BOHR International Journal of Current Research
in Optometry and Ophthalmology
2023, Vol. 2, No. 1, pp. 39–42
DOI: 10.54646/bijcroo.2023.32
www.bohrpub.com

CASE REPORT

A case of fusional vergence disorder associated with myopia

Vishal Biswas* **and Roshni Majumder**

Department of Optometry, School of Allied Health Sciences, Noida International University, Uttar Pradesh, India

***Correspondence:**
Vishal Biswas,
vishalbiswas45@gmail.com

Received: 02 August 2023; **Accepted:** 22 August 2023; **Published:** 20 September 2023

Aim: This case study demonstrates the management options for fusional vergence dysfunction (FVD) and uncorrected myopia.
Background: Binocular vision disorder with abnormalities in fusional vergence dynamics is referred to as "fusional vergence dysfunction (FVD)." A patient with FVD has asthenopic symptoms, no refractive error, healthy eyes, normal accommodative functions, a normal accommodative convergence/accommodation ratio, and normal distant and near phoria status.
Case presentation: A 19-year-old female diagnosed to have FVD along with simple myopia presented to the clinic with a complaint of asthenopic symptoms. Complete vergence-related and accommodation-related vision therapies were advised and provided. After 2 months from the initial presentation, the patient successfully recovered from the existing condition.
Conclusion: Uncorrected myopia with FVD was determined based on the patient's complaint and the results of the examination. The condition was treated with vision therapy and a distance optical correction. An office-based and home-based program can successfully cure FVD.

Keywords: fusional vergence disorder, myopia, binocular vision, accommodation, vergence

Introduction

One of the binocular vision (BV) disorders is fusional vergence dysfunction (FVD), which has no known etiology (1). The accommodative function is intact and distant, near heterophorias are within normal ranges, and the accommodative convergence/accommodation (AC/A) ratio is normal; however, fusional vergence results are hindered in both positive and negative directions (2, 3). In the previous literature, this binocular condition has also been referred to as sensory fusion insufficiency and inefficient BV (4, 5). FVD is frequently accompanied by a variety of symptoms, frequently while reading or engaging in other prolonged near tasks (6). In order to prevent these symptoms, some FVD patients avoid near-visual activities like reading; this may interfere with the patients' ability to perform well in school, on the field, and in the workplace, which lowers their quality of life (7). Therefore, diagnosing and treating this disease effectively are crucial challenges in optometric practice (3). Compared to other BV abnormalities, FVD has gotten less attention, and the literature is sparse on its many characteristics (8). FVD is a crucial but lesser known diagnostic category that clinicians may easily overlook or ignore, which may lead to inadequate or improper care of this condition (3).

Case report

A 19-year-old female, previously diagnosed with simple myopia, visited the clinic with a complaint of difficulty in concentrating while doing near work along with headache and eye strain. These occurred after the spectacle correction, which was given previously as per the patient for months. Other ocular, systemic, and birth histories were within the normal limits.

On a comprehensive eye examination, the aided visual acuity was 20/20 with the LogMAR acuity chart for distance and N6 at 40 cm with a near English reading chart for

both eyes (BE); the objective refraction after cycloplegic drop administration was −1.75 Ds BE. After the deducting tonus allowance, the refractive value was 1.00 Ds. Cyclopentolate hydrochloride USP 1% eye drops were used for cycloplegic refraction. The subjective refraction was −0.75 Ds BE. Slit-lamp examination showed no abnormality in the anterior eye, and the posterior examination showed no signs of abnormality as well.

The patient was asked to visit a week later for the BV examination. The BV parameters showed a normal AC/A ratio, a normal amplitude facility, and accommodative response found during accommodating testing. NRA and PRA were both low, but considering that the accommodative function was normal, these data indicated that fusional vergence was an issue. On direct assessments and indirect testing of fusional vergence, both PFV and NFV results were decreased. Results with low NRA and PRA and decreased BAF revealed fusional vergence issues (shown in **Appendix Table 1**). The results from the tests were compared with the expected values shown in the optometric extension program (9). We diagnosed this patient with FVD.

Management plan

As per available literature studies, in FVD, the vergence parameters are majorly affected as compared to the accommodative parameters. Hence, treating the vergence parameters becomes the primary goal, although treating the accommodation level can help with the process of building the experience of seeing near and distant as well as of converging and diverging as accommodation is the indirect measure of vergence and accommodating training approaches are frequently helpful during the early phase of therapy (3).

The first goal was to prescribe the optimum optical correction of the ametropia, followed by vergence and accommodative therapy (3). All the treatment modalities were given as per the AOA guidelines (2).

Vision therapy

A total number of 32 office vision therapies were given, which lasted for 2 months; the patient also continued home vision therapies. The therapy modalities are shown in **Appendix Tables 2**, **3** in a summarized manner.

For treating vergence parameters

Brock string was used initially, followed by Tranaglyphs for both divergence and convergence; an aperture ruler was used for both divergence and convergence and to increase the difficulty level; and a barrel card was used along with bug on the brock string phenomenon to treat for the convergence level. Opaque and Transparent Life saver cards were also administered during the process of vergence therapy for treating both divergence and convergence (2, 3).

For treating the accommodation parameters

Lens sorting (with lenses ±2.00 DS to ±10.00 DS) was used for voluntary relaxing and stimulating the accommodation, followed by loose lens rock, and to treat for the poor facility, accommodative flippers of (±1.00 to ±10.00 DS) were used along with Word Rock Chart of N8 sized optotypes (2, 3).

Discussion

The initial parameters showed phoria within the normal range for distance, and for near, slight exo was noted. The AC/A ratio was within the normal limits. The vergence parameters such as NFV, PFV for distance and near, and vergence facility were reduced. Indirect measures included accommodative parameters such as NRA, PRA, and BAF, which showed reduced values. All these made a conclusive diagnosis of FVD (10). All the values are shown in **Appendix Table 1**. Accommodative infacility is a disorder that may be mistaken with FVD. The main differentiating factor is that all monocular accommodative testing is normal in FVD.

A proper way of management and well-planned vision therapy sessions can reduce symptoms which are faced by an individual with FVD. But before all these therapies, one should consider the first line of management, that is, correction of the ametropia if present. In our case, a significant amount of ametropia was present; hence, we corrected it first, and then we started the base line therapies. However, as per literature, association of refractive error is not found majorly with FVD (3, 11). In our view, this is probably the first case which highlights the fact that refractive error can be associated with FVDs. The anticipated number of sessions will vary from one patient to another for the vision therapy (3). However, the main goal is to resolve the condition which an individual experiences with FVD.

Conclusion

Based on the patient's complaint and the examination findings, it was established that the patient had uncorrected myopia with FVD. A distance optical correction and vision treatment were used to address this problem. FVD can be successfully treated using a home- and office-based program. Surgery is ineffective for treating FVDs; hence,

vision treatment is still essential. FVD is a rare kind of non-strabismic BV impairment, making it crucial for clinicians to detect and treat it.

Author contributions

Both authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

Acknowledgments

We would like to thank the patient who allowed to present the data for this case report.

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Appendix

APPENDIX TABLE 1 | Pre-BV versus post-BV parameters.

Tests	Pre-vision therapy	Post-vision therapy
Visual acuity	RE 20/40, N6 at 40 cm: LE 20/40, N6 at 40 cm	RE 20/20, N6 at 40 cm: LE 20/20, N6 at 40 cm
Refractive error	RE: −0.75 DS, LE: −0.75 DS DS	RE: −0.75 DS, LE: −0.75DS DS
Stereopsis	80 s/arc	40 s/arc
WFDT	Fusion present for distance and near	Fusion present for distance and near
EOM	Full free and painless	Full free and painless
IPD (mm)	60 mm	
AC/A (Calculated method)	4.4:1	5.2:1
Covert Test	D: Ortho N: 4 PD Exo	D: Ortho N: 2 PD Exo
AOA	RE: 10D LE: 10D BE: 10D	RE: 12D LE: 12D BE: 10D
NRA	+1.25D	+2.75D
PRA	−1.505D	−2.25D
MEM	RE: +0.25D LE: +0.25D	RE: +0.50D LE: +0.50D
MAF and BAF	RE: 9 cpm LE: 9.5 cpm and 3 cpm	RE: 11 cpm LE: 11cpm and 10 cpm
NPC with pen light	6 cm	6 cm
NFV	D: x/4/2 N: 6/8/4	D: x/8/6 N: 10/20/12
PFV	D: 4/8/4 N: 8/10/4	D: 10/18/12 N: 16/24/12
VF	2 cpm fails with ± flippers	12 cpm

EOM, extra-ocular muscle; AOA, amplitude of accommodation; NRA, negative relative accommodation; PRA, positive relative accommodation; MEM, monocular estimation method; MAF&BAF, monocular and binocular accommodative facility; NPC, near point of convergence; NFV, negative fusional vergence; PFV, positive fusional vergence; VF vergence facility; RE, right eye; LE, left eye; BL, blur; BR, break; RC, recover.

APPENDIX TABLE 2 | Office vision therapy program.

Sessions	Parameters	Therapies
Session 1–10	Vergence	1. Brock string 2. Tranaglyphs: for convergence
	Accommodation	1. Lens sorting 2. Lose lens rock
Session 11–20	Vergence	1. Brock string 2. Tranaglyphs: for divergence and convergence
	Accommodation	1. Lens sorting 2. Accommodative flippers with word rock chart
Session 21–32	Vergence	1. Aperture ruler: for convergence and divergence 2. Life saver card: transparent and opaque 3. Barrel card
	Accommodation	1.Lens sorting 2. Lose lens rock 3. Accommodative flippers with word rock chart

APPENDIX TABLE 3 | Home vision therapy program.

Sessions	Parameters	Therapies
Session 1–10	Vergence	1. Brock string
	Accommodation	1. Lens sorting
Session 11–20	Vergence	1. Brock string 2. Life saver card: opaque
	Accommodation	1. Accommodative flippers with word rock chart
Session 21–32	Vergence	1. Life saver card: transparent and opaque 2. Barrel card 3. Brock string
	Accommodation	1. Lens sorting 2. Accommodative flippers with word rock chart