

Vision Aids for People Sighted in One Eye

The National Institute for Rehabilitation Engineering (NIRE) is a non-profit organization which operated clinics for the development and dispensing of low-vision aids from 1967 through 1987. These clinics assisted *hundreds* of people having permanent impairments of visual acuity and/or visual fields. This paper summarizes successful clinical methods developed and used during this 20-year period for assisting individuals having **Monocular Vision**. Because the NIRE no longer operates these vision clinics, the information is being made available in hopes that NIRE's methods and data may be used by other vision-care professionals all over the world to help functionally rehabilitate individuals having Monocular Vision.

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Two types of "CROS-VISION" eyeglasses were developed for monocular people to give to each such person, vision expanded toward the blind side and more naturally centered vision. Neither type restores "normal" vision. However, each of these eyeglass types have proven very helpful to their users while being attractive looking and low-cost.

CV Glasses, TYPE-1 have the appearance of ordinary eyeglasses, fit in any standard eyeglass frame, are light-weight and low-cost, and do NOT require any special user intelligence, awareness or training. They can be made as single vision, bifocal or trifocal glasses and can accommodate any corrective lens prescriptions. **CV Glasses, TYPE-1 are recommended for all people with Monocular Vision.** They expand central vision to the blind side and are beneficial for all activities (*see below for more on CV-Glasses,TYPE-2 which expand both central and peripheral vision to the blind side*).

The TYPE-1 CV glasses are made for a person blind in one eye (either eye). EXAMPLES given in this paper assume the bad eye is totally blind and that the good eye has a normal visual field and acuity that is correctible to normal or near normal. EXCEPTIONS *to these assumptions are discussed separately*.

The lens for the good eye is ground with prism and installed with the prism base toward the user's blind side. For cosmetic purposes, an identical lens is installed in front of the blind eye with the prism base also toward the blind side. For a person having a plano lens prescription (no correction), the two lenses are identical and very simply made.

CVG Type-1 EXAMPLES: (for person age 30 years)

for Left Eye blindness: OD: plano with 5 prism diopters base-left: functional
 OS: plano with 5 prism diopters base-left: cosmetic

for Right Eye blindness: OD: plano with 5 prism diopters base-right: cosmetic
 OS: plano with 5 prism diopters base-right: functional

Lenses should be made of plastic or polycarbonate and should be coated for uv blocking, for scratch resistance, and for light reflection reduction. The amount of prism varies with age. (See Age Table.)

All criteria are the same for left-sighted and right-sighted monocular people. Eyeglasses with the above example prescriptions will:

- (1) Expand the patient's vision toward his blind side – and
- (2) Center the patient's face toward what he is viewing.

EXCEPTIONS:

RESIDUAL VISION or LIGHT PERCEPTION IN BAD EYE – may require either of two additional steps. (1) If the two eyes track together and converge properly without the poor vision degrading the good vision, then prism lenses, base-toward-blind side can be used for both eyes. Sometimes, the two lenses need to have prism variations to assure convergence and tracking. Such variations have to be determined with testing using trial lenses. Or, (2) If residual vision in the bad eye is so poor as to be useless, and if it merges with and impairs with the good vision of the better eye, then the inside surface of the lens for the bad eye can be frosted or blackened.

THE MONOCULAR HEMIANOPE – is a patient blind in one eye and sighted but hemianopic with the other. This assumes the blind eye is totally blind or absent. If so, the one good eye is dealt with in either of two ways: (1) if the good eye is hemianopic (blind) toward the person's nose, then the information in this paper is applicable and can be used. Or (2) if the good eye is hemianopic (blind) toward the outside – away from the nose - then this Institute should be contacted for a copy of its paper on "Vision Aids for People With Homonymous Hemianopsia."

CV Glasses, TYPE-1 PRESCRIPTIONS & SPECIFICATIONS - These glasses can be prescribed and/or dispensed by any 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.

- (A) Eyeglass Frames should be light weight, comfortable, close-to-the face, and rigid. Avoid using "flex" or "flexible" frames so that prism lenses do not shift alignment.
- (B) 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, and to use the lens's prism characteristics to generate the desired amount of prism base-toward-blind side.

Decentration becomes a factor for strong correction, e.g. plus or minus 3 or 4 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.

(C) Cylinder or Astigmatism Corrections & Rx Tolerances are very important when using prism lenses and are especially sensitive when making field expander eyeglasses for people over 40 years who are less accommodating and 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 factors. 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) glasses.*

(D) Age Table for Prism Selection – Older people have reduced focus 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, 4 prism diopters – wait three months – and then remake the glasses with 5 prism diopters. Using this staging method, it is possible to get some patients up to 7 or 8 prism diopters. Having used this staging method early in our clinical research, we eventually found it to be an unnecessary burden for most patients. Instead, we develop the AGE vs PRISM table below. (Try the higher value first with trial lenses, and then the lower value, if necessary, and fit glasses once. They need not be changed until such time as new lenses are needed because of needed correction changes.)

<u>PATIENT AGE (Yrs)</u>	<u>PRISM DIOPTERS</u>
6 – 18	6 or 7
19 - 30	5 or 6
31 - 39	5 or 6
40 - 46	4 or 5
47 - 52	3.5 to 5
53 - 60	3 to 5
61 - 70	3 to 4
71+	3 to 3.5
aphakics	2.5 to 3.5

CV Glasses, TYPE-2 have *almost* the appearance of ordinary eyeglasses but with an added over-the-nose prism. The extra prism fits either in front of or behind a specially selected eyeglass frames. It's use DOES require user intelligence, awareness or training. These glasses can be made as single vision, bifocal or trifocal glasses and may accommodate just about any corrective lens prescription. **CV Glasses, TYPE-2 are recommended for some (but NOT all) people with Monocular Vision.** They expand BOTH central vision (thru main lens) AND peripheral vision (thru clip-on-prism) over the nose, to the blind side. These Type-2 CV glasses are most beneficial for outside activities, including walking, bicycling and driving.

The CV Glasses, Type-2 are made for a person blind in one eye but with “good” to “normal” acuity in the other eye. Essentially, the lenses have been ground and installed with the prism bases toward the user’s blind side for 3 to 7 degrees expanded central vision, plus the benefit of a special clip-on prism above the nose which gives 15 to 20 additional degrees of vision, simulating peripheral vision toward the blind side. This provides a total of up to 27 degrees of expanded vision toward the blind side. We will be describing two alternate methods for mounting the over-the-nose prism. One will be designated CVG Type-2A and the other CVG Type-2B.

Important Notes:

- (1) **PREPARATION** - TYPE-2 CV Glasses for Monocular People should NEVER be prescribed or dispensed as the first, or as the ONLY field expanding glasses, for anyone. Always prescribe or dispense TYPE-1 CV Glasses first – and then consider TYPE-2 Glasses as a second pair at some future time after the patient has become comfortable using the TYPE-1 CV glasses. (Sometimes, the Type-2 add-on prism can be made as a clip-on that can be attached to and removed from a Type-1 CV eyeglass frame.)
- (2) **TYPE-2 USER TRAINING IS REQUIRED** because of the special prism segment added over the nose, which the user must learn to use. Learning to use the added prism is comparable to a person learning to use a bifocal add for the first time. TYPE-1 Eyeglass users require no training; the glasses are effective even for stroke or brain damaged patients whose cognitive functions are impaired. On the other hand, TYPE-2 glasses require conscious judgment and reasonable cognition for use.
- (3) **TYPE-2 USER ACTIVITIES CAN BE DANGEROUS** – Many people desiring these glasses want them for potentially hazardous outside activities such as riding a bicycle, walking in high crime areas, or driving a car or boat. And, YES, they can be and usually are helpful for such activities. However, patients need to be cautioned as follows, for their own safety and for the safety of others:

(A) YES, these glasses do help in these situations because they expand, toward the blind side, BOTH central and peripheral vision. BUT, while expanding the vision, up to 7 degrees CENTRAL and up to 25 degrees PERIPHERAL, they do not restore the full, normal vision that was lost. Even with these glasses, monocular drivers must have and use appropriate inside and outside rearview mirrors and must follow careful defensive driving techniques.

(B) DISTANCE and SPEED JUDGMENTS by the user are most important for safety when using these glasses. People who are newly monocular are advised to take on-the-road defensive driver training whether or not they use CV Glasses. We have found that using these glasses, either type, significantly improves the newly monocular person's ability to judge distances and angles, to park, etc.

CVG Type-2 SPECTACLE PRESCRIPTIONS & SPECIFICATIONS - These glasses can be prescribed and/or dispensed by any eye-care professional, ophthalmologist, optometrist or optician. Retesting is needed at dispensing.

TYPE-2 CV glasses are identical to TYPE-1 glasses in basic design and construction. The same age table data should be applied. An important difference is that, while TYPE-1 glasses can be bifocal or trifocal, **we recommend that TYPE-2 glasses be single vision**, for distance. This lessens the weight and fragility, and enhances the peripheral vision expansion characteristics of the TYPE-2 glasses and makes the glasses easier to use.

Please refer to the EXAMPLE information at the beginning of this paper. We assume the patient is totally blind in one eye and is 30 years old and that he will have TYPE-2 CV glasses that are single vision, either plano or with a weak prescription. We assume he was tested and that 5 prism diopters were decided upon for his main or carrier lenses, both **prisms to be BASE-LEFT for this patient who is blind on his left side.**

This is how his glasses will be constructed:

1. **EYEGLOSS FRAME:** All-metal eyeglass frame that is light weight but rigid, preferably with two metal connections, one across the nose bridge and the other at the top of the frame. The eye sizes should not be too large because the prism lenses could become too thick. The height of each lens should be moderate and the width should be greater than the height. The two lenses are either plastic or polycarbonate – not glass. The frame must be compatible with the desired type of

prism mounting, e.g. OUTSIDE PRISM MOUNTING (Type-2A) ... or INSIDE PRISM MOUNTING (Type-2B).

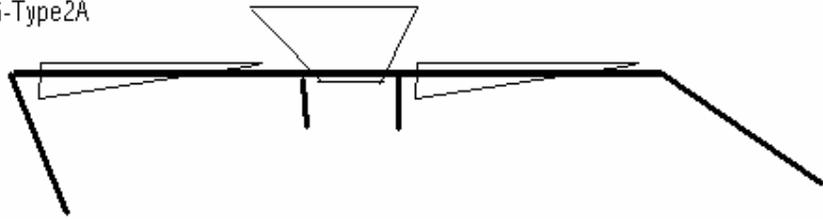
2. RIGHT LENS: plano or Rx single vision - with 5 prism diopters BASE-LEFT functional for vision to left with good right eye
3. LEFT LENS: plano or Rx single vision - with 5 prism diopters BASE-LEFT cosmetic for best appearance of blind eye

A 90 degree quartz prism, made as described below, is clipped or otherwise fastened to the bridge of the nose, inside or outside the eyeglass frame.

From industrial sources, a polished quartz prism is obtained. The apex of the prism is at a 90 degree angle and each of the other two angles is 45 degrees. The apex, which points toward the user's forehead, can remain pointed or, for a safer, more comfortable and more compact shape, a small portion may be cut off. The prism's front surface, which is parallel to the user's forehead, should be $\frac{3}{4}$ " to 1" long (wide). The thickness (height) of the prism, mounted, can be *either* $\frac{1}{4}$ " or $\frac{1}{2}$ " as preferred by the user.

CVG-Type 2A glasses are shown below in a top view, looking down from the top of the user's head. Because the prism is mounted outboard on the frame, over the nose, the eyeglass frame is worn close to the face and is quite comfortable. The disadvantage to the user is the odd appearance of the prism which often prompts people to ask questions about the purpose of the prism. The benefits of these glasses are the 4 to 7 degrees of vision expanded to the left at all times for central vision as afforded by the prism lens ... PLUS the additional 15 to 20 degrees of vision (simulated peripheral vision) given by the 90 degree quartz prism when the person looks sharply to the left or behind, to the left. The quartz prism is plano, of course, because vision through it is through the main lens which is a corrective lens when a prescription is required. (NOTE: The front-mounted prism can be used on CV Glasses, Type-1 if the frame was selected with this purpose in mind; and if the prism is mounted to a clip which can attach to and detach from the eyeglass frame.)

Fig. 1 - Top View CVG-Type2A



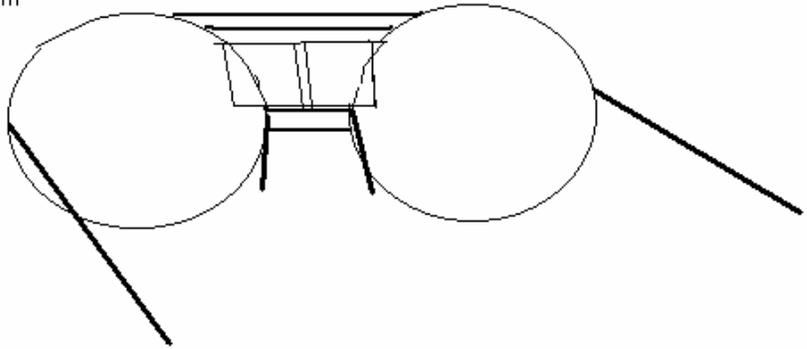
CVG-Type 2B glasses are shown below in a top view, looking down from the top of the user's head. This differs from the diagram above in that the 90 degree quartz prism is mounted behind the eyeglass frame. The appearance is better and the prism is much less noticeable to other people. Disadvantages are: (1) long nose pad legs are needed so that the apex of the prism does not touch and irritate the user's skin, and (2) vision through the 90 degree prism occurs before the carrier lens – not after it. For this reason, spherical or cylindrical corrections in the lens do not correct vision through the prism.

Fig. 2 - Top View CVG-Type 2B



Figure 3, below, shows a rear view of the eyeglass frame. The 90 degree quartz prism can be either on the outside of the frame (Type -2A) or on the inside (Type-2B). Note that the point or apex of the prism points toward the user's forehead. If outside, it cannot touch or irritate the skin. If inside, then long nose pad legs must be used, and the frame is worn low on the nose, to prevent the prism's apex from touching the skin.

Fig. 3 - rear view showing prism



CAUTION - Do NOT use fresnel lenses (of grooved plastic) as either main lens or over-the-nose prism. Fresnel lenses are of such poor optical quality as to make them entirely unsafe and unsuitable for this application. Please use only a highly polished, high resolution quartz prism obtained from industrial (optical equipment maker) sources.

For additional information, please email: nire@warwick.net or contact:

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