Treatment of Intermittent Esotropia Incorporating Peripheral Awareness Training

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Abstract:

The patient with intermittent esotropia at distance can be symptomatic for diplopia, which may interfere with driving, work performance, and school achievement. The cosmesis of the strabismus may also affect the patient's self-esteem. This report describes a patient with intermittent esotropia at distance who underwent vision therapy to relieve her symptom of diplopia and cosmetic concerns. After two sessions of therapy emphasizing peripheral fusion and divergence, the patient became kinesthetically aware of the eye turn and she was able to regain single vision with minimal effort. The patient remained non-strabismic at one- and three-month follow-ups. This case illustrates that vision therapy can effectively relieve the symptoms of a patient with intermittent esotropia once the patient is able to gain active control of her visual system.

Key Words

intermittent esotropia, vision therapy, diplopia, peripheral awareness, divergence.

The patient with intermittent esotropia can experience double vision. The diplopia may affect the individual's ability to safely operate a vehicle, to perform optimally at work, and to achieve the full academic potential. The cosmesis of the eye turn can be embarrassing for patients whose lifestyle and work require extensive eye contact.

Treatment modalities for eso-deviations may include lenses,[1] prisms,[2] vision therapy,[1] and surgery.[3-6] Plus lenses may be effective in reducing the size of the deviation. Base-out prism has been reported to be successful in many cases of divergence insufficiency eso-deviations.[3,4,6] The risk of prism adaptation should always be considered, especially in patients with poor sensory fusion.[1,7] Nevertheless, Moore and co-workers[6] reported "immediate relief and comfort" in six out of 12 (50%) divergence insufficiency patients treated with base-out prisms. In the study by Prangen and Koch,[3] 24 out of 45 (53%) patients with divergence insufficiency reported "a reasonable degree of ocular comfort" after wearing base-out prisms.

The efficacy of vision therapy in treating intermittent esotropia ranged from 55% (five out of nine patients in the study by Ludlam[8]) to 100% (seven out of seven patients in the study by Etting[9]). The latter study included two patients with intermittent esotropia at distance only, which is similar to the patient of this report. The clinical profile of 25 patients with intermittent esotropia was reported by Molarte and Rosenbaum[5] as follows: average cycloplegic refraction: +2.50 DS, average size of deviation: 20 to 25 prism diopters, amblyopia: 12%, and presence of Titmus stereo: 96%. Diplopia was reported in six of these 25 patients (25%), three of whom were primarily at distance (12.5%).

Divergence ranges at distance are not easy to train. A controlled, prospective study by Griffin and co-workers[10] showed improvement of base-out but not base-in ranges at distance when three sessions of vision therapy were given to 31 asymptomatic, non-strabismus subjects using either the Cine-ortho method or a standard vision therapy regimen. On the other hand, there is good evidence that divergence at near can be improved with therapy. In a retrospective study of 83 convergence excess patients by Gallaway and Schieman,[11] vision therapy emphasizing divergence and accommodation showed a statistically significant improvement in the base-in break and recovery ranges at near. In view of these findings, techniques in addition to divergence training are likely needed for the successful treatment of the patient with intermittent esotropia at distance.

In the report, the patient was managed by a vision therapy program in addition to previously prescribed prism spectacles. Both divergence training and peripheral awareness were utilized in the therapy program. The successful use of peripheral awareness has been reported in managing diplopia in patients with post-surgical exotropia with dissociated vertical deviation,[12] hyperdeviation,[12] and

superior oblique myokymia.[13] The theoretical basis of the central-peripheral relationship had been extensively reviewed by Marrone[14] and Gallop.[15] There is very little clinical research regarding the role of peripheral awareness in maintaining fusion. An experiment by Burian[16] demonstrated that disparate vertical peripheral stimuli were capable of breaking fusion even when the subject was concentrating on targets presented centrally to each eye. Conversely, maintaining peripheral fusion should in turn help stabilize central fusion.

CASE REPORT

History

The patient SD, a 35-year-old massage therapist, was referred to the Optometric Center of Fullerton by her optometrist for a strabismus evaluation. The chief complaint was diplopia associated with an intermittent right eye turn that started five years previously. The symptoms appeared mostly at night and when she was tired. She was embarrassed when the eye turned in unpredictably during conversation with clients. She had the fear that some day she would develop total reliance on the prismatic correction that was prescribed a year previous. She used the prism correction for night driving and a non-prismatic correction for distance use during the day. She liked to remove her spectacles for reading and general mobility. There was no history of trauma, surgery, diabetes, or hypertension. She took oral contraceptives and reported no allergies. She denied asthenopia, headaches, or diplopia associated with near work.

Findings

Visual acuities were 20/20 OD and OS at distance and near through her single vision distance prescription:

OD -1.00-1.25x118
OS -0.50-1.00x111.

Her prism correction had the same sphero-cylinder powers and incorporated 3 base-out ground-in prisms in each eye. Cover testing through the non-prismatic prescription showed a mild A-pattern 15 prism diopters intermittent (frequency 50%) alternating (left eye preferred) esotropia at distance and 5 prism diopters of esophoria at near.

Her pupils were round, reactive to light, with no afferent pupillary defects. Ocular motilities and confrontation fields were full OU. The anterior segment and posterior pole were within normal limits OU.

Correspondence was found to be normal by major amblyoscope testing and the presence of 250 seconds of arc random dot stereopsis. The Worth-4-Dot Test revealed uncrossed diplopia at far and near. Motor divergence in the major amblyoscope with a second-degree, peripheral-sized target was 7/5 (break/recovery) from her angle of deviation. Subjective refraction showed a mild myopic astigmatic prescription:

OD -0.50-1.25x120 (20/20)
OS PL-0.75x098 (20/20)

Assessment

The intermittent diplopia she experienced was secondary to an intermittent esotropia at distance and reduced fusional divergence. There was no amblyopia, suppression, or anomalous correspondence.

Recommendations

A trial of six vision therapy sessions were recommended. She was advised to continue using the current prismatic correction for night driving and movies and the non-prismatic prescription for all other distance tasks during the day.

Vision Therapy

The goal of visit #1 was to develop divergence awareness and to improve fusional divergence ranges. The feeling of divergence was demonstrated using the major amblyoscope: at the patient's objective angle of deviation (20Δ BO), the peripheral-sized target (frog) was fused and she reported her eyes as totally relaxed. As the demand was changed toward 14Δ BO (divergence of 6Δ), she started feeling a straining sensation while the target was still single. She reported diplopia at 13Δ BO (divergence of 7Δ) and recovery at 16Δ (divergence of 4Δ). She was asked to remember those feelings. Instruction was then provided for the Wheatstone stereoscope and Brock string as home therapy to reinforce divergence awareness.

At visit #2, the goal was to extend her fusional ability from near to distance. Biopter tromboning was performed with the Keystone View EC10 target [a] (Figure 1). The patient was instructed to maintain fusion starting at the near position and then slowly move ("trombone") the target toward the more distance (optical infinity) setting. The patient was reminded to use divergence awareness she learned from visit #1 to maintain fusion. At about midway between the near and distance target demands, she reported intermittent diplopia and made the following interesting comment: "I can make it single if I look at the rocks in the background instead of directly at the lady at the center." This was interpreted as her using peripheral awareness to lock in fusion. I suggested that she use the same technique whenever she became diplopic at work or at home. This concept was further reinforced with the VO Star Chart [b] (Figure 2) and Lora's Card [b] (Figure 3) as home therapy activities. The patient was instructed to expand awareness of the peripheral stimuli on the charts while maintaining fixation at the center target.

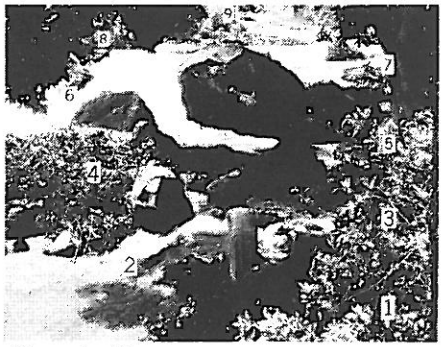

Figure 1. Biopter target

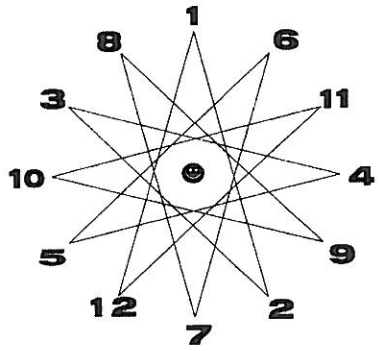

Figure 2. VO star chart

Figure 3. Lora's card

The patient returned two weeks later for visit #3. She was excited about what she had achieved and said, "Ever since you taught me to pay attention to the surroundings, I am able to straighten my eyes to get rid of the double vision. Whenever I talk to people, I know my eyes are straight by noticing things off to the side while maintaining good eye contact." No strabismus was measured by cover test from this day on as summarized in Table I. As of the date this report was written, the patient had completed five sessions of vision therapy and was quite satisfied with the results. In addition to the techniques listed above, increasing the distance of fused red-green targets by "walking away," and 3 base-in loose prism jumps were performed during therapy visits #3 to #5 to further enhance divergence and peripheral awareness.

She continued using the prismatic correction for night driving only. To investigate the possibility of reducing the amount of base-out prism in the correction, a total of 2ΔBI (in the form of Fresnel prisms) were placed over her prism spectacles while she sat as a passenger in a car at night. She was able to maintain fusion but she found it to be too stressful. However, she stated that one night she forgot her prism spectacles and was able to drive home safely without diplopia, using the non-prismatic distance prescription. She attributed this to the power of peripheral awareness training. Currently, she is not interested in the total elimination of prism in her spectacles. She was advised to maintain the home therapy regimen with loose prism jump three times a week (with decreasing illumination and increasing working distances) until her next progress evaluation in six to eight weeks.

Table I. Summary of the deviation and divergence ranges

Visit	Time of Day	Cover Test	Distance BI Ranges
Pre-therapy	8:30 am	15 AE(T)/ 5 EP'	7/5 @ 18BO
#1 (1wk)	1:00 pm	16 CRET/ 15 EP'	7/4 @ 20BO
#2 (3wk)	1:00 pm	15 E(T)/14 EP'	-
#3 (5wk)	1:00 pm	14 EP/ 17 EP'	6/2 Freespace
#4 (2mo)	1:00 pm	19 EP/ 12 EP'	4/2 Freespace
#5 (4mo)	11:00 am	19 EP/ 15 EP'	-

Discussion

This patient is unique because of the late-onset diplopia from esotropia and dramatic response to therapy. Late-onset diplopia at distance can be due to neurological etiologies. Scheimen[17] reviewed two possible differential diagnoses of divergence insufficiency: divergence paralysis and sixth nerve palsy. Divergence paralysis is of sudden onset. There may be papilledema and other central nervous system signs that include dizziness, vomiting, lethargy, and gait disturbances. Sixth nerve palsy presents as a non-concomitant deviation with end-point nystagmus. There may be papilledema as well as vertigo, lethargy, irritability, and distal parathesia.

Because of a lack of previous refractive and cover test findings, it is difficult to explain why the patient's symptoms began at the age of 30. My prediction is that an increase in visual demand and stress at work led to a decompensation of a large esophoria at distance. Also, an increase in myopia required more minus power be incorporated into her spectacles, which drove her phoria into an even more eso posture.

Prior to therapy, the patient experienced diplopia under stress or in a dark environment (due to the lack of peripheral fusion clues). With improvement in divergence, she was able to initiate the realignment process easily. However, the stability of fusion required intense effort. The patient used peripheral awareness to maximize peripheral fusion, and was able to align her eyes readily and comfortably. Vision therapy had given her a priceless "peace of mind" at work and when driving. The fact that she had no sensory anomalies (amblyopia, suppression, or anomalous correspondence) positively influenced her prognosis of success. The diplopic response actually worked in her favor as a valuable feedback whenever the strabismus manifested.

One may question why the esophoria at near had increased in size since therapy (see Table 1). There is no evidence that suggests an increase in esophoria with divergence training. My hypothesis is the variation in the size of near deviation at different hours of the day. As shown in Table 1, the pre-therapy cover test was the only measurement made in early morning, when the patient was least exposed to nearpoint stress.

Additional vision therapy techniques that encourage peripheral awareness may include: (1) Yoked base down prisms,[18] (2) Binasal occlusion,[15] (3) Base-in Quoits vectogram with Marsden ball,[18] (4) Macdonald's form field recognition card,[19] (5) transparent bull's eye target,[19] and (6) stress reduction techniques.[20]

Several other clinical applications of peripheral awareness had been summarized by Marrone.[14] These include sports vision, head trauma rehabilitation, exo/eso processors, and hyperactive children.

Conclusion

This case report illustrates that vision therapy can be highly effective in relieving diplopia in a patient with intermittent esotropia at distance and it can positively influence a patient's function in everyday life. By listening carefully to the patient, we can implement vision therapy techniques that lead to dramatic results. The key factor of success is to develop the patient's self-awareness as a method to control the visual system.

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