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## The Art of Prescribing Low Amounts of Prism

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# The Art of Prescribing Low Amounts of Prism

## Abstract

*Expanding the Box*

## Keywords

prism

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## INTRODUCTION

Prescribing prism has a long history in the ophthalmic field. As it pertains to the topic at hand, the art of prescribing low amounts of prism, the origin of my approach can be traced to an ophthalmologist whose background was in mathematics and statistics prior to entering medical school.<sup>1</sup> In the mid-20th century in Philadelphia, Dr. Samuel Askovitz was prescribing micro-prism for students with unresolved learning issues. His niche population was students mastering the Hebrew language in which there is a visual sub-code of symbols that modifies pronunciation of letters. The font size, font type, crowding of print, and non-linear scanning required, all added to the complexity of the visual demands. The amount and direction that he prescribed was unconventional at the time, consisting of low amounts of base-in, vertical, or yoked prisms (prisms with the same base direction in both eyes). Accumulated anecdotal evidence in subsequent years has broadened the application of low amounts of prism to symptomatic patients with unresolved visual complaints that may be attributed to instability in the binocular visual system.

My primary purpose here is to discuss prism, but specifically as it applies to relatively small amounts. For the purpose of our discussion we will consider a small amount of prism to be any magnitude up to and including three prism diopters, and frequently on the order of one prism diopter or less. That is noteworthy because many clinicians in the United States tend to shy away from prescribing small amounts of prism, particularly in the absence of diplopia. In contrast, practitioners in European countries are comparatively more aggressive about incorporating small amounts of prism into spectacle lens prescriptions.<sup>2</sup>

## BACKGROUND

Optometrists who prescribe prism for non-strabismic patients often use the associated phoria method with success, for both vertical as well as horizontal prism.<sup>3,4</sup> This provides another level of analysis beyond conventional methods relying solely on the measurement of dissociated phorias typically used for strabismic patients. Associated phoria is the most accessible clinical component of fixation disparity testing, and its measurement is influenced by the nature of the central fusion lock within the disparity target.<sup>5</sup> When a central fusion lock is present, the disparity measurement and associated phoria values are less, and smaller amounts of prism are typically indicated as compared to when there is no fusion lock.

Ronald Mallet, FBOA in the U.K., was the first clinician to introduce a user-friendly measurement device for fixation disparity and associated phoria testing at near point.<sup>6</sup> He referred to the small misalignment of the nonius lines referenced to the right and left eyes respectively as a retinal slip. As noted by Karania and Evans, it is important not just to determine the presence of fixation disparity or offset of the nonius lines, and the amount of prism to align to zero in each eye which represents the associated phoria, but to detect instability or drift of the respective lines.<sup>7</sup> In deriving the optimal prism to prescribe, and the balance or splitting the prism between the right and left eyes, the amount of prism that stabilizes binocular instability or drift is important.

My preference among the various targets commercially available for near point detection of fixation disparity is the polarized refraction slide at near produced by Bernell Corporation (See Figure 1).

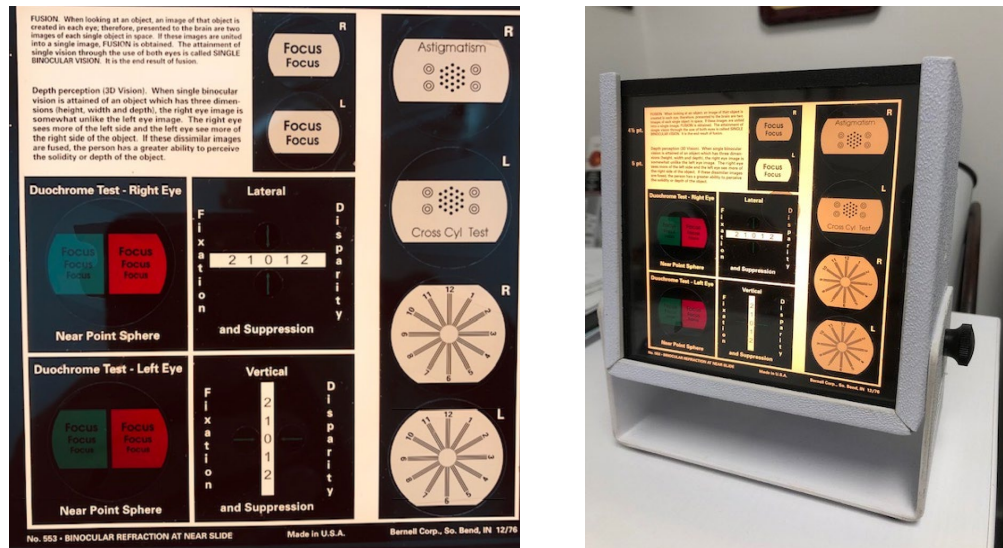
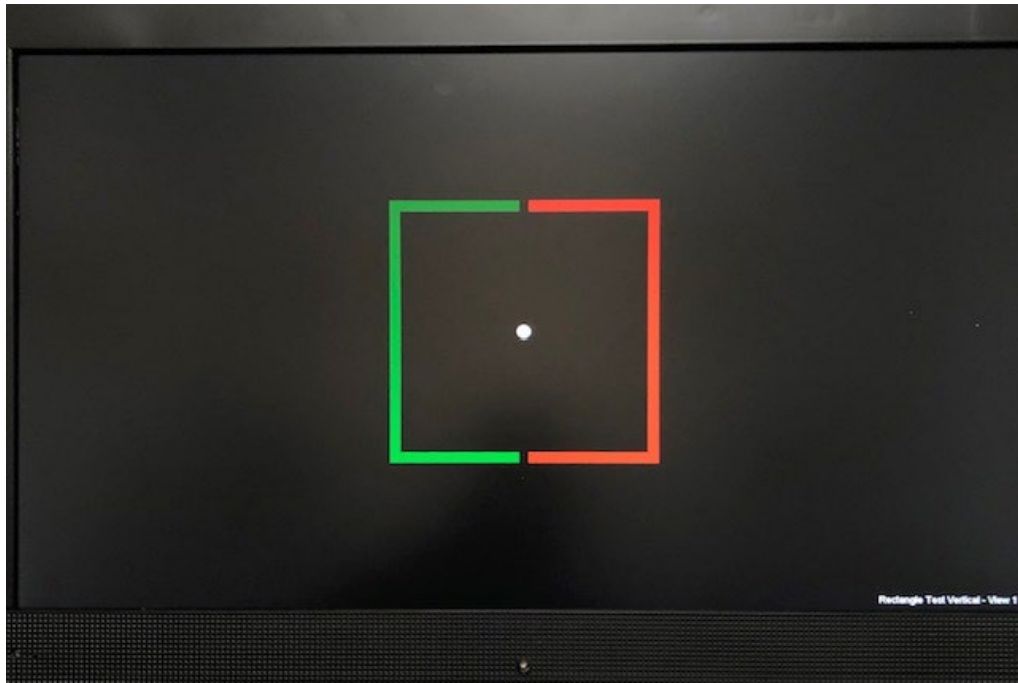


FIGURE 1. (a) Bernell No. 553 Binocular Refraction at Near Slide. (b) Bernell Lantern with slide (a) inserted.

The slide inserts into an illuminated lantern box and is used outside of the phoropter. The nonius lines are two slim green arrows, one above a central zero seen only by the right eye and one below seen only by the left eye. It tests for vertical as well as lateral disparity. An advantage of this slide is that it also contains a polarized duochrome test so that the subjective balance of accommodation between right and left eye and the effect of added plus lenses can be determined outside of the phoropter as well. Given the inter-relationships of the AC/A and CA/C ratios, it is also

useful to compare the influence of added plus lens power at near on fixation disparity and the influence of prism on the binocular balance of accommodation.

For distance fixation disparity detection, and the measurement of associated phoria, I have found some of the targets introduced by Hans-Joachim Haase to be very useful. This is part of the Mess-und Korrektionsmethodik nach H.-J. Haase (MKH-Haase system), (See Figure 2) used extensively in German speaking countries, and its comparison to other common clinical tests has been reviewed in detail by researchers at the University of Waterloo.<sup>8</sup>



## METHODOLOGY

My approach to prescribing low amounts of prism is a hybrid of the Mallet and Haase determination of an associated phoria, blended with data from the Maddox Rod measurement of a dissociated phoria in free space. The determination of an uncompensated phoria is conducted after a conventional refraction to determine the best spectacle lens Rx (related to visual acuity) and involves retinal slip in Panum's

area. This area predicts that there is less tolerance for, and more symptomology from small amounts of uncompensated vertical misalignment.<sup>4</sup> I therefore place a premium on probing the impact of vertical dissociated and/or associated phoria in accordance with the following sequence.

1. I first measure the dissociated phoria with a Red Maddox Rod/Risley Prism at distance and near, comparing vertical phoria with a measuring prism over the right eye vs. left eye. (See Figure 3) Near testing is done at the habitual reading or work distance and the angle of gaze is typically below eye level.

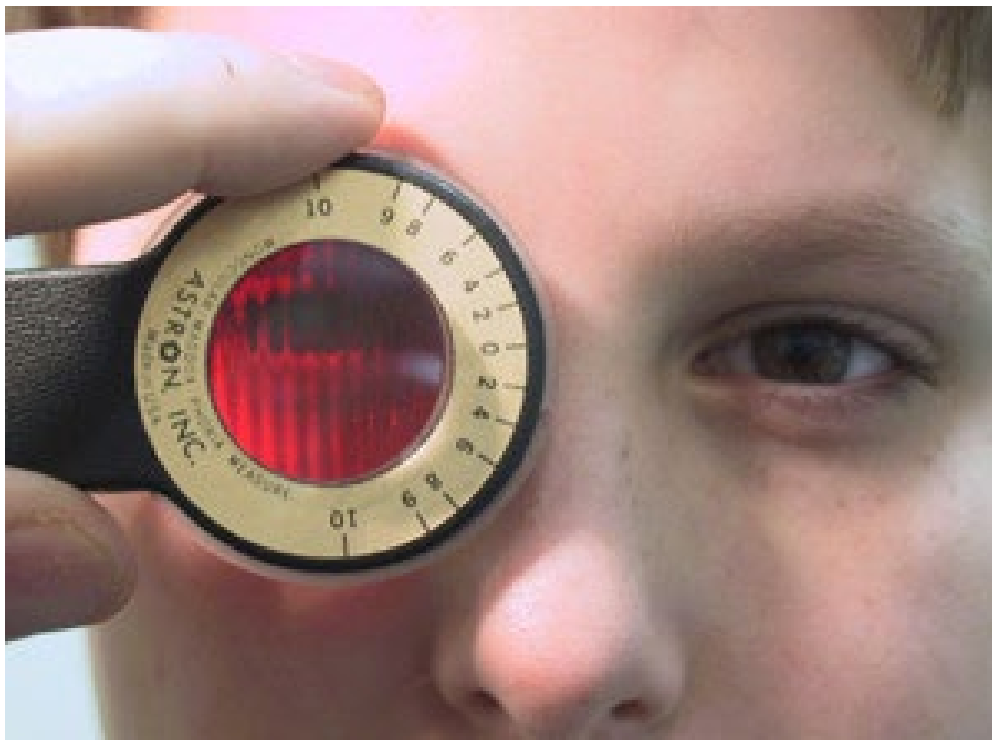


FIGURE 3. Risley prism integrated with red Maddox rod, distributed by Bernell as Phoria Measure BC 1211.

2. Vertical fixation disparity is then probed at distance and near, taking note of unilateral vs. bilateral slip, and asymmetry.
3. A horizontal line of letters is then presented, and vertical vergence ranges are measured at distance and near. I look for asymmetry (for example, a right hyper of 1prism diopter should be confirmed with diplopia occurring on BU prism sooner than BD prism, and/or recovery BU prism poorer than

BD prism). In addition to supra and infravergence ranges, I do loose prism flips to measure vertical vergence facility.

4. If there is habitual head tilt, I conduct the Worth Dot test looking for diplopia that occurs in the field opposite to the habitual tilt and see if the tentative vertical prism in primary gaze helps extend the range of single vision.
5. After this, Wirt Circle stereopsis is measured without prism, and then repeated with the tentative vertical prism to note any improvement.
6. I then have the patient look at a paragraph of print to gain a sense of comfort or performance, and then repeat this with tentative vertical prism to note any improvement.
7. If there is significant horizontal or cyclophoria, I repeat the assessment with prism in place and see if it lessens considerably. If not, I repeat the vertical phoria measure with horizontal prism as derived through horizontal associated phoria or disparity.
8. With the tentative prism in place, I take the patient into an open space and note any change in head posture or gait. I elicit their sense of comfort in space as they look around, as well as while looking out a window across the street with cars passing by.
9. Based on history and testing, I decide along with the patient where their greatest concern is: at distance compared to near. Many times, the patient will be able to absorb the same prism in low amounts for all distances, but that may not always be the case.
10. I also consider the influence of vertical prism on accommodative balance, as well as the effect of plus lenses on vertical heterophoria and the indications for asymmetrical plus power at near. You would expect lateral interactions through the CA/C and AC/A relationships but can't assume that vertical prism has no impact on accommodation and vice-versa.

If there is no clinically significant, uncompensated vertical imbalance, full attention is turned toward horizontal imbalance, particularly at near. The approach is similar to the sequence above in comparing the profile of associated phoria as well as the dissociated phoria. As with vertical phoria, the smallest amount of prism to neutralize or stabilize the fixation disparity is used as a performance probe for the

tentative prism Rx. Because I am most interested in the patient's response to various performance tests such as reading text or using a personal device, prism can be interposed during the task or placed in a trial frame. It is not uncommon to find combinations of vertical and horizontal micro-prism amounts in both lenses yielding the best results.

In addition, my observation has been that patients with a mild or subclinical extraocular muscle pareses may adopt subtle head turns or tilts that invite small amounts of yoked prism. This may be a residual effect of an early history of torticollis and is sometimes seen in mild traumatic brain injury (mTBI). In rare cases the patient may benefit from prism prescribed at oblique axes. Lastly, patients with anisometropia may require a low amount of slab off prism to aid fusion in downgaze, as when reading or computing, due to Prentice's rule inducing asymmetric vertical vergence demand. Prescribing for these cases is beyond the scope of this paper.

## DISCUSSION

Patients with unresolved binocular problems usually will not respond adequately to approaches involving only sphere and cylinder combinations, or a plus lens addition at near. My clinical experience has been that a significant percentage of these patients respond positively to small amounts of prism, referred to as mini-prism or micro-prism. This term was originally used by Bowan for the prescribing of low amounts of base-in prism at near<sup>9</sup>, and has more recently been used by Feinberg, Rosner, and Rosner with regard to prescribing small amounts of vertical prism.<sup>10</sup>

I also find it advantageous to conduct a chair-side, out-of-the-phoropter probe by interposing loose prism over the patient's habitual Rx, or unaided, so that only one variable is changed at a time. For this purpose, I favor the use of individual round prisms. **(See Figure 4)** This approach also lends itself to a short-term cross-over trial, where the patient serves as her own control. If the examiner has determined, for example, that 0.5 prism diopter base up right eye is indicated by clinical testing, then he can compare the response to prism in the base up direction to the response in the base down direction. The same holds true for combining vertical and horizontal prism, as well as changing the balance between prism amounts for the right and left eyes when the disparity or phoria measured is asymmetrical.



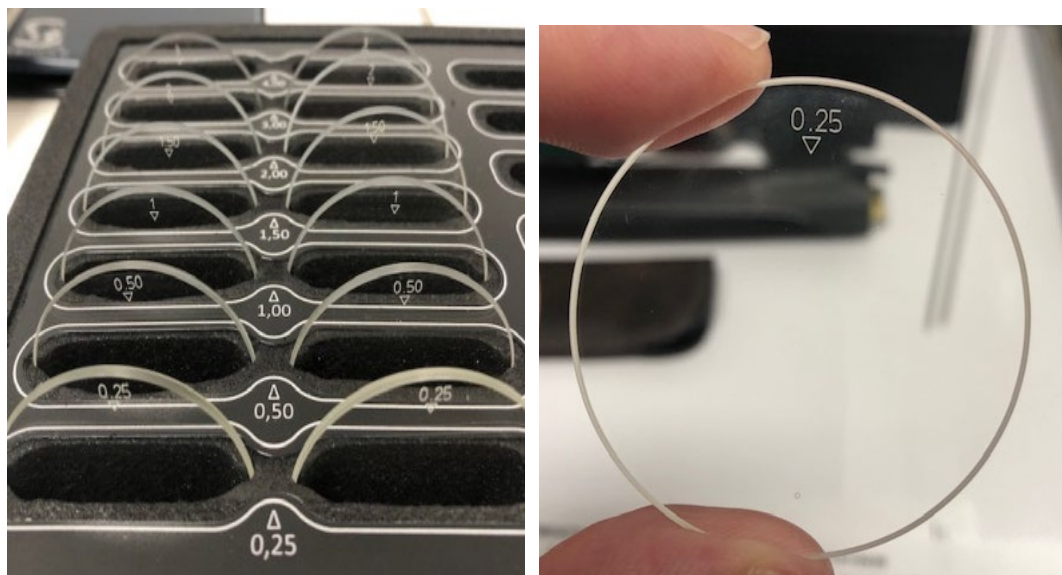


FIGURE 4. (a) Left figure. Individual loose prism set manufactured by Optomat in Spain, etched for easy identification of prism amount and base direction. (b) Right figure. This is particularly helpful to the examiner in locating the base direction for very small amounts of prism. <https://youtu.be/5swImWAI2e0>

The mechanisms through which low power prisms effect their changes remains to be elucidated. Elsewhere I have reviewed the spatial properties of prisms that have been proposed to account for recalibration, postural adjustment, and learning changes.<sup>11,12</sup> Irrespective of the precise mechanisms involved, my clinical experience has been that prisms prescribed in the lowest amount to effect the maximum therapeutic benefit as described above can subsequently be reduced over time.

Prism prescribed in the manner outlined above can also be synergistic with traditional optometric vision therapy programs. However, not all patients have the time or resources to engage in vision therapy. When prescribing small amounts of prism, it is important for the optometrist to monitor the patient's response to the prism prescription in order to make adjustments through re-balancing the prism when indicated. This is guided by repeating key elements of the initial evaluation including case history, questionnaires, diagnostic evaluation, and performance testing. The interval at which I conduct progress evaluations is typically every three to six months but may be shorter or longer depending on the patient's individual needs and response profile.

## CONCLUSION

The art of prescribing low amounts of prism, as most other clinical interventions, is acquired over time and with experience. Prism prescribed in the United States by ophthalmic providers has mainly been reserved for relief from diplopia. When the binocular system is stressed or debilitated to its breaking point, it is not surprising that prism may become a crutch of sorts. European providers have, historically, been more receptive to prescribing small amounts of prism well before the patient has devolved into diplopia. My approach is modeled more after the European systems pioneered by Mallet and Haase, as reviewed above.

In presenting a suggested sequence of micro-prismatic probes, my goal has been to provide a rationale for the prescribing of low amounts of prism in the vertical as well as horizontal directions, and in combinations as indicated. Emphasis has been placed on values typically less than three prism diopters, as utilized in prescriptions for patients who have difficulties related to visual performance problems or unaddressed visual symptomology. The performance difficulties most often relate to reading and instability of print, and the symptomology typically involves unresolved asthenopia and other elements of visual comfort. In that regard, the prescribing of low amounts of prism is an art that parallels the prescribing of low amounts of added plus lens power for near.

## Addendum

For those interested in more information on the topic, I draw your attention to two audiovisual presentations. One is a graduate level seminar presented to Optometry students in 2018 on prism prescribing by Dr. James Kundart, an educator at the Pacific University College of Optometry.<sup>13</sup> The other is a lecture titled Neurotherapeutic Approach to Prescribing Low Amounts of Prism that I presented to an international audience as part of the iheartVT2020 online sessions.<sup>14</sup>

## Financial Disclosure

The author has no financial interest in any of the products or lectures mentioned in this article.

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