

FUSIONAL VERGENCE DYSFUNCTION

A CASE REPORT

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Abstract

Fusional vergence dysfunction is a binocular condition that is relatively easy to diagnose and treat but is often overlooked. FVD can negatively impact an individual's ability to function, particularly when performing near work. A 17-year-old white female presented to our clinic with visual symptoms associated with sustained near work. The findings were characterized by normal phorias, poor but relatively balanced vergence ranges and low positive/negative relative accommodation. A comprehensive eye/vision examination with a complete binocular vision evaluation revealed a fusional vergence dysfunction and a secondary accommodative dysfunction. The patient was successfully treated with a combination of a near vision spectacle correction and a course of optometric vision therapy.

Key Words

accommodative dysfunction, asthenopia, fusional vergence dysfunction, vergence infacility, vision therapy

INTRODUCTION

Optometrists, as primary eye/vision care providers, are charged to diagnose and treat eye and vision related problems including binocular and accommodative dysfunctions. Binocular and accommodative conditions can interfere with a child's academic and athletic performance.¹ Once diagnosed, these deficiencies can be successfully treated with lenses and/or vision therapy (VT) to enhance functional vision and increase visual comfort.² Although binocular conditions, typically characterized by high phorias at distance or near are readily recognized, the diagnosis of fusional vergence dysfunction is often overlooked.

Fusional vergence dysfunction (FVD) has been clinically defined as a condition where a patient may have a normal AC/A, phorias within expected values at distance and near but with restricted fusional vergence findings¹ and binocular instability.² Patients with FVD usually do not have a high degree of refractive error.¹ However, inaccurate ocular motilities and suppression have also been documented.²

There are often low negative relative accommodation (NRA) and positive relative accommodation (PRA) findings (these can be considered an indirect measure of fusional vergence) along with lowered accommodative and vergence facility findings.^{1,3,4} Symptoms include eyestrain, headaches after relatively short periods of near work, sleepiness, inability to concentrate, excessive tearing, blurred vision, and loss of comprehension over time. Patients often occlude one eye when reading, suppress one eye or avoid near tasks. If they have a high pain threshold, patients may also be asymptomatic.¹

The etiology of FVD is unknown and the prevalence has not been clearly defined in

the literature. Scheiman et al⁵ reported a prevalence of 0.6% in children aged 6-18 years. Porcar⁶ found a prevalence of 1.5% in a university population. Based on these reports, FVD is considerably less common than convergence insufficiency (7%) and convergence excess (5.9%-7.1%).⁷ The differential diagnosis of FVD includes: accommodative conditions (insufficiency, excessive lag, and infacility), convergence insufficiency, convergence excess, latent hyperopia, vertical or cyclodeviations, aniseikonia, systemic disease and medication.¹

The Case

A 17-year-old female presented for a vision examination. The chief complaint was discomfort with prolonged near work, blur when reading, words running together, a pulling sensation around her eyes and frontal headaches with reading. Other, less severe symptoms included losing her place while reading and words "smushing together or moving apart". She always read with a three-year-old spectacle prescription of +1.50 sph. OU. Symptoms began several months earlier and were relieved only by discontinuing near work and resting. Her medical and ocular histories were unremarkable. Color vision was normal (14/14- Ishihara). Pupil testing and confrontation fields were normal. Table 1 contains the pertinent initial vision exam data.

Analysis of the findings indicated fusional vergence dysfunction and accommodative infacility. The findings that lead to this diagnosis included: slightly high exophoria at near (but within normal limits), low positive fusional vergence (PFV) at distance and near, low negative fusional vergence (NFV) at distance and near, low NRA, low PRA and low binocular accommodative facility (BAF), reduced cycles per minute on monocular accommodative

facilities (MAF) and no lag of accommodation on MEM (possible accommodative excess). In addition to FVD, these findings also indicated a secondary diagnosis of accommodative dysfunction.

No distance Rx was issued but the patient was offered a new near vision spectacle prescription and VT. The patient was educated on the advantages and disadvantages of lenses alone and lenses in conjunction with VT. The patient chose the latter of the two options. She was given a reduced reading Rx of +0.50DS OD, +0.75DS OS, her subjective refractive measure. The patient subsequently underwent a program of combined in-office and at home VT for 14 weeks. Weekly therapy sessions were administered and consisted primarily of vergence and accommodative procedures. Similar support techniques were prescribed for home activities.

The patient's phoric posture remained relatively unchanged at distance and near throughout therapy. (Table 1.) There was significant improvement in both positive and negative fusional vergences at distance and near to normal or above normal ranges. Both monocular and binocular accommodative facilities as well as the NRA and PRA improved. As VT progressed, the patient reported a decrease in symptoms and began to discontinue use of her prescribed lenses. By the end of therapy, she reported complete resolution of symptoms and was able to enjoy reading comfortably for longer periods of time without using her spectacles.

DISCUSSION

There are several possible visual conditions that can cause similar symptoms to FVD. Moderate to severe amounts of latent hyperopia can cause symptoms that include; red or tearing eyes, asthenopia, constant or intermittent blurred vision, decreased binocularity, poor eye-hand coordination and an aversion to reading.⁸ Latent hyperopia alone was ruled out in this case as only low hyperopia was measured on both dry and wet refraction, objectively and subjectively. (Table 1.) In addition, the patient had reported that her previously prescribed lens Rx (+1.50 sph. OU) had been exacerbating her symptoms, not alleviating them.

A vertical deviation and a cyclodeviation were ruled out as well since neither manifested on either the cover test or vertical phoria test. Aniseikonia is usually the result of anisometropic spectacle correction, or pseudophakia after unilateral

Table 1.
Optometric Examination Findings

Finding	Initial Evaluation	Final Evaluation
External/Internal	No Abnormalities	NP
Distance VA	20/20 OD, OS	20/20 OD, OS
Near VA	20/25 with +1.50 OD,OS,OU	20/20 OD, OS sc
Keratometry	45.50@180/46.25@90 OD, OS	NP
Static Retinoscopy Dry	OD +0.50-0.50x180 OS +1.00	NP
Static Retinoscopy Wet	OD +0.50 OS +0.75	NP
Manifest Refraction	OD +0.50 ,OS +0.75 20/20 OU	NP
Cover Test Far/Near	Ortho/6XP	Ortho/4XP
Nearpoint Convergence	1st 15/17 cm;2nd /3rd 11/13 cm	NP
No Rx: Wirt Circles	50 arc sec	NP
Randot Stereo	250 arc sec	NP
Distance Phoria	Ortho	Ortho
Distance Pos. Fus. Verg.	6/10/4	X/35/30
Distance Neg. Fus. Verg.	6/10/2	X/13/4
Near Phoria with +1.5	6XP	4XP
Near Phoria with +2.5	7XP	NP
AC/A	1:1	NP
Binocular Cross Cyl	+1.00	NP
MEM	Plano OU	NP
Near Pos. Fus. Verg. (+1)	4/7/3	>40 no suppression
Near Neg. Fus. Verg. (+1)	5/12/6	10/18/13
Neg. Rel. Acc.	+1.50	+4.00*
Pos. Rel. Acc.	-0.50	-2.50
Acc. Fac. OD,OS, OU	4/5/1 cyc/min	24/24/12 cyc/min

sc=without correction

NP=not performed

cataract extraction.¹ Although aniseikonia was not specifically assessed, this condition would not be expected in this case. The patient had essentially symmetrical refractive measures between the eyes, and no history of cataract extraction. Likewise, the medical history ruled out systemic disease. The patient had recently undergone a physical exam with her primary care physician and was not taking any medications.

Diagnoses of convergence insufficiency (CI), pseudo CI, and convergence excess (CE) could not be made. See Table 1 for all of the following discussed findings. The patient demonstrated a low gradient accommodative convergence ratio (AC/A), a receded nearpoint of convergence (NPC), low PFV, and a potential lead of accommodation (there was no measurable lag of accommodation) with MEM retinoscopy. She had difficulty clearing

print with plus lenses on NRA and BAF and with tests involving divergence capability (NFV, PRA, minus BAF). These results were found in the presence of a normal phoria. Pseudo CI should show improvement in the NPC with plus at near. A patient with CE would have a high AC/A along with greater esophoria at near. By ruling out these conditions, the diagnosis of FVD was made.

A secondary diagnosis of accommodative dysfunction, specifically infacility, was also concluded in this case. Accommodative infacility (AI) is a condition where the patient experiences difficulty accommodating from one distance to another.¹ The patient demonstrated reduced findings on: PRV/NRV, NRA/PRA, BAF, and the Binocular Cross Cylinder Test (BCC).

VT: FVD and Accommodative Dysfunction

A reading prescription of +0.50 OD, +0.75 OS was given. In hindsight, due to the insignificant amount of anisometropia (0.25 D) between the eyes, another, more conservative approach would have been to prescribe a balanced/equal Rx of +0.50 or +0.75 OD, OS. Some near testing during the initial examination (higher NRA vs. PRA and lag on BCC) indicated that a higher amount of plus should have been considered. However, since the patient would be entering VT and the previous near prescription of +1.50 increased the symptoms, a lower prescription was issued. When managing the patient with binocular and/or accommodative dysfunction, it is of utmost importance to ensure that he or she is wearing the appropriate refractive correction.¹ It has been suggested that even small magnitude prescriptions should be considered.

Dwyer and Wick⁹ found that 67% of patients with fusional vergence dysfunction recovered to normal findings, as defined by the study, after one or more months of spectacle wear. They compared initial heterophoria, AC/A, fusional ranges, fixation disparity curve slope and/or accommodative finding to those taken at least one month after lens wear. Recovery of diagnostic findings to within normal ranges was found in 51.6% of patients. In addition, 52% of patients who initially failed an accommodative response test recovered to normal. However, the spectacle prescriptions were determined objectively with an auto refractor and the study failed to mention patient symptoms. In addition, they found that one half of patients with heterophoric binocular anomalies required further management.⁹ Press² proposed that plus lenses may be required for increased functioning in a patient diagnosed with FVD. However, one drawback to only prescribing plus lenses for near may be that although they may temporarily reduce or eliminate symptoms, they may serve as a crutch and may not resolve the binocular dysfunction completely.

In a similar vein, Birnbaum¹⁰ has proposed that a benefit of prescribing plus lenses is that they can facilitate increased integration of accommodation and vergence that then facilitates stable binocular function. VT can then be used to improve performance quality.

VT enables an individual to develop smoothness, efficiency, stability of vision, and enhances the ability to sustain attention. VT further allows a person to adjust performance to levels of high automaticity in each of the basic visual functions of ocular motility, accommodation and binocular fusion.¹⁰ VT, in addition to lenses, has become the accepted standard of care in managing patients with FVD.⁷ It is important to realize, however, that VT can only be effective if the patient is motivated and willing to invest valuable time and effort.

For over 75 years, optometric VT has been an important treatment modality for both children and adults who manifest a variety of non-strabismic accommodative and vergence disorders.¹⁰ Several studies have evaluated the efficacy of VT in eliminating symptoms and abnormal objective findings associated with binocular anomalies.¹¹⁻¹⁵ The VT implemented in this case followed a traditional protocol.

The VT we conducted for accommodative and binocular dysfunction was in accord with the American Optometric Association's Clinical Practice Guidelines for this entity.⁷ It was divided into four phases. The goal of the first phase was to normalize accommodative and vergence amplitudes. The second phase was designed to increase the speed of response to accommodative and vergence stimuli. The third phase utilized step and/or jump vergence stimuli, while the fourth phase integrated vergence and accommodation to automate both accommodative and vergence responses.

The goals were to increase the efficiency of the accommodative system to facilitate a more effective interaction between accommodation and vergence. This would serve to maximize functioning of the fusional vergence system.¹² There is evidence that this protocol is effective for binocular dysfunctions. Cooper et al¹³ performed a controlled, prospective double blind reversal study that evaluated computer based vergence treatment vs. placebo treatment for a group of patients diagnosed with convergence insufficiency. They utilized an automated Random Dot Stereopsis program that increased or decreased vergence demand based on patient response in the experimental group. The vergence demand did not change in the placebo group regardless of patient response. In addition to demonstrating a dramatic improvement in vergence ranges, the experimental group

also reported a decrease in headaches and asthenopic symptoms.

Others have demonstrated improvement in subjective Risley prism vergence ranges with VT.¹⁴ Objective vergence tracking rate in patients with vergence dysfunction also showed improvement after VT.¹⁴ Persistence of the training effect was monitored for up to nine months, with no regression in patients who met all release criteria and did not discontinue vision training when they achieved only symptomatic relief.¹⁴ Goss et al¹⁵ reviewed the records of 26 patients who had undergone VT for accommodative dysfunction and found that in addition to improved clinical test findings, 88% of patients' symptoms were either reduced or eliminated.

Lastly, convergence insufficiency, the most prevalent type of vergence dysfunction,¹¹ is the subject of numerous research projects.^{16,17} In a pilot study¹⁶ and the Convergence Insufficiency Treatment Trial Study Group, it was determined that VT was more effective than pencil pushups or placebo therapy. VT reduced symptoms and improved signs of convergence insufficiency in children 9 to 18 years of age. Another study¹⁷ also found that orthoptic exercises are an effective means of reducing symptoms in patients with convergence insufficiency and decompensating exophoria.

CONCLUSION

Fusional vergence dysfunction is a significant finding that can be easily missed by even the most astute clinician. In addition to taking a detailed patient history, it is crucial that a complete examination, including a binocular vision assessment, be performed. This testing should include vergence ranges and vergence facilities to rule in or out a diagnosis of fusional vergence dysfunction. Once properly diagnosed, it can be quickly and easily managed with a course of active VT, thereby enhancing the individual's daily function and overall quality of life.

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