BINASAL OCCLUSION

By John D. Tassinari, O.D.

ABSTRACT

Binasal occlusion is a vision therapy technique familiar to many behavioral optometrists. Its use in esotropia, amblyopia, peripheral awareness enhancement and biocular vision therapy is discussed. A literature review, description of materials, methodology, expected patient responses and rationale are presented for each condition. Although the efficacy of binasal occlusion is disputed, there appears to be sufficient evidence for its continued use.

KEY WORDS

binasal occlusion, esotropia, amblyopia, peripheral awareness

Binasal occlusion is a type of sector occlusion used in the treatment of functional vision disorders. It has been recommended for esotropia,[1-9] amblyopia,[1-3,6-8] and non-strabismic functional vision problems.[1-2,10-11] Optometrists have prescribed binasal occlusion for at least 50 years.[4] Presently, its use is widespread albeit somewhat controversial.[12] Although reports of clinical implementation of binasal occlusion are scarce, some have reported favorable results.[6,10,13-16] Others have stated that: binasal occlusion is "...of doubtful practical value,"[17] "...no consistent rationale has evolved regarding the use of partial occluders."[18] and their use "...would simply prove ignorance of the mechanisms of the disturbance of binocular vision in strabismus."[19] The intent of this paper is to review binasal occlusion and support its continued use in vision therapy regimens.

Louis Jaques strongly advocated binasal occlusion (referred to as bimedial covers and binocular-monocular macular covers in his writings).[2,16,20-28] He stated that binasal occlusion is effective because it eliminates visual inhibition and suppression and allows "...the opportunity to establish the basic vision patterns of the normal human being."[20] Jaques reported on five specific cases where binasal occlusion was successfully prescribed.[20-22,24] Two were cases of anisometropic amblyopia and three were esotropia with anisometropia and amblyopia.

Petito et. al. described the use of binasal occlusion along with other vision therapy on an adolescent female with constant alternating esotropia (30 prism diopters), normal visual acuities and anomalous retinal correspondence.[13] The case was considered successful in that the esotropia magnitude was reduced to a cosmetically acceptable level (3 prism diopters) and a fair level of sensory fusion developed (250" stereopsis). They provide an excellent discussion of the rationale for vision therapy (binasal occlusion included) for strabismus within the context of a model of spatial localization.

Tassinari reported on the use of binasal occlusion as part of a vision therapy program for an 11-year-old boy with congenital comitant constant right esotropia (40 prism diopters at far, 30 prism diopters at near), harmonious anomalous retinal correspondence and right eye amblyopia.[15] There was also a history of unsuccessful extraocular muscle surgery. At the conclusion of therapy the magnitude of the deviation was less (20 prism diopters far and near), amblyopia was shallow (20/25) and normal retinal correspondence was present. The patient was cosmetically aligned with a spectacle prism prescription which was prescribed for full time wear (10 prism

Figure 1. Binasal occluders in the form of translucent adhesive tape applied to a child's eyeglasses.

diopters base-out on each eye).

Sarniguet-Badoche, a French orthoptist, has reported on large numbers of esotropic children treated with binasal occlusion.[6,14,29] Her largest study population consisted of 384 constant esotropes who were less than 18 months of age.[6,29] Thirty-five percent had amblyopia. Binasal occlusion along with "daily motility exercises" under parental supervision was prescribed to all subjects. With this treatment, 90% of the amblyopes enjoyed full restoration of visual acuity, 9% achieved residual mild amblyopia, and 1% did not improve at all. Regarding the esotropia, 44% were reported to have developed orthophoria, 15% reached a level of cosmetic cure, and the remaining 41% required extraocular muscle surgery to obtain eye alignment.

Sarniguet-Badoche reported on another group of constant esotropes aged 18 months through 3 years receiving the same treatment of binasal occlusion and motility exercises.[6,29] Forty-four percent of this group had amblyopia. Among the amblyopes, 70% reached full restoration of visual acuity, 21% reached a level of mild residual amblyopia, and 9% did not improve. Out of the total group, 13% became orthophoric after treatment. Twenty-five percent achieved a cosmetic cure, and the remaining 62% required extraocular muscle surgery.

A group of 151 children with infantile (congenital) esotropia and cross fixation were prescribed binasal occlusion and motility exercises.[14] Sarniguet-Badoche reported that 96% of this group avoided amblyopia and 75% did not require surgery. In all cases, treatment was initiated before age one year.

MATERIALS

Binasal occluders are not sophisticated devices. Any material that attenuates light and is easily affixed to eye glasses is suitable. Translucent adhesive tape is frequently the material of choice. This occlusive material allows only diffuse light to pass through, yielding a formless field. Alternatively, clear nail polish can be brushed on the lens surface and stippled to achieve the same effect as the tape. If opaque binasal occlusion is desired, black electricians' tape can be utilized.

METHODS

Binasal occlusion is not prescribed as a permanent treatment and it is rarely prescribed in isolation. In most cases it is one aspect of a complete vision therapy regimen. The occlusive material is applied to the nasal portion of each spectacle lens extending temporally to some predetermined width (Figure 1). In the vertical meridian, the tape extends the full length of the lens. The most straightforward method is to apply the occluders in the manner recommended by Jaques.[2] While the patient wears glasses and fixates a distant target in primary gaze, one eye is completely occluded. The pupil of the seeing eye is then bisected by the edge of the tape so that the nasal half of the monocular field of view is occluded. The procedure is repeated for the fellow eye. There are variations of this technique that depend on the type of vision disorder present. In order to facilitate application, the occluders are applied to the front lens surface. If binasal occlusion is to be worn out of office, the occluders can be transferred to the back lens surface so that the glasses are more cosmetically acceptable.

ESOTROPIA

When used in esotropia, binasal occlusion is intended to inhibit any sensory maladaptations that are present and encourage divergence. Presumably, these results occur as a result of selective occlusion of specific retinal areas. With binasal occluders in place, the temporal retina of the fixating eye is occluded. The temporal retina, fovea, and a portion of the nasal retina of the turned eye are occluded (Figure 2). This selective occlusion disturbs the individual's habitual way of processing central visual space and the desired response is a breakdown of sensory maladaptations and divergence of the turned eye.

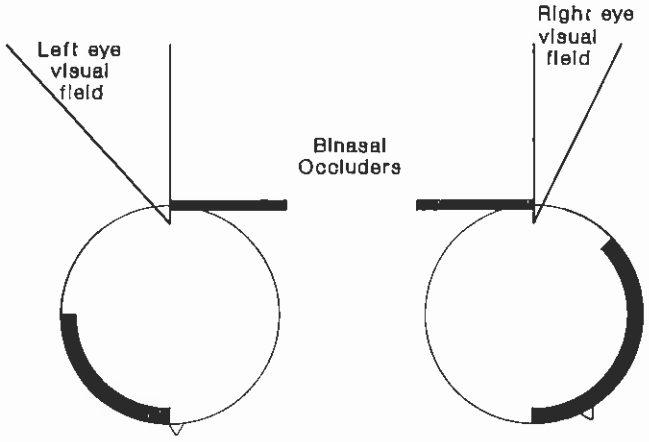

Figure 2. Schematic representation of a right esotropia and binasal occlusion. The patient is viewing a distant target in primary gaze. The temporal retina of the left eye is occluded (shaded) which excludes the nasal visual field of that eye. The temporal retina, fovea (small triangle), and a portion of the nasal retina are occluded in the deviating right eye. The right eye nasal visual field is not visible and the temporal visual field is constricted as a consequence of the eye turn.

Methods

Greenwald has extensively described the methods of prescrib-

ing binasal occlusion for esotropia.[1,30] For alternating or intermittent esotropia, occlusion tapes of equal width are prescribed. The temporal edge of the tape extends far enough so that the pupil is bisected during monocular fixation in primary gaze. Greenwald suggests tilting the tapes inward inferiorly by 10° to allow for convergence.

For unilateral esotropia, the temporal edge of the tape in front of the turned eye is placed so that the corneal reflex is barely visible when both eyes are open. This placement should result in occlusion of the fovea and a small adjacent nasal retinal area. For the fixating eye, the tape is applied in the previously described manner where the pupil is bisected by the temporal edge of the tape and temporal retina is occluded. In this case the tape widths are unequal. Tilting the occluders inward inferiorly to allow for convergence is also recommended.

Inhibition of Sensory Maladaptations

In esotropia, the binocular sensory maladaptations of concern are suppression and anomalous retinal correspondence (ARC). Typically, foveal suppression of the turned eye is present so that confusion (perception of two disparate objects occupying the same point in space) is avoided.[31-33] In order to avoid diplopia, the fovea of the fixating eye anomalously corresponds with a (typically) nasal, retinal area in the turned eye.[31-34] A treatment plan for esotropia should attempt to eliminate these sensory maladaptations.

Total occlusion of the habitually turned eye is a recommended treatment for suppression and ARC.[31-33,35] The premise is that suppression and ARC are not activated under monocular conditions. Binasal occlusion is analogous to this approach as the turned eye has a substantial portion of the retina occluded, including and especially the fovea.

It has been suggested that confusion is the trigger mechanism for foveal suppression of the turned eye.[31-33] Because the fovea is occluded under conditions of binasal occlusion, confusion cannot occur and foveal suppression is avoided. Furthermore, Petito et. al. have suggested that foveal occlusion of the turned eye afforded by binasal occlusion can inhibit ARC as well.[13]

Clinically, evidence for inhibition of ARC, is found in the patient's response after application of the binasal occluders. He may report intermittent or constant homonymous diplopia of a fixation target once the binasal occluders are in place. This response indicates that the area of the turned eye that previously corresponded anomalously with the fovea of the fixating eye no longer corresponds (as it should not in normal retinal correspondence). Normal diplopic projection is present and it is interpreted as a positive response to binasal occlusion. The patient has adopted (at least temporarily) a normal retinal correspondence (NRC) status or an unharmonious ARC status where the anomalous area of the turned eye has shifted toward the fovea. This diplopia response is useful in applying the nasal occlusion in front of the turned eye. Trials of tape of different widths can be used until the minimum tape width that produces diplopia is found.

Divergence

In the case of intermittent esotropia, binasal occlusion permits bifoveal binocular fusion when the patient aligns his eyes. When the esotropia manifests, the fovea of the turned eye is occluded, suppression and ARC are inhibited and diplopia is present. Thus, maintenance of alignment is encouraged.

For the constant esotrope responding to binasal occlusion with diplopia, divergence may be attempted as a normal fusion response but bifoveal binocular fusion is not automatic as it is for the intermittent esotrope. If the divergence attempt is of sufficient magnitude, the fovea of the deviating eye will no longer be occluded. At that point one of two responses may occur.

The ideal response is bifoveal alignment, normal fusion and NRC, even if it is only for a brief moment. This response is more likely to occur in a patient with alternating esotropia as opposed to unilateral esotropia. In alternating esotropia, the occluders are placed so that the temporal edge of the tape bisects the pupil when each eye is foveally fixating. Because of this placement, a divergence movement of the turned eye that allows the fovea to look just past the temporal edge of the occluder results in motor alignment of the foveae. Of course the fellow eye must continue to centrally fixate the target for bifoveal alignment to occur. It is quite possible for this eye to simply deviate inward as is habitually done in alternating esotropia. However, this inward deviation will result in foveal occlusion of that eye, ARC is inhibited, diplopia may result, and the cycle begins again. The cycle of alternation can be broken if alignment is maintained.

The second possible response to a divergence movement that brings the fovea of the turned eye out from behind the occluder is expected in unilateral esotropia. In unilateral esotropia, the occluder before the fixing eye is placed so that the temporal edge of the tape bisects the pupil. In the turned eye, the occluder is narrower and the temporal edge extends to some point past the mid-pupil meridian when the eye is in its deviated position. This type of occlusion will not result in motor alignment of the foveae when the fovea of the turned eye first looks past the temporal edge of the tape. The patient will still be esotropic but the magnitude will be less. Once the fovea is exposed, confusion can occur and suppression and ARC are activated. Under the influence of ARC, the patient will make an anomalous movement in to reestablish the habitual esotropic alignment and ARC. However, this anomalous fusional movement inward will once again occlude the fovea, confusion cannot occur, suppression is inhibited and the anomalous area shifts as before with diplopia resulting. Diplopia initiates another divergence movement and the cycle begins again. This cycle can be very disrupting to the patient. Clinically, this cycle appears as rapid, cyclical, fluttering movement of the eyes in patients responding favorably to binasal occlusion. Eventually, to break the cycle, the patient could establish a new nasal retinal area that anomalously corresponds with the fovea of the fixating eye and allows the fovea to remain outside the occluder. Foveal suppression is activated along with ARC. The net gain is an anomalous area that is closer to the fovea (a smaller angle of anomaly) and a reduction in the size of the manifest esotropia. This may occur after a period of days or weeks.

Another potential stimulus for divergence when binasal occlusion is used in esotropia is peripheral awareness.

Esotropia reduces the extent of the temporal binocular visual field on the side of the turned eye. Binasal occlusion may enhance the patient's awareness of the constricted visual field. Birnbaum has suggested that occlusion of the temporal retina in the esotrope heightens habitually depressed nasal retina sensitivity.[32] As divergence occurs under conditions of more acute nasal retina sensitivity the patient is aware of a wider temporal visual field. Peripheral awareness vision therapy activities (bimanual chalkboard circles, Macdonald charts, etc.) could be used to enhance the effect. Divergence toward alignment is rewarded with visual field expansion. Manifestation of the esotropia is punished by visual field constriction.

Modifications

For alternating or intermittent esotropia which has improved maximally (small angle esotropia, microtropia, heterophoria) as a result of binasal occlusion and other vision therapy, the patient is weaned away from the tapes by gradually decreasing the tape widths in equal amounts as the patient is able to maintain the desired binocular status.

For unilateral esotropia, the tape width over the habitually turned eye is gradually increased as the patient establishes new and smaller angles of anomaly with concurrent reduction in the manifest deviation. These gradual increases are continued until maximum potential is reached or the tape widths are equal. Then the tape widths are decreased in the same way described for alternating esotropia.

Other Considerations

While inhibition of suppression and ARC with divergence are the desired responses to binasal occlusion, the opposite is entirely possible. The patient may increase the magnitude of the eye turn in an attempt to occlude more of the retina and maintain habitual sensorial adaptations. Greenwald interprets this response as indicating a poor prognosis for a functional cure.[2] Another contraindication to binasal occlusion is failure of diplopia to manifest when the occluders are applied. In fact, the key response in binasal occlusion therapy for esotropia is homonymous diplopia. Its absence suggests deeply embedded sensory maladaptations.

In some cases of esotropia, binasal occlusion and other vision therapy may only serve to inhibit suppression and ARC with no or insufficient reduction in the magnitude of the deviation. These are typically large angle esotropias and would appear to require prism glasses or extraocular muscle surgery to achieve an acceptable therapy result. In any event, binasal occlusion served a necessary purpose by contributing to the inhibition of suppression and ARC and allowing a more normal binocular fusion to occur with the prism glasses or post surgically. In fact, binasal occlusion can be used along with correcting prism therapy then gradually weaned away. Also, binasal occlusion can be used after extraocular muscle surgery along with other vision therapy to help the patient maintain his or her new alignment or near alignment status.

AMBLYOPIA

The first step in the treatment of amblyopia is to improve the resolving, fixation, tracking and accommodative skills of the amblyopic eye under monocular conditions using direct complete occlusion of the sound eye. The next step might be to promote use of the amblyopic eye when both eyes are open. Binasal occlusion can serve this purpose.

Method

For anisometropic amblyopia, the occluders are applied in the same manner as alternating esotropia. Equal width tapes that bisect the monocular visual fields are used.

For esotropic amblyopia, the occluders are applied in the manner described previously for unilateral esotropia. In the early stages of therapy, degradation of the acuity in the sound eye may be necessary to ensure fixation with the amblyopic eye. If this is deemed necessary, degradation techniques such as stippling the central part of the spectacle lens in front of the fixating eye can accompany the binasal occlusion.

Treatment Objectives

When binasal occlusion is prescribed so that the nasal visual field of each eye is occluded, objects to the right can only be fixated by the right eye and objects to the left can only be fixated by the left eye (assuming no head movements). Thus, alternation of fixation is promoted and the amblyopic eye will be used to see objects in the ipsilateral visual field while the habitually fixating eye is under partial occlusion

Binasal occlusion following complete direct occlusion is especially valuable for the very young patient who might not respond to more sophisticated techniques that allow monocular fixation when both eyes are open (anaglyphs, etc.). Apell and Lowry recommend binasal occlusion for the 2- to 3-year-old age group.[5] They advocate assigning gross motor and eye-hand activities for the period when binasal occlusion is worn. As mentioned previously, Sarniguet-Badoche reported successful treatment outcomes when binasal occlusion was prescribed for infants and toddlers with amblyopia.[6,29] Vreecken recommends binasal occlusion for congenital esotropic amblyopia after the direct patching stage.[3] If the child insists on head movements to avoid fixation with the amblyopic eye, binasal occlusion is contraindicated.

PERIPHERAL AWARENESS ENHANCEMENT

For many practitioners, peripheral awareness training is an integral part of any vision therapy program. Gruning emphasizes that binasal occlusion is one part of a treatment program for functional vision problems and should not be used in isolation.[10] It is particularly applicable for the highly central processor with esophoria. Forrest states that "they (binasal occluders) simply emphasize and encourage peripheral awareness and peripheral sensitivity in the eso processor who is weakest in this area."[11] Greenwald likens binasal occlusion to yoked bases-down prism lenses in that the individual is forced to utilize peripheral cues.[1]

Methods

For heterophores in need of peripheral awareness enhancement, binasal occlusion is applied so that some portion of the binocular central visual field is occluded. The width of the tapes is not as precisely determined as it is for esotropia. The further the tapes extend temporally, the greater the emphasis on the periphery will be. It is not uncommon

for practitioners to use binasal occlusion that extends to the temporal pupil border. Francke provides an excellent discussion of the instructional set and interpretation of responses for peripheral awareness training with binasal occlusion.[37]

As with esotropia or amblyopia, the occluders can be affixed to the patient's prescription or training lenses. Alternatively, Gruning describes application of the occlusive material to "Visitor's Specs" goggles.[10] This method is convenient because the goggles can fit over existing eyewear or be used when eyeglasses are unnecessary.

Treatment Objectives

While wearing the binasal occlusion, the patient is asked to perform in an environment where peripheral vision is sufficient for successful task performance (chalkboard activities, negotiating an obstacle course, etc.). During the task the patient performs with a narrow strip of peripheral visual field on each side and is forced to rely on peripheral visual information in the absence of central information.

By accentuating the periphery, binasal occlusion promotes improved central-peripheral interaction. Ultimately, improved peripheral awareness and central-peripheral interaction may reduce the stress associated with a near visual task.[10]

BIOCULAR VISION THERAPY

Biocular viewing is two-eyed viewing in the absence of paired function of the two eyes.[38] When applied appropriately, binasal occlusion creates a biocular condition in that both eyes are open and functioning but binocular fusion is not possible.

Methods

For biocular activities, the occluders are applied so that the pupil of each eye is bisected and there is no visual field overlap.

Treatment Objectives

Griffin recommends a biocular phase of vision therapy for accommodative infacility.[31] This phase should follow a monocular phase and precede a binocular phase. Jacques describes a technique where unequal spherical lenses (i.e. +1.00 DS OD and -3.00 DS OS) are placed in a frame along with binasal occluders. The patient is instructed to read a passage while turning his head left and right alternately to change the accommodative demand.[39] A modification of this technique I have used is to have the patient wear the same spectacle arrangement (unequal spheres and binasal occlusion) and track a Marsden ball swinging left to right and right to left. Thus a biocular accommodative facility task is combined with a dynamic eye movement task.

SPECIAL APPLICATIONS OF BINASAL OCCLUSION

Spasm of the Near Reflex

Manor reported on the use of binasal occlusion for an adult female diagnosed as having spasm of the near reflex.[40] Spasm of the near reflex is a functional disorder that manifests as persistent convergence, accommodation, and miosis.[40-41] Daroff et al. suggest a psychogenic etiology for this disorder.[41] Spasm of the near reflex can be misdiagnosed as bilateral abducens palsy. If this occurs, the patient is submitted to unnecessary, complicated, invasive neurodiagnostic procedures.

After prescribing binasal occlusion for the woman presenting with spasm of the near reflex, Manor observed immediate straightening of the eyes and dissipation of the patient complaints. Thus, bilateral abducens palsy was ruled out. He recommended binasal occlusion as a test in the differential diagnosis of spasm of the near reflex and bilateral abducens palsy.

Detection of Strabismus and Amblyopia

Sarniguet-Badoche describes the utilization of binasal occlusion to detect strabismus and amblyopia in infants.[6] For strabismus, glasses with binasal occluders previously affixed are placed on the infant's head. An interesting fixation target is presented to the patient and the amount of visible iris remaining for each eye is observed. Symmetry of visible iris suggests no strabismus. Asymmetry suggests a monocular or alternating deviation.

For amblyopia, the same detection glasses are used. The fixation target is moved from left to right at the infant's eye level. If the infant fixates the target with his left eye when the target is on his left and with the right eye when the target is on the right, equal acuity is assumed. If the infant persists in head turning to maintain fixation with one eye, then amblyopia should be suspected in the fellow eye.

CONCLUSION

Binasal occlusion appears to have value as a vision therapy technique in the treatment of functional vision disorders. It may also serve as a diagnostic tool. It has the advantage of being inexpensive, simple, and readily available. A rationale for its effectiveness has been offered that is based on existing literature, but is not assumed to be proven. The relative paucity of literature regarding binasal occlusion has probably contributed to its poor acceptance by some. Clinical success on a case by case basis has encouraged others to use it regularly. Additional case reports, clinical trials, and controlled research would serve to substantiate the use of binasal occlusion by optometrists and other vision specialists.

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Corresponding author:
John D. Tassinari, O.D.
Southern California College of Optometry
Optometric Center of Fullerton
2575 Yorba Linda Blvd.
Fullerton, CA 92631-1699
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