy interventions can lead to enhanced visual acuity among individuals in the pediatric, teen, and young adult age groups [16, 17].

The present anisometropic amblyopic case illustrates the type of amblyopia that can be managed appropriately by prescribing appropriate glasses or contact lenses as well as using electronic training exercises/games to improve the VA, C.S, and stereopsis during the occlusion therapy. This

demand a wide range of visual skills that will promote and develop better visual functions, activities might be aimed at a particular monocular skill deficit. Amblyopia is not only a VA issue; Saccadic movements, pursuits, accommodation, spatial perception, and contrast sensitivity may all be impaired in monocular vision [18-20]. The length of time for the entire course of occlusion therapy is the last factor to be considered in amblyopia treatment. A sudden and total cessation of occlusion might cause regression once the amblyopia has received the best possible care and there are no more improvements feasible [8]. Regression can be avoided by establishing a timetable to reduce occlusion hours gradually, by starting two hours per day for a month; if there is no regression, reducing it to one hour per day for a month; and finally, with the continue training exercises while occluded, stop all occlusion, followed by careful examination of binocularity and refraction, if regression occurs.

In this case study, therapeutic management for amblyopia has improved visual capabilities, which was manifested in follow-up examinations. Therefore, it is useful to have a variety of visual function measurements so that treatment plans can be appropriately changed as required and develop a specific daily routine for each case based on the type of functional amblyopia, refractive errors, age, and lifestyle. The overall results indicate improvements in visual acuity, stereo acuity and contrast sensitivity that showed remarkable progress and justify continuing this approach for the management of this condition.

Conclusion

In conclusion the multifaceted approach, including SVD, vision therapy, SVCL, occluder glasses, and low-dose atropine, demonstrates promise in managing high myopia and amblyopia with significant improvement in visual acuity, refractive imbalance, myopia progression, and contrast sensitivity and stereo acuity. This study emphasizes the importance of early, tailored interventions and contributes to evidence-based strategies for reducing high myopia prevalence and vision impairment.

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Table 1: Visual Acuity assessment

Visit	Eye	UCVA	V.A.P.H.	BCVA
1st	OD	1.00	0.10	0.20
	OS	+1.30	0.50	0.30
2nd	OD	1.00	0.00	0.20
	OS	+1.20	0.30	0.30 high C.S 0.40 low C.S
3rd	OD	0.60	0.00	0.20
	OS	+1.20	0.40	0.20 high C.S 0.30 low C.S
4th	OD	0.60	0.00	0.00
	OS	+1.10	0.00	0.00
5th	OD	0.60	0.00	0.00
	OS	1.00	0.00	0.00

Table 2: Refraction

Visit	Eye	AUTO REF.	DRY REF.	CYCLO. REF.
1st	OD	-4.50 / -1.0 *180	-4.50 / -1.00 *180	-5.00 / -1.00 *180
	OS	-12.50 /-1.50 *165	-11.0 / -1.00 *180	-12.0 / -1.50 *180
2nd	OD	-4.50 / -1.0 *180	-4.50 / -1.00 *180	
	OS	-12.50 /-1.50 *165	-11.0 / -1.00 *180	
3rd	OD	-4.50 / -1.0 *180	-4.50 / -1.00 *180	
	OS	-12.50 /-1.50 *165	-11.0 / -1.00 *180	
4th	OD	-5.00 / -1.0 *175	-5.00 / -1.00 *180	
	OS	-12.50 /-2.00 *170	-11.0 / -1.50 *180	
5th	OD	-5.00 / -1.0 *175	-5.00 / -1.00 *180	-5.50/-1.00*180
	OS	-12.0 /-1.75 *165	-11.0 / -1.50 *180	-12.50/-15.0*180

Table 3: P.G (Prescribed Glasses)

Visit	Eye	P.G	VA/log mar
1st	OD	-4.00 / -0.50 *180	0.20
	OS	-6.00 / -1.00 *165	0.80
2nd	OD	-4.00 / -0.50 *180	0.20
	OS	-6.00 / -1.00 *165	0.80
3rd	OD	-4.00 / -0.50 *180	0.20
	OS	-6.00 / -1.00 *165	0.70
4th	OD	-4.50 / -0.50 *175	0.00
	OS	-6.50 / -1.50 *165	0.60
5th	OD	-4.50 / -0.50 *175	0.00
	OS	-6.50 / -1.50 *165	0.60

Table 4: CLs (Prescribed Contact Lenses)

Visit	Eye	P.CLs	V.A
1st	OD	-4.00	0.10
	OS	-10.0	0.40
2nd	OD	-4.00	0.00
	OS	-10.0	0.30
3rd	OD	-4.00	0.00
	OS	-10.0	0.30
4th	OD	-4.50	0.00
	OS	-11.0	0.00
5th	OD	-4.50	0.00
	OS	-11.0	0.00

Table 5: Occluder Glasses (OCC.G)

Visit	Eye	OCC.G.
1st	OD	PLANE
	OS	-10.0 / -1.0 *165
2nd	OD	PLANE
	OS	-10.0 / -1.0 *165
3rd	OD	PLANE
	OS	-10.0 / -1.0 *165
4th	OD	PLANE
	OS	-11.0 / -1.5 *165
5th	OD	PLANE
	OS	-11.0 / -1.5*165

Table 6: Keratometer

Visit	K	Eye	
1st	K1	41.00	41.00
	K2	42.00	42.25
2nd	K1	41.00	41.00
	K2	42.00	42.25
3rd	K1	41.00	41.00
	K2	42.25	42.50
4th	K1	41.00	41.00
	K2	42.25	42.50
5th	K1	41.25	41.50
	K2	42.50	42.50

Table 7: Contrast Sensitivity and Stereo Acuity

Visit	Contrast sensitivity	Stereo acuity
1st	1.97%	400 sec
2nd	1.87%	140 sec
3rd	1.08%	100 sec
4th	0.689%	50 sec (normal)
5th	0.259%	50 sec (normal)

Table 8: Axial Length Measurement

Visit	Eye	
1st	23.98mm	26.1mm
2nd		
3rd		
4th	24.18mm	26.60
5th		

Table 9: Intraocular Pressure (IOP) Reading

Visit	Eye	
1st	13	20
2nd		
3rd	15	20
4th		
5th	12	19

Table 10 A: The summary of the patient's follow-up results for both eyes (OS) across multiple assessments.

Case Follow-up (OS)	Follow-up1	Follow-up2	Follow-up3	Follow-up4	Follow-up5
UCVA	1.30	1.20	1.20	1.10	1.00
BCVA.PG	0.80	0.80	0.70	0.60	0.60
BCVA.PCLS	0.40	0.40	0.30	0.00	0.00
AUTO.REF	-12.50 /-1.50 *165	-12.50 /-1.50 *165	-12.50 /-1.50 *165	-12.50 /-2.00 *170	-12.50 /-1.50 *165
DRY.REF	-11.0 / -1.00 *180	-11.0 / -1.00 *180	-11.0 / -1.00 *180	-11.0 / -1.50 *180	-11.0 / -1.50 *180
CYCLO.REF	-12.0 / -1.50 *180				-12.50/-1.50*180
P. G	-6.00 / -1.00 *165	-6.00 / -1.00 *165	-6.00 / -1.00 *165	-6.50 / -1.50 *165	-6.50 / -1.50 *165
P.CLS	-10.00	-10.00	-10.00	-11.00	-11.00
P.OCC.	-10.0 / -1.0 *165	-10.0 / -1.0 *165	-10.0 / -1.0 *165	-11.0 / -1.50 *165	-11.0 / -1.50 *165
KREADINGS	K1:41.00 K2:42.25	K1:41.00 K2:42.25	K1:41.00 K2:42.50	K1:41.00 K2:42.50	K1:41.50 K2: 42.50
C.S	1.97%	1.87%	1.08%	0.689%	0.259%
STEREO	400	140	100	50	50
AXL	26.1			26.6	
IOP	20		20		19

Table 10 B: The summary of the patient's follow-up results for both eyes (OD) across multiple assessments.

Case Follow-up (OD)	Follow-up1	Follow-up2	Follow-up3	Follow-up4	Follow-up5
UCVA	1.00	1.00	0.60	0.60	0.60
BCVA.PG	0.20	0.20	0.00	0.00	0.00
BCVA.PCLS	0.10	0.00	0.00	0.00	0.00
AUTO.REF	-4.50 / -1.0 *180	-4.50 / -1.0 *180	-4.50 / -1.0 *180	-5.00 / -1.0 *175	-5.00 / -1.0 *175
DRY.REF	-4.50 / -1.00 *180	-4.50 / -1.00 *180	-4.50 / -1.00 *180	-5.00 / -1.00 *180	-5.00 / -1.00 *180
CYCLO.REF	-5.00 / -1.00 *180				-5.50 / -1.00 *180
P.G	-4.00 / -0.50 *180	-4.00 / -0.50 *180	-4.00 / -0.50 *180	-4.50 /-0.50 *175	-4.50 /-0.50 *175
P.CLS	-4.00	-4.00	-4.00	-4.50	-4.50
KREADINGS	K1: 41.00 K2: 42.00	K1:41.00 K2:42.00	K1:41.00 K2:42.25	K1:41.00 K2:42.25	K1: 41.25 K2: 42.50
C.S	1.97%	1.87%	1.08%	0.689%	0.259%
STEREO	400	140	100	50	50
AXL	23.98			24.18	
IOP	13		15		12