TREATMENT OF AN ANISEIKONIC/NEARPOINT SYMPTOMATIC PATIENT WITH PROGRESSIVE ADDITION LENSES

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ABSTRACT

This case report describes the presentation, diagnosis and treatment of a young female graduate student suffering from axial length-induced anisometropic aniseikonia with unequal accommodative response and a nearpoint esophoria. The design and use of a progressive addition spectacle lens for the treatment of symptoms is discussed.

KEY WORDS

aniseikonia, anisometropia, progressive addition lenses, refractive error

This case illustrates how progressive addition lenses can be used to alleviate the symptoms of a non-presbyope with aniseikonia and a nearpoint esophoria. Aniseikonia is a refractive condition of unequal image sizes between the two eyes. Attempts to fuse two differently sized images can cause asthenopia, headaches, photophobia, nausea and diplopia.[1] Image size differences as low as 1.0% have been reported to produce clinically significant symptoms and differences greater than 5.0% can make binocular vision impossible.[2] Aniseikonia is not uncommon in the population but is difficult to diagnose clinically. This case report will review the findings for an anisometropic-aniseikonic patient with nearpoint esophoria and the steps taken to compensate for the refractive conditions.

SUBJECTIVE

A 23-year-old female graduate student presented with complaints of asthenopia, headaches, blur and occasional diplopia after prolonged near work. These symptoms were reported as being more severe while wearing rigid contact lenses as opposed to her spectacle lenses. The problems were first noticed by the patient after she had begun her first year of graduate studies. She further reported that she sometimes had eliminated the diplopia at near by covering one eye with her hand or by utilizing a head turn to obtain nasal occlusion of one eye. She possessed no systemic health problems and had been a contact lens wearer for several years. The patient stated that previous attempts by another practitioner to modify contact lens parameters so as to relieve her visual symptoms had failed.

OBJECTIVE

The patient had been wearing rigid gas permeable contact lenses with diameters of 9.7 mm OU, base curves of OD: 7.70 mm, OS: 7.60 mm, and powers of OD: -6.25, OS: -2.50. Examination of the patient's contact lenses revealed very good fitting characteristics with an over refraction of 0.25 D of astigmatism. The habitual spectacle prescription worn was OD: -6.75 -0.25 X 90 and OS: -3.00 D sphere. The binocular subjective refraction revealed OD: -7.00 -0.50 X 75 and OS: -3.25 D sphere. These lenses resulted in best visual acuity of 20/15 OD, OS, and OU. Keratometric findings were: OD: 44.12 @ 180, 44.37 @ 090, and OS: 44.50 @ 180, 45.37 @ 090. The results of the phorometric binocular testing are presented in Table 1. All testing was done through the binocular subjective as indicated above.

Dynamic streak retinoscopy at 50 cm showed neutrality of the reflex with +0.75 D sph OD and +1.00 D sph OS over the habitual contact lenses. When the net unequal add prescription was placed in a trial frame, the patient reported increased comfort as compared to adds of +0.75 D sph OU and +1.00 D sph OU. The unequal add was given to the patient in a spectacle form for use over the habitual contact lenses. This prescription was dispensed in a loaner frame to be used at near for one week. The patient then again reported continued discomfort at near when she wore this lens combination. Because of these

Phorometric Test	Result
Lateral phoria at distance	0
Induced lateral phoria at distance	2 p.d. esophoria
Base out fusional range test at distance (Blur/Break/Recovery in p.d.)	24 / 40 / 18
Base in fusional range testing at distance (Break/Recovery in p.d.)	12 / 5
Vertical phorias at far / near	0 / 0
Induced lateral phoria at 40 cm	6 p.d. esophoria
Fused cross-cylinder accommodative response test (Net over subjective)	OD: + 0.75 D OD OS: + 0.75 D OS
Unfused cross-cylinder accommodative response test (Net over subjective)	OD: + 0.75 D OD OS: + 1.00 D OS
Base out fusional range testing at 40 cm	30 / 36 / 24
Base in fusional range testing at 40 cm	10 / 18 / 7

Similar findings were elicited through the habitual contact lenses when tested through the phoropter.

Table 1. Phorometric Binocular Testing Results

unrelieved symptoms, the patient was tested for evidence of anisometropic aniseikonia. A previous A-scan ultrasound recording yielded axial lengths of 25.64 mm OD and 24.17 mm OS. The Space Eikonometer was utilized to measure image size differences with habitual contact lenses and spectacles. With spectacle lenses, the overall magnification of the left eye over the right eye was determined to be only 0.50%. However, with habitual contact lenses in place, a 2.0% overall magnification of the left eye over the right eye was elicited from the eikonometer. A 4 p.d. BU OD vertical phoria in the reading position was measured using a Maddox rod through trial frame testing of the distance subjective formula.

ASSESSMENT - DISCUSSION

This patient is an excellent example of how several visual conditions (i.e. a nearpoint esophoria, unequal accommodation and aniseikonia) can complicate the solution to seemingly simple vision problems. Graphical phoria analysis showed a convergence excess which failed Percival's criterion at near. This criterion states that the demand point or the point in the zone of clear, single, binocular vision where orthophoria is obtained should fall within the middle third in order to pass.[3] The ideal add calculated by this criterion is +0.50 D sphere. The unfused cross-cylinder test and dynamic retinoscopy both revealed an unequal accommodative response. The spherical equivalents of the patient's refractive error showed 4.00 D of anisometropia between the two eyes. Different accommodative stimuli can occur when anisometropia is 4.00 D or greater as demonstrated by ocular accommodation calculations in the literature.[4] Compensating only for the convergence excess and aniso-accommodative response was unsuccessful.

A-scan ultrasound elicited an axial length difference of 1.47 mm. Keratometry findings showed the OS cornea to be steeper by only 0.37 D. These findings indicated that the primary cause of the anisometropia was the unequal axial lengths between the two eyes. Space eikonometry yielded a clinically insignificant 0.50% left overall magnification with spectacles. A 2.0% left overall magnification was found while wearing contact lenses. These findings seem to follow Knapp's law, which states that when axial anisometropia exists, the spectacle plane correction (when coincident with the eye's anterior focal plane) will produce no relative spectacle magnification.[5] It should be noted however that this theory has not been found to hold true in many cases.[6] Clinically, some form of eikonometry should always be performed on aniseikonia suspects to obtain a direct measurement of the image size difference. Measurement of vertical imbalance through clinical techniques is usually reported to be more accurate than utilization of methods of calculation.[6]

PLAN

A 2.0% overall size magnification trial lens was ordered and delivered. This lens was then mounted in the right eye well in the loaner frame with the unequal add for a second trial period of wearing over the contact lenses. The patient reported a positive response to this lens with relief from all previous symptoms.

The convergence excess posture, as well as the student's requirements for frequent near-far-near fixations in the classroom, indicated a need for a multifocal lens design. Since the patient was primarily a contact lens wearer and was concerned about the cosmetic appearance of a bifocal line at her age, it was decided to utilize a progressive multifocal lens with plano distance power for indoor wear to be worn over the patient's contact lenses. Because a plano distance power was being utilized, the power factors (i.e., vertex power, vertex distance) of a lens could not be manipulated in designing an iseikonic lens. The shape factors (i.e., base curve and lens thickness) could be varied so as to design a 2.0% overall size magnification lens. The shape factor nomograms for iseikonic lenses were consulted to design the shape parameters.[7] The Varilux Infinity lens comes in base curves of 2.00, 4.00, 6.00 and 8.00 Diopters. From the nomograms, a plastic lens of 2.00 D base curve with a lens thickness of 1.8 mm would generate a magnification of 0.2% over the left eye. A lens of 8.00 D base curve with a thickness of 4.0 mm would generate a magnification of 2.2% over the right eye, minimizing the aniseikonia of the combined left eye and left spectacle lens. The add was set at OD: +0.75 D and OS: +1.00 D to relieve the accommodative imbalance and esophoria. I was assured by my laboratory that the lenses could be made to the above specifications. Monocular P.D.'s and measurements of height to the center of the pupils were taken in the frame selected by the patient. The frame and lenses were ordered and the parameters verified before being dispensed.

After the patient was educated in the use and adaptation to the lenses, the spectacles were dispensed. Time was taken to explain the areas of the lenses to use for reading and distance tasks and the areas where some mild lens distortions could occur. The patient reported that the In-

finity lenses worked exceptionally well and that her nearwork performance and efficiency increased greatly while wearing her new overspectacles. She also reported a slight change in depth perception which was easily adaptable and not persistent during wear. A second backup prescription was ordered for use while not wearing contact lenses. The distance subjective was prescribed with 4 p.d. slab-off prism in the right eye to neutralize the vertical imbalance induced at near through the non-eikonomic lenses. No add was prescribed because of the expected low frequency of use in the evenings for long term near work.

CONCLUSIONS

This case serves as an example to clinicians that subjective complaints and performance deficits may be of multifactorial etiology. Axial anisometropia, aniseikonia, accommodative imbalance and convergence excess all worked to generate the nearpoint problems of this patient. Her desire to continue contact lens wear with a working spectacle overcorrection for classroom and nearwork proved to be an interesting clinical challenge. Progressive addition lenses were the treatment of choice in the selection of lenses for this patient's unique visual requirements. The base curve range, the incremental near addition, power availability and thickness capabilities of the Varilux Infinity lens was the most varied of all progressive lenses surveyed for the needs of the patient. Creative manipulation of lens parameters designed a lens which functioned successfully. The primary care optometrist should be able to detect, diagnose and prescribe for all of the patient's needs with the clinical skills, technology and materials available. In order to deliver comfortable and optimal visual function for patients with simple or difficult vision problems, the optometrist should have a good working knowledge of available lens materials, designs and parameters.

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SOURCE LIST

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