Chapter 16
Pseudomyopia

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CASE HISTORY

Grant, a 10- year old white male, was diagnosed with accommodative spasm by a local optometrist and was referred for a vision therapy consultation. He went to the local optometrist with complaints of blurred vision in the distance and at near. He had also recently failed a vision screening at the pediatrician's office. Grant complained of eyestrain when reading or performing other near tasks. There were no reports of academic difficulty such as poor reading comprehension or below-average performance in particular subjects. The patient's medical history was unremarkable.

EXAMINATION

Table 1 shows the data taken at the initial examination. Slit lamp examination was performed, and anterior segment health was unremarkable. Dilated fundus examination was performed, and posterior segment was unremarkable.

DIAGNOSES

- Accommodative spasm (Pseudomyopia)
- Binocular vision dysfunction
- Shallow central suppression OS

TREATMENT

The patient was sent back to the referring optometrist's office for visual field testing that had been scheduled prior to the vision therapy consultation. The other optometrist had recommended field testing because the initial examination findings fluctuated greatly and were inconsistent. Results showed a reliable test with no solid defects in either eye.

In office optometric vision therapy (OVT) was the only treatment consideration in this case. Initial correction of ametropia was not indicated because of the variable nature of the patient's refractive error and the lack of improvement with lenses. Nearpoint testing (NRA/PRA, BI/BO vergences, near phoria) showed no acceptance of low plus lenses. Prism was not considered because the patient was unable to achieve stable motor fusion with any prism amount during the initial evaluation.

The patient and mother were educated on the need for an estimated 24 sessions of in-office OVT combined with home reinforcement activities. Weekly sessions with a duration of 45 minutes were recommended. Progress evaluations would be performed every 8 sessions.

My overall approach to therapy was to focus on improving performance at near. The main goals were to build accurate and efficient accommodation and binocularity with elimination of the shallow central suppression and subjective diplopia. It was expected that the most, if not all, of the myopic refractive error that manifested at the initial evaluation would be eliminated by the conclusion of treatment.

Therapy procedures were performed in a general sequence of monocular oculomotor and accommodative procedures were started at the beginning of therapy. The patient did not exhibit any difficulty with pursuit or saccadic ability with gross observation at the initial evaluation. However, it is my approach that eye movement must be at an equal level monocularly in order for stable binocularity to occur. Since accommodative reflexes are located at and near the fovea, stable fixation ability is crucial for accommodative accuracy. Accurate eye movements provide a foundation for the patient to achieve accurate spatial localization ability, which requires knowledge of their eye, head, and body position.

Oculomotor therapy began with procedures such as Wayne Saccadic Fixator (WSF), pegboard rotator, and Hart chart fixations. Each is performed monocularly until ability is equal between the eyes, and then the procedure is performed with both eyes together. A balance board was added to WSF as the patient's ability improved. Pegboard activities began with board stationary, and then

rotation was added as the patient gained the ability to achieve steady fixation with each eye.

Accommodative therapy was started monocularly, ensuring that each eye was able to focus at an equal level before vergence activities were introduced. The goal for patients is to develop equal ability to relax/stimulate accommodative procedures included spatial discrimination (lens sorting), monocular bull's-eye, and monocular accommodative rock. Emphasis is placed on the patient's ability to perceive spatial changes and to feel the difference in "tone" when accommodation is relaxed or stimulated.

For spatial discrimination, a series of lenses of unknown power were placed in front of the patient. He was asked to look through the lenses and determine some way to sort these lenses (it is expected that he would notice that some lenses magnified and some minified objects). Over the course of a few weeks, the power difference between the lenses was deceased to determine the just noticeable difference, or the smallest spatial change that the patient could appreciate.

Monocular bull's-eye requires the patient to shift focus from near to for and to learn to feel the change in tone between the near bull's-eye and the distance Heart chart (Appendix A). Once the patients learns to feel the change in accommodation, they can learn to control the change, allowing them to achieve higher-level procedures at later vision therapy sessions. Monocular accommodative rock is appropriate when the patient can feel the difference in stimulation and relaxation of accommodation. At this point, they will have the ability to work through difficulty often experienced with higher lens power. The patient begins with +/-1.00 D flippers and the word rock card with smallest size letters they can appreciate. The procedure is performed weekly until the patient can achieve clarity with +/-2.50 D.

Accommodation and vergence work in sync with one another, thus some binocular procedures are introduced as early as session 10. The first binocular procedure introduced to the patient was vectograms. The main goal I have for patients during this sequence is to achieve a single and clear target. The secondary goal is for the patient to be able to appreciate SILO (Smaller In, Larger Out) and to achieve accurate spatial localizations. The quoit vectogram, which is more peripheral, is used first, and then the patient work with the clown and spirangle vectograms. Initially, the patient is asked to maintain accommodation and vengeance at the plane of regard as the vectograms are slowly moved in a base-out or base-in direction. Once Grant was able to maintain smooth vergence, jump vergence was introduced. First the jumps were base out/base out and base/in base in until the patient was eventually ready to make larger jumps from base out to base in targets. The goal was to be able to make immediate, accurate shifts in vergence and accommodation. Grant had some difficulty in the beginning with the quoit vectogram figuring out how to maintain accommodation and vergence at the same place. A round sticker was placed in the center of the quoit to help him appreciate the spatial change that was occurring as the vectogram moved from low base in to low base out. The sticker, of course, remained at the plane of the vectogram holder, while the rope shifted closer or farther. He was immediately able to appreciate SILO with this set-up. Once consistent smooth vergence ranges were achieved, he was able to progress through the clown and spirangle vectograms without difficulty.

Other binocular procedures with suppression checks, such as binocular accommodative rock and Brock string, were performed in the latter part of the patient's therapy regimen. It was especially important to monitor this patient for a possible suppression response since he demonstrated a shallow central suppression at the initial examination. Binocular accommodative rock was performed over several weeks, progressing from +/-1.00 D to +/-2.50 D flippers. The red-green bar reader was placed over the rock card to ensure that the patient was not suppressing either eye. Initially he was unable to clear +/-1.00 D binocularly with a 20/30 target, so the font was increased to 20/40 size. For a few weeks, the patient worked on rapidly shifting from stimulation to relaxation, with a goal of immediate clarity when the lens was switched. Once he was able to achieve this with a 20/40 target, and he was now able to progress through all other lens power without exhibiting difficulty or suppression

Brock string was introduced and performed in-office but was also sent with the patient as a home activity. The levels of Brock string that the patient performed included make an X, moveable X, and variations of gaze. He did not exhibit difficulty with any of the levels during Brock string. Emphasis was placed on his ability to shift rapidly from closer to farther beads and to

Table 1: Examination data from the initial examination

VA Distance (without correction)	OD: $20/50^{-2}$, OS: $20/60^{+1}$
VA Near (without correction)	OD: 20/60, OS: 20/60
Pupils	PERRLA (-) APD
EOMs	Full range of motion OD/OS, smooth with no lead movement or fixation loss
Stereo	Global: 250 sec arc (Randot stereo shapes Local: 140 sec arc (Wirt Circles)
Confrontation Fields	Full to finger count OD/OS
NPC	TTN x 3
Cover Test	Ortho at distance and near
Worth Four Dot	Distance: Full illumination 2 red dots only Dim illumination 4 dots (2 red/2 green) Near: Full illumination 4 dots (2 red/ 2 green)
Retinoscopy	OD: -2.75 sphere OS: -3.00 sphere Reflexes were equal, slow, and dull at most neutral point (never showed a bright white streak)
Manifest Refraction	OD: 2.50 sphere; $20/50^{-2}$ OS: 3.00 sphere; 20/60 Patient reported subjective improvement in clarity with manifest, but no improvement in visual acuity was noted No improvement in visual acuity with pinhole OD, OS
Von Graefe Near Phoria	13 esophoria when initially tested, 9 esophoria when repeated second time Through +0.50 sphere and +1.00 OU: 11 esophoria Through -1.00 sphere: 20 esophoria
NRA/PRA	Unable to assess secondary to diplopia
BI/BO Smooth Vergences (NEAR)	Unable to assess secondary to diplopia, patient reported intermittent ability to fuse targets with variable amounts of prism

Table 2: Examination data from the progress evaluations performed throughout the course of vision therapy

Visit	**8 week Prog Eval**	**16 week Prog Eval**	**24 week Prog Eval**
Uncorrected VA OD/OS at distance and near	20/20 20/20	20/20 20/20	20/20 20/20
Retinoscopy	OD: -0.50 sph OS: -1.00 sph	OD: -0.25 sph OS: -0.25 sph	OD: +0.25 sph OS: -.25 sph
Manifest Refraction (Distance)	OD: Plano OS: Plano	OD: Plano OS: Plano	OD: Plano OS: Plano
Worth 4 Dot (Dist and Near)	2 Green 2 Red	2 Green 2 Red	2 Green 2 red
Stereovision (Wirt Circles)	30 sec arc	25 sec arc	25 sec arc
Near Phoria	2 esophoria	2 exophoria	4 exophoria
BO Vergence (Near BI Vergence (Near)	x/40/18 x/8/2	30/40/18 24/30/22	32/40/20 18/26/22
NPA/PRA	+2.50/-0.75	+3.00/-1.00	+2.00/-1.75

maintain stable vergence on the bead at which he was focused (Appendix B).

vision therapy session included Michigan tracking, dotting Os, and the pointer-in-the-straw. Near/far Hart

In the final month of therapy, Grant was able to perform vectograms and Brock string with BIM/BOP (base-in minus/ base-out plus). In this Case, we were using plus/minus lenses to create a mismatch that the patient had to resolve in order to re-establish clear, single vision. If the patient is working with a base-out vectogram and plus lenses are introduced, accommodation will begin to relax. He had to stimulate or maintain vergence at the plane of regard in order to maintain clear, single vision. The goal is to establish degrees of freedom between accommodation and vergence.

Home reinforcement activities were performed in-office before being sent home to ensure that the patient and/or parent knew how to do them correctly.

Initial activities introduced at the first chart is the main activity used for accommodation. Binocular procedures for home included ones such as Brock string and lifesaver cards. It was crucial that the patient understood the importance of regularly completing the home activities. Higher-level procedures are performed in-office, but home activities are important to help maintain progress that is gained during the weekly visit.

PROGRESS EVALUATIONS

Grant completed the recommended 24 sessions of weekly in-office optometric vision therapy with home reinforcement activities. Table 2 shows exam findings from the progress evaluations performed after 8 sessions, after 16 sessions, and the final evaluation after the 24th session.