THE PRISM TEST FOR STRABISMUS SCREENING*

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The ophthalmologist and pediatrician must have a quick and reliable test for strabismus detection. Strabismus is here defined as a manifest eye deviation of any degree. Fusion is considered here to be the blending of the central (foveal) as well as the peripheral cerebrally presented images.

The cover test, especially the cover-uncover test, is a most reliable test which occupies the place of the "supreme court" in examination of the exact characteristics of an ocular deviation, as well as for the detection of a frank strabismus.

However, sometimes the ophthalmologist is not certain of the results of the cover-uncover test, especially as to whether there was or was not bifoveal fusion, i.e. full fusion. It is not always easy to detect a very small movement of an eye to pick up fixation, or indeed, the remaining uncovered eye may hesitate for a moment, or for a considerable time, before picking up fixation of the target light. Furthermore, when eccentric fixation is present in the strabismic eye, it does not move to take up fixation with the fovea. Or, the deviation may be so small (1-2 prism diopters) as to escape detection.

It is especially in patients with small degree of esodeviations where the cover test procedure does not always unequivocally answer the question as to whether bifoveal fusion is or is not present. It is well to have an alternative test to resolve this common problem. It is especially desirable to have a simple strabismus screening test, that will sift out patients requiring further care, i.e. a manifest strabismus, deep amblyopia, or other situations where the fovea of one eye is not partaking in the binocular act.

Description of the prism test for strabismus screening. The child's attention and fixation are secured with a small light. The 4 diopter (4 prism is held base-out) before one eye, while the other eye is observed by the examiner. If the observed eye moves and stays moved, when the prism is introduced before the other eye, a strabismus has been detected. The prism is similarly placed before each eye in turn.

This five-second detection test reduces strabismus screening to the simplest possible objectivity, requiring only patient cooperation in maintenance of fixation on a small light or target, and the observer's ability to detect a small eye movement. It does not depend upon the ability of the questionably deviating eye to promptly and securely take up foveal fixation. Because of this, it is often a useful adjunct to the cover-uncover test, and as such fulfills the examiner's wish to always have a suitable alternative test in doubtful situations. (Figure 1—A, B, and C.)

Basis for the test. The basis for the positive screening criterion, namely that the eye moves and stays moved, rests upon the fact that the macula of the strabismic eye is out of the binocular picture, and insofar as the selected parameters of the test are concerned, the strabismic eye may be equated to a blind eye, which is still attached to muscles, and therefore capable of movement with its fellow eye. Indeed, the analogy of the strabismic eye being equated to a blind eye is a workable explanatory concept since the testing prism (4 prism diopters) is selected to test the functionally absent fovea of the strabismic eye. Even very small degrees of deviation in which there is an absence of bifoveal fusion, fall into this category. A strabismic eye, of any degree, or a blind eye, move

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along with the fixing eye when the fixing eye changes from one fixation point to another.

When the small prism is placed before the deviating eye, the image on the retina is optically displaced by a small amount, which, since this retinal area is blotted out in consciousness during the strabismic binocular act, the shift of the object is not seen, and no eye movements occur. Indeed, it is as if the prism had been placed before a blind eye.

When, however, the prism is now placed before the good fixing eye, the image is similarly optically displaced on the "awake" macula, which appears to the subject as if the target has been moved. The subject maintains fixation on the light by moving the good eye behind the prism to keep fixation on the optically shifted target. Both eyes move together (by the amount of the prism image displacement) even though the fellow eye be blind, deeply amblyopic, or suppressed as in strabismus. The strabismic eye is simply carried along as excess baggage during the re-fixation of the good eye, so long as muscles are somewhat capable of moving the poorer eye to any degree. The essence of the strabismus screening criterion (presence or absence of bifoveal fusion) is the observation that the eye without the prism has moved and stayed moved, which reveals that its macular function is not participating in the binocular act, i.e., there is an absence of bifoveal fusion, or a manifest strabismus.

It is important to note that the observed eye must move and stay moved. The reason for this screening criterion becomes obvious when one examines the other kinds of eye movements that may take

*An inexpensive, 4-prism diopter glass or plastic prism may be obtained from any local optician. Parsons Optical Laboratories, 518 Powell Street, San Francisco, California, will supply a prism as marked in Figure 1.A.

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place with this test. These are discussed
now for full understanding of the various
types of reactions, but are not germane to
the sole criterion discussed above.

No apparent movement of the observed
eye may indicate either that the prism was
placed before a manifestly deviated eye, or
that bifoveal fusion was present, and a
very slow fusion vergence movement took
place without detection.

Or, the observed eye may move, but not
stay moved, which may occur in some non-
strabismic eyes when the non-dominant
eye of a fused pair may be shoved “off
base” of its insecure, but awake macular
fixation, by the re-fixation and movement
of the good dominant eye However, in
this case, the fusion mechanism is immedi-
ately alerted, and a quick readjusting eye
movement takes place, and the eye in
question does not stay moved. If the
moved eye does not remain moved, the
type of readjusting fusion movements dif-
fer depending upon whether there is a
normal fusion status without deviation of
any sort, or a convergent or divergent
latent deviation, or an occasional strabis-
mus, i.e., all latent deviation of one sort or
another.

Whether the questionably strabismic eye
moves and stays moved during the test
depends upon whether or not the fovea of
the observed eye in question is awake and
participating in the binocular act. If it is
participating (good bifoveal fusion), the
optical shift will be noticed by it, and fu-
sion readjustment movements take place.
If it is not participating, the shift will go
unnoticed in the questionably deviating
observed eye, and no readjusting move-
ments take place, i.e., it moves and stays
moved.

Qualitative differences in fusion states.
It should be noted that the prism test for
strabismus screening (absence of bifoveal
fusion) does just that, and no more. It

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Figure 1.B. (A) represents convergence strabismus of the left eye under usual circumstances. (B)
shows the patient's left eye move and stay moved as the prism is placed before the good fixing right
eye. This indicates a left eye strabismus (in this case esotropia.) (C) When a prism is placed befor
the strabismic eye, the observed right eye does not move. See text for detailed explanation.
Figure 1.C. More detailed description of the two movements described in the text. A. The fixation light is imaged on the fovea of the dominant left eye and on a suppressed non-foveal area of the esotropic eye. B. When the 4-prism dioptric prism is placed base-out before the suspected deviating eye, the image in this eye is merely moved within the suppressed area and is not perceived; hence there is no movement of either eye. C. At the moment of prism introduction before the dominant eye before eye movement occurs, the image is moved from the fovea to the non-foveal area which is perceived. D. The dominant fixing eye alters its fixation so that the image again falls on the fovea, while the image in the conjugately moved right eye merely moves about unnoticed in the suppressed area. It is the conjugate movement, such that the observed eye moves and stays moved, that is the positive test criterion for detecting a manifest strabismus (absence of bifoveal fusion).

do not further differentially separate the group of fusors with bifoveal fusion, whether they show normally orthophoric, or any latent deviation (phoria), or occasional-intermittent deviations.

Exodeviations either fuse well, or have a frankly manifest strabismus with a concomitant sensory suppression adaptation.

Esodeviation may fuse with bifoveal fusion, or may not fuse with varying degrees of sensory defect. Hence, here one must be explicit relative to the degree of fusion present. Bifoveal fusion denotes the most critical or highest form of fusion.

Defects of fusion in esodeviations extend centripetally so that it is possible to have “fusion” of perimacular areas with strabismus of the foveas (absence of bifoveal fusion). (Refs. 1, 2)

Patients with a frankly manifest strabismus of small degree, or patients with fusion disparity, may exhibit vergence movements when a small prism is placed before an eye, or on a major amblyoscope if the amblyoscope targets are large enough to engage the non-suppressed portions of the field. This observable vergence movement may be a “fusion vergence movement” with normal retinal correspondence, or it may be a vergence movement in the presence of anomalous retinal correspondence that “keeps the eyes zeroed” in the deviated position.

Hence, the presence of an observable vergence movement is not a suitable criterion for “fusion” since such a vergence movement may be observed in some patients with as much as 15 prism diopters of manifest deviation with well-developed anomalous retinal correspondence.

Summary of prism test and examples. In summary, the prism test for strabismus screening rests upon the sole, simple observation that the observed eye moves and stays moved, when the prism is placed before one and then the fellow eye. The test may be done with a relatively unrestrained head, so long as fixation is secured on a target at any suitable (preferably more distant) position. The steps in the test are as follows:
1. The child’s attention and fixation re-
main secure on a small light or target.

2. A small (4 prism diopter) prism is appropriately placed before one eye, while the examiner observes the other eye.

3. If the observed eye (without prism) moves and stays moved, a frank strabismus of the moved eye has been detected. There is an absence of bifoveal fusion.

4. Step 2 is repeated. The prism now is placed before the other eye. If in either instance, the observed eye (without prism) is seen to stay moved, a strabismus has been detected.

A few examples follow:

Example 1. There is a suspected, right convergent strabismus (esotropia). The prism is placed before the right eye. No movement is seen in the observed left eye.

The prism is now placed before the left (fixing) eye. The right eye is observed to move and to remain moved. Therefore, a right strabismus has been detected. The right fovea is not participating in the binocular act.

Of further interest, but not necessary to establish the fact that a strabismus exists, is to note that the moving eye adducts, indicating that it was deviating towards the nose under habitual, usual conditions, and thus, a convergent strabismus (esotropia) has been detected.

Example 2. There is a suspected alternating esotropia. The prism is placed before the right eye. The observed left eye moves and remains moved. Therefore, a left strabismus exists.

No further testing is necessary to establish the fact that a strabismus exists. However, one may complete the second part of the test, and now place the prism before the left eye. In alternating strabismus, the now observed right eye may be noted to move and remain moved, indicating an alternating strabismus.

During the first part of the test, the right eye was fixing, with a left strabismus. While the examiner was moving the prism away from the right eye, and before placing it before the left eye, the subject may have switched fixation (alternating strabismus) so that at this time a right strabismus exists and will be detected.

Example 3. There is a suspected latent deviation, such as an esophoria (a latent convergent strabismus masked by the fusion compensation). The prism is placed before the right eye. The observed left eye is seen to remain stationary, or to undergo a fine oscillatory readjustment fusion movement.

The prism is placed now before the left eye. The now observed right eye may seem to undergo similar oscillatory readjustment fusion movements. There is an absence of a positive test criterion, namely, an observed eye movement which remains moved, in either instance, thus ruling out a frankly manifest strabismus. There is bifoveal fusion present.

When the results of the prism screening tests are doubtful, one may start the five-second test all over again, preferably preceded by having the patient blink a few times, move his head, and repeating the test.

This test has been used by the author for years as a simple strabismus screening device, which has been especially useful to the ophthalmologist in the differential diagnosis of certain puzzling, small degree ocular deviations. (Reference 3)

The practical simplicity of the test affords it a place in the doctor’s armamentarium.

References