

Vision Aids for People Having *Bi-Temporal Hemianopsia*

(Normal Acuity in Both Eyes ... but No Side-Vision to Either Side)

The National Institute for Rehabilitation Engineering (NIRE) is a non-profit organization which engaged in research and clinical work for the development and dispensing of low-vision aids from 1967 through 1997. NIRE staff assisted *hundreds* of people having permanent impairments of visual acuity and/or visual fields. This paper describes methods and devices developed to assist individuals having BI-TEMPORAL HEMIANOPSIA. Because the NIRE no longer operates vision clinics, the information is being made available in order that NIRE's methods and data may be used by vision-care professionals everywhere, to assist individuals having Bi-Temporal Hemianopsia. These data are updated to year 2004. The N.I.R.E. continues to serve the public with research, information, advice and referrals. Individual and personal communications are welcomed via e-mails, telephone and regular mail.

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Different Forms of Hemianopsia:

“Bi-Temporal Hemianopsia” is one of the less common forms of Hemianopsia. It is almost as disabling as Tunnel Vision and is difficult to live with. Typically, the person has good visual acuity in both eyes and has fused, binocular stereoscopic vision. The problem is that the person has no side vision to either the right or left. He or she sees only straight ahead. *THIS PAPER describes special eyeglasses that can significantly help people with “Bi-Temporal Hemianopsia” in many of their everyday activities.*

“Bi-Nasal Hemianopsia” is one of the less common forms of hemianopsia. Typically, the person has good visual acuity in both eyes and has fused, binocular stereoscopic vision. He has good vision straight ahead and to each side. The problem is that the person has no vision toward the nose, with each eye, and thus has a central blind area that can lead to accidents and injuries. *Another N.I.R.E. paper describes eyeglasses that can help these people in their everyday activities.*

“Monocular Hemianopsia” is one of the less common forms of hemianopsia. Typically, the person is blind in one eye and has “half-eye” vision in the one good eye. This disability can occur in any of four forms. It is rare but quite disabling when it occurs. *Another N.I.R.E. paper describes eyeglasses that can be helpful for each of the four forms of “Monocular Hemianopsia.”*

“Homonymous Hemianopsia” is the most common form of hemianopsia. Typically, the person has good visual acuity in both eyes and has fused, binocular stereoscopic vision. He has good vision straight ahead and to one side – the same side for each eye or both eyes. Both eyes may be blind to the left (Left Homonymous Hemianopsia) – or to the right (Right Homonymous Hemianopsia). The problem is that the person has no vision toward one side with each eye (both eyes) and, unaided, this can lead to accidents and injuries. *Another N.I.R.E. paper describes eyeglasses that can help these people in their everyday activities.*

ALL FORMS of Hemianopsia are most often caused by brain or optic nerve disorders rather than by problems within the eyes. **Early medical attention** is of the utmost importance to diagnose, treat, arrest or, sometimes, to reverse these disabilities. Optical aids may help, functionally, but do not substitute for essential medical care. People having any form of hemianopsia may also have slowed reflexes and/or cognitive problems arising from the same brain lesions causing the hemianopsia. Therefore, even with field expanding optical aids for the hemianopsia, formal mobility and/or driver training may be beneficial to assure safety.

SERVICE PROVIDERS ... and professionals

to help people with any form of hemianopsia include:

Medical Doctors: ophthalmologists, neuro-ophthalmologists, and neurologists.

Optometrists to examine and refract patients' eyes; to design and use special optics with trial frames for evaluation and training purposes; to design and construct special lenses and optics; to train and advise patients regarding use of special optics for specific functions and tasks.

Optical Dispensers or Opticians to construct and dispense customized optics and eyeglasses, to the specifications of, and under the guidance of either an ophthalmologist or an optometrist.

Instructors ... for Safe Driving to ensure that a person with hemianopsia drives safely using special field expanding eyeglasses, special rearview mirrors, and special visual scanning techniques. Some hemianopes can safely drive day or night; others can safely drive in daylight but not at dusk or in the dark, due to night blindness. Others cannot drive safely at all, either because of the type of hemianopsia or because of co-existing reflex or cognitive impairments. (Some states still refuse to road test or license hemianopes no matter how well their instructors feel they drive.)

In all cases, a hemianope who wants to drive will need a licensed driving instructor after he has his hemianopic field expanding eyeglasses – and has mastered walking in crowded areas without bumping into people or furniture.

Special Optics for Bi-Temporal Hemianopes can greatly enhance the visual fields to both sides without impairing the existing central fused, binocular (stereoscopic) vision.

The principles and construction of these special eyeglasses are explained and illustrated below.

Availability: These **Bi-Temporal Hemianopsia - FX eyeglasses** can be made by any qualified optical dispenser. However, a lot of extra hand work is required. This means that some dispensers may be too busy and may decline to make them. It also means the eyeglasses will be costly when they are made.

User Training: These eyeglasses use 3 progressive, vertical segments for each eye. Their use requires timely coordinated head and eye movements, somewhat comparable to a person's use of horizontally segmented trifocals. For these FX eyeglasses, however, user training is recommended – to be given by an optometrist, orthoptist or vision trainer.

Candidates: A typical user of these glasses will have corrected visual acuity for each eye that is the same, or very close. Examples: 20/20 for each eye and both eyes together.

NOTE: If the acuity is different for each eye, the difference should be no greater than 10 or 20 feet, i.e. 20/20 and 20/40 or 20/40 and 20/60. The user should have fused,

binocular vision straight ahead using both eyes, with no blind spots or areas toward the nose or between the two eyes. It is assumed the person sees ahead with binocular central vision using both eyes so as to see at least 40 degrees wide with each eye, alone, and 70 degrees or more wide (left to right) using both eyes. *NOTE: If these minimal conditions do not exist, then other types of field-expanding eyeglasses may be preferable.*

Principles of Design and Use: In front of each eye is a lens that is divided into three vertical segments. (*Note: Common trifocals have 3 horizontal segments, each with different optical characteristics. These glasses have 3 vertical segments for each eye.*) All 3 segments provide astigmatism and distance corrections needed by each eye. However, each of the three vertical lens segments – for each eye – has a different value of prism. A typical design may have these segment prism values: (Rx lens A ... nearest nose; Prism lens C ... nearest outside; and Rx + Prism lens B ... in the middle – for each eye)

See Figure 1 below

Lens for

Each Eye: **Segment A - nearest nose: 0 prism diopters + Rx corrections**

User sees ahead with binocular fusion, using both eyes. He turns his eyes slightly and his head more, to see toward his sides with sharp, fused vision using both eyes. This is a standard prescription lens cut vertically and installed as a vertical segment meeting the cut edge of lens B (which has both Rx and prism).

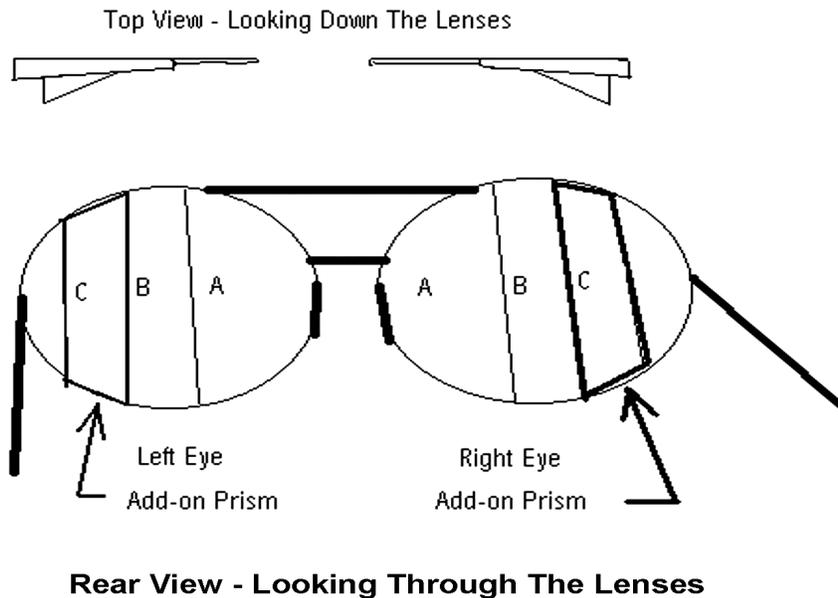
Segment B - in center: 10 prism diopters, base-out + Rx corrections
(patient's age may limit this to 6 or 8 prism diopters)

User turns his eyes 25 to 30 degrees to either side. He sees clearly through prism B with one eye, 10 degrees more toward the side than otherwise possible. He easily extends his vision toward that side (left or right) by simply turning his head in the same direction. This is a standard Rx lens having 6 to 10 prism diopters and has a vertical cut edge to abut the cut edge of lens A. *NOTE:* The prescribing professional needs to use trial lenses to conduct patient tests before ordering or making glasses, to determine the optimum locations for the A-B and the B-C segment boundary placements and the maximum amount of prism the patient can comfortably use with sharp vision.

Add-on C - nearest outside: 20 prism diopters, base-out (no corrections)
+10 deg. of prism B = 30 prism diopters, total

User turns his eyes far to either side and sees through prism C. What he sees is not clear but it is expansive. This simulates far-out peripheral vision in image quality and overall angle of coverage. The user can turn his head and his eyes far to either side and see a person behind him. Grooved plastic fresnel lenses must NOT be used because their resolution is too low. A plastic or polycarbonate 20 prism diopter lens is ordered and then a precision power cutting tool is used to cut from it, a vertical segment with the required prism, base-out. If the lens used for C has the same base curve as the underlying lens B, then the two will fit perfectly when cemented together.

Figure 1 ... Field-Expander Eyeglasses for Bi-Temporal Hemianopsia



Functionality of The Eyeglasses

For Most Tasks and Functions (excluding one's driving an automobile)

The functionality almost always depends on the person's willingness and ability to learn to use the optics automatically, without conscious thought. Hemianopsia, in all its forms, is usually caused by a brain or nervous system injury or lesion rather than by an eye condition. The neurological causes of hemianopsia sometimes causes slowed reflexes and response times, and sometimes memory problems or confusion, or even poor judgement in emergency or high pressure situations. For these reasons, VISION TRAINING by a professional is almost always needed. Even with such training, some users are able to drive safely and pass road tests while other users cannot qualify to drive.

When elderly people need trifocal lenses and have never before used even bifocals, they have a similar learning need. Most learn quickly and become very proficient and comfortable with their trifocals; some learn to use them usefully but not with complete comfort; and a few derive even less benefit from their trifocal eyeglasses. The users of tri-segmented field-expanding eyeglasses, as described in this paper, similarly fall into one or another of these same three categories.

Driving an Automobile (safely and legally)

This is a worthy goal, attainable by some bi-temporal hemianopes but not by others. The probability of success is greatest if driving is not rushed or attempted too

quickly. First of all, one should not attempt to obtain these glasses until after 4 to 6 months have passed and it is known that the vision loss has stabilized; that it will neither improve nor worsen.

Once the glasses are designed, made and fitted, then it is best for the bi-temporal hemianope to learn to use them for safely and comfortably walking, jogging and moving in crowded areas and close quarters, indoors and outdoors.

If the patient needs reading glasses, this need can be handled in either of two ways. (1) He uses separate reading glasses with reading distance Rx lenses – but no prism; or (2) on the FX glasses, a reading add segment can be placed low down on lens A of each eye to allow reading with fused binocular vision.

After the patient has learned to use his FX glasses efficiently, comfortably and for extended periods, he can start thinking about whether or not to drive. To become able to drive safely, sensibly and legally, a few specific steps are needed.

1. **The eye doctor or optometrist** should provide a letter stating the patient's corrected acuity for each eye, and for both eyes, for distance. The letter should state that the patient's corrected overall horizontal field of vision, with both eyes, is 120 degrees or more. (This is with eye movements allowed while being tested with the glasses on – but not head rotations.)
2. **A licensed driving instructor** should be consulted for on-the-road assessment, training and reporting purposes. He should fill these functions: (1) Evaluate the driver's on-the-road performance, at various times. (2) Provide necessary or helpful on-the-road driver training. (3) Provide course completion certificates and reports, in writing, that can be shown to or copied for auto insurers, state Motor Vehicle Inspectors, etc. NOTE: in many states, the driver must notify the state DMV of the handicap and arrange to be road-tested. In a few states, if the person is already licensed, he merely has to notify the state by mail, with a copy of his license and letters from the eye doctor and the driving instructor recommending he be permitted to drive.
3. **Night Driving** - may or may not be safe for bi-temporal hemianopes. Many, but not all, lose their night vision sensitivity when they lose their peripheral vision. Ability to drive safely at dusk or in the dark must be evaluated for each hemianope, individually, both in the doctor's office and on the road, by the driving instructor.
4. **Special Rearview Mirrors** – see below

Special Rearview Mirrors should be gotten for the vehicle, before or early in the driver training program. The vehicle should have two OUTSIDE rearview mirrors – each of which is electrically movable by the driver from within the car. Both mirrors should be plain or plano mirrors – not minifying mirrors. On many cars, the left outside mirror is plano while the right outside mirror minifies. If so, the minifying mirror can be replaced or else a plano mirror can be attached to or added to it.

The INSIDE rearview mirror should be changed or added onto. We have found that a 3-section, 180 degree, non-minifying mirrors is excellent for the purpose. It is available for mail-order purchase, at low cost, from J.C. Whitney Co.

The RECOMMENDED inside, rearview mirror is the 3-panel flat (non-minifying) 180 degree wide-angle mirror sold by J.C. Whitney. This mirror may clip onto an existing mirror or it may be permanently mounted over the windshield. It can be seen by viewing this website:

<http://www.jcwhitney.com/product.jhtml?CATID=157301&BQ=tt>

and can be ordered from:

J.C. Whitney Company
1 JC Whitney Way
LaSalle, IL 61301 e-mail: customerservice@jcwhitney.com

For this mirror to be most useful and effective, the hemianope should drive only an automobile or van with windows all around, not a windowless commercial van.

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EXCEPTIONS – conditions for which additional corrections may be needed:

Abnormal Convergence - If the patient's two eyes do not have normal convergence or tracking, then corrective prism differentials may be needed between the two eyes – which can be determined using trial lenses for testing. Some such patients can be compensated and some cannot be compensated with prism differentials.

FX Eyeglass Prescriptions & Specifications - These eyeglasses can be prescribed and/or dispensed by an eye-care professional, ophthalmologist, optometrist or optician. Retesting is needed at dispensing so, if gotten from an optician, return visits for testing and evaluation by the prescribing doctor may be necessary.

Eyeglass Frames should be light-weight, comfortable, close-to-the face, and rigid. Avoid using “flex” or “flexible” frames so that the lens segments and prisms do not shift alignment between themselves or from one eye to the other.

Decentration of Lenses to increase or decrease prism effects is a technique requiring careful thought and planning. In general, for weak to moderate lens prescriptions, it is better to NOT decenter, but to use the lens's prism characteristics to generate the desired amount of prism, base-toward-outside. Decentration becomes a factor for strong correction, e.g. plus or minus 3 or 4 (or more) diopters of sphere. Where there is strong correction, it is helpful to use Decentration to prevent the strong Rx from lessening the effective prism toward the blind side. It may also be used to enhance or increase the effective prism toward the blind side, in some cases. If the corrective Rx is strong for one eye and weak for the other, don't allow Rx

Decentration to unbalance the overall base-toward-blind-side prisms for the two eyes.

Cylinder or Astigmatism Corrections & Rx Tolerances are very important when using prism lenses and are more important when making field expander eyeglasses for people over 40 years old (who are less accommodating or more presbyopic). All candidates for these glasses **must** be very carefully refracted with trial lenses, in combination, to arrive at the exact cylinder and sphere corrections required for each eye, without **and** WITH the added prism values. If this is done carefully, the patient will see as clearly with his prism Rx glasses as he sees using similar glasses lacking the prism features. *What must be avoided is a situation where a patient has both regular and prism glasses and chooses to use the regular glasses instead of the prism glasses because he sees more sharply through the regular (non-prism) lenses.*

Age Table for Segment-B Prism Selection – Older people have reduced focal distance accommodation (more presbyopia). For this reason, younger people can tolerate, adjust to and enjoy more prism than older people. Yes, it is possible to start a person on, say, 5 prism diopters – wait three months – and then remake the glasses with 8 prism diopters. Using this staging method, it is possible to get some patients up to 10 or 12 prism diopters. Having used this staging method early in our clinical work, we eventually found it to be an unnecessary burden for most patients. Instead, we developed the AGE vs PRISM TABLE below. (Try the higher value first, with trial lenses, and then the lower values, if necessary.)

Patient Age	Prism Diopters for B segment
6 to 18 years	8 to 14 diopters
19 to 30 years	7 to 12 diopters
31 to 39 years	7 to 10 diopters
40 to 46 years	6 to 10 diopters
47 to 52 years	5 to 10 diopters
53 to 60 years	5 to 10 diopters
61 to 70 years	4 to 9 diopters
71 + years	3 to 8 diopters
Aphakics and	3 to 6 diopters
people with lens implants	3 to 6 diopters

For additional information or free technical support, please email: nire@warwick.net or contact us by regular mail or telephone.

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