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DIAGNOSIS OF VERTICAL DEVIATIONS OF THE EYES

BY

RODERICK O'CONNOR, M.D.

SAN FRANCISCO

THE object of this paper is to emphasize the following points :

(a) In the diagnosis :

1. A hidden vertical deviation is the commonest cause of a persistence of asthenopic symptoms after accurate correction of a refractive error and any apparent heterophoria.

2. A complete and accurate diagnosis of heterophoria, in kind and degree, can be made only by the aid of prolonged monocular occlusion (Marlow). This procedure is the same to the extra-ocular muscles as mydriasis is to the intraocular and its importance can be upheld by the same line of reasoning. As absolute proof of this statement it might be well to take out from Table I the 23 cases that showed exact orthophoria in all directions before patching. In these cases the final tests, as regards vertical deviations only, were, as follows (in prism degrees) :

1° to 2°, eight cases; 2° to 3°, five cases; 4° to 5°, two cases; 6° to 7°, one case; 7° to 8°, one case.

3. Nearly all cases of vertical deviation have a parietic foundation.

(b) In the treatment :

1. In the lower deviations vertical prisms are usually effective in giving relief—frequently severe symptoms disappearing after neutralizing errors as low as one degree.

2. In cases beyond the possibility of prism correction or when, because of low refractive error, the patient wishes to avoid altogether the wearing of glasses, operation can be done without any fear of bad results provided it be a shortening of the weak muscle.

Stevens was of the opinion that one degree of vertical deviation could cause symptoms as severe as fourteen of horizontal. There is no doubt that it does cause disproportionately severe symptoms. I have one case in which the correction of two degrees of entirely hidden hyperphoria caused the disappearance not only of headaches and disabling eye symptoms, but also of digestive troubles so severe that an exploratory abdominal operation, to determine their cause, was under serious consideration. The reason for this disproportion is, in all likelihood, that the correction of a vertical deviation involves an entirely abnormal use of the muscular apparatus. Either the elevators of one eye act with the depressors of the other in varying amounts to bring the eyes to a level or one group acts for the entire amount. In either event the functioning is abnormal as compared with the more or less normal paired action of the horizontal recti in overcoming horizontal deviations. Furthermore, horizontal deviations, especially esophoria, are often spasmodic (false) and lessen or disappear on correcting the refractive strain, while a vertical deviation is usually true and permanent. The results of monocular occlusion given in Table I prove this statement.

Prolonged Monocular Occlusion

I have been using this procedure since early in 1919, and in a short paper read before the Pacific Coast Oto-Ophthalmological Society in that year I emphasized its importance. By the spring of 1920 I had accumulated data in about 50 cases with the idea of publication, when Marlow's paper appeared in the *BRITISH JOURNAL OF OPHTHALMOLOGY*. Until then I had been ignorant of his work. In my opinion he is entitled to the credit for discovering the greatest advance in the diagnosis of heterophoria. I never treat a symptom-causing heterophoria till the information afforded by monocular occlusion is obtained. I have seen so many cases of esophoria disappear to be replaced by vertical deviations that I now suspect such cases to be spasmodic conditions of the interni associated with the effort of bringing the eyes to the level.

My first case was stumbled on accidentally, being a young woman who had had headaches and eye disability for many years. She was practically emmetropic and showed only an esophoria of four degrees. It has been my practice to cover one eye rapidly to develop a total deviation (Worth's scheme), and this was done in expectation of finding a sufficient amount of esophoria. But, much to my surprise, the esophoria disappeared to be replaced by an exophoria of four degrees and a hyperphoria of four degrees. This took ten days. She was perfectly comfortable while wearing the patch for the first time in years. She was then given vertical prisms and her troubles were over.

Since that experience I have been using occlusion in all cases where it can be proved that the symptoms are due to the eyes and where proper correction of any refractive error has failed to give results desired.

A more general use of this procedure will cause a reduction in the number of cases of "retinal asthenopia" almost to zero.

In addition to the true muscle balance the following information is obtained by prolonged occlusion.

1. Whether or not the patient is really suffering as much as claimed. I feel that those who refuse to wear the patch are not suffering much and tell them so while advising its use.

2. The character of the deviation whether paretic or not. The great majority of vertical deviations have a paretic foundation as emphasized by Edward Jackson. It is most important to locate the weak muscle, for any needed operative work should be done on it and should be a shortening. I would consider myself guilty of malpractice in tenotomizing a right superior rectus to balance a paretic left superior rectus. Such is permissible only in the higher grades of vertical squint where shortening has failed to give sufficient result. Even in such cases I prefer to repeat the shortenings and in one case did so three times on the same muscle, finally with success, and without cutting the superior rectus of the other eye.

3. Whether or not any imbalance found is the cause of the symptoms. In practically all cases the discomfort and disability disappears or is noticeably lessened when the binocular strain is abolished and this in spite of the annoyances incident to monocular vision. For this purpose the patch is worth while in cases of pure insufficiency of convergence of which I have seen several cases.

In his summary of muscle literature for the year-book Dr. Duane raised the objection that normal eyes might show these deviations if occluded. This is entirely likely. Very few people

are emmetropic but plenty of ametropes have no symptoms from their errors. The same is undoubtedly true of muscle imbalances. The following facts prove at least that the measurements disclosed by the patch are true deviations :

1. Prisms prescribed on the basis of the patch measurement do not cause the appearance of an opposite test measurement.
2. Cases operated on on the same basis do not develop the opposite condition, even when occluded later on to determine this point.

There is just as much indication to relieve muscle imbalances, even though slight, that are causing trouble, as there is to relieve low refractive errors, possibly more as their correction involves a more complicated action.

In using monocular occlusion the sighting eye is located by the ring test and the patient directed to keep the other eye occluded all the time he is awake. He is requested to use the one as he would like to use the pair and to note whether or not the discomfort lessens. The relief is often marvellously prompt as shown by the case mentioned under introductory remarks. She had absolute eye disability and constant headache with nausea, vomiting, and other digestive disturbances. All ceased within an hour after starting the patch, and on reporting for the first test three days later she informed me that in that time she had made a dress; was able to read as long as she wished, and that the indigestion was a thing of the past. Measurements are to be taken every two or three days till two agree. I have had cases where, on first test, no appreciable change had occurred, but the relief afforded caused it to be continued with success in developing a suspected deviation. Most of the cases take six days, some eight, and a few ten to become consistent.

Changes after patching occur in approximately the following order :

1. Increase in divergence—
 - (a) increase in a present exophoria;
 - (b) orthophoria may become an exophoria;
 - (c) esophoria lessens;
 - (d) esophoria disappears to be replaced by an exophoria.
2. Increase in a present vertical deviation or the appearance of a hidden one.
3. Appearance of a combination of exophoria with the vertical
4. Increase in an esophoria (uncommon).
5. Reversal of vertical tests (rare).

TABLE I.

EIGHTY CASES IN WHICH THE DIAGNOSIS WAS MADE BY
MONOCULAR OCCLUSION.

In placing a value on this table the following points must be considered :

1. All of these cases had severe symptoms amounting to practically complete disability from eye fatigue, severe headaches or both. Many had car-sickness, dizziness. Some had nausea and digestive difficulties. A common complaint was pains in the neck, and practically all were head tilters.

2. All had had examinations before, most of them many times, with no relief. Those having first examination failed to show enough, by usual method, to account for the severe symptoms. Some were even orthophoric or practically so. Some were even emmetropic.

3. The results column prove the value of the method in the almost uniform relief obtained by treatment based on findings as brought out by the patch.

4. Those who failed to secure entire relief had too great a deviation to correct by prisms, or had a definite insufficiency of convergence. Most of these refused operation. Some permitted it and obtained the desired effect.

5. This table shows the one important fact running through all medicine. It is necessary to know what one is treating in order to obtain results.

6. Under older ideas tenotomies for non-existent esophoria could have been done in many of these cases. I had one case of horizontal orthophoria go to 14 degrees of exophoria behind the patch, which shows that a tenotomy to correct an apparent exophoria of eight would do no good if the real deviation were 20.

7. It is my opinion, therefore, that the monocular patch is a necessary preliminary to the intelligent treatment of the heterophorias, and that good operative results in the absence of the information it affords are apt to be due more to luck than to good management.

Case No.	Before Patching.			Maximum Deviation.		Treatment.	Results and Remarks.
	Eso.	Exo.	Hyper.	Convergence (inches)	Eso.	Exo.	Hyper.
2982	...	1	...	...	...	6	L 6
2963	1/2	...	...	...	...	6	L 2
1323	...	...	...	5.5	...	...	L 4
2964	...	2	R 1/2	...	...	7	R 1
2875	...	...	...	4.5	...	9	L 1/2
2949	2	...	R 1/2	...	...	4	R 4.5
1983	...	...	...	...	...	4	L 7.5
2300	1	...	...	...	3	...	L 1.5
1298	...	...	...	...	...	...	L 2
2586	...	1	...	12	...	6	L 8
2877	4	...	...	...	1	...	L 5.5
2881	5	...	R 1	...	...	3	L 2
2355	1	...	...	...	1	...	L 2 1/2
2454	5	...	...	...	...	4	L 6
2505	...	...	...	...	...	1	L 3.5
2603	3	...	...	5.5	...	...	L 2.5

Never returned
 "Very much better. Can use eyes in relative comfort"
 Entire relief
 Prisms gave no relief. Comfortable with patch so that cause of symptoms is probably the exophoria
 Never returned. Case probably one of insufficiency of convergence
 Very much better as to headaches and eye discomfort
 Operation refused
 Would not follow advice and disappeared
 "Great relief from lifelong disability"
 Refused operation
 Fifteen months later reports entire and continued relief. Able to use eyes in any way and for any time. Entire disability before operation
 No more nausea. Eyes ache at times but not severely
 No better. Headaches might be due to cerebral arteriosclerosis as that condition is marked in the retina although patient is a girl of only 19 years
 "Perfectly comfortable in all uses of the eyes even long motor trips." There had been almost complete disability
 Entire relief from headaches, dizziness and eye discomfort
 No better. Relief under patch points to weak convergence for which operation advised but refused

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3130	2	...	...	...	...	...	L 2	Prisms 1 up and down	Entire relief. "Feels fine except when glasses are off"
3079	...	...	...	10	...	5	L 1.5	Left internus shortened	Entire relief. Patch proved case to be one of weak convergence
3146	...	...	...	6	...	4	R 2	Prisms 1 up and down	Better. No dizziness. Near work for a short time. Case is one of weak convergence for which operation was advised
206	...	...	...	...	...	7	L 4.5	Prisms 1.5 up and down	Very much better
3055	3.5	...	L 1/2	...	15	...	L 3	Shortening left externus advised. Disappeared	Operation refused
3083	...	4	R 2	...	...	7	L 4 reversal	Prisms 1.5 up and down	Very much better. "But little nausea or dizziness"
2350	...	...	...	5	...	2	L 1	Prisms 1/2 up and down	No better. Possibly a case of weak convergence
3081	...	...	R 1/2	5.5	...	4	-L 1.5	Prisms 2 bases in R up 15° L down 15°	Entire comfort in reading. Sewing difficult
3774	2	...	...	...	...	...	L 2	Prisms 1 up and down	Entire relief
3954	2	...	...	6	...	1	R 2	Prisms 1 up and down	Entire relief
3909	...	...	...	...	...	...	L 2.5	Prisms 1 up and down	Much better. Had been in bed for several weeks before starting patch because of severe headaches. Immediately was able to be up and come to office for examinations. A neurasthenic and hyperthyroid girl
3883	...	1	L 1	6	...	15	L 2	Left internus shortened	Entire relief
3885	...	1	...	...	...	7	R 1	Prisms 3 bases in each eye	Entire relief
3039	3	...	...	...	3	...	L 3	Prisms 3 bases out of 22.5° up and down	Entire relief. Very neurotic case
3816	1	...	R 1	...	...	4	R 3	Prisms 1 up and down	Very much better
2128	1	...	...	...	...	6	R 1	Prisms 2 bases in 15 up and down	Entire relief
4024	...	...	...	6	...	2	L 3.5	Prisms 1.5 up and down	Much better. Probably a great part of trouble is due to weak convergence
4100	1	...	...	...	...	...	R 4	Prisms 2 up and down	Entire relief
4113	1	...	...	6	...	3	L 1	Prisms 1/2 up and down	Entire relief

Case No.	Before Patching.			Maximum Deviation.			Treatment.	Results and Remarks.
	Eso.	Exo.	Hyper.	Convergence. (inches)	Eso.	Exo.	Hyper.	
4118	1	...	...	5	...	5	L 1	Prisms 1/2 up and down Entire relief
4166	1	...	...	...	...	...	L 1	Prisms 1/2 up and down Entire relief
4145	...	...	L 1/2	...	...	6	L 5.5	Prisms 2 up and down Entire relief
2597	...	...	...	...	...	4	R 7	Left superior rectus shortened Entire relief
2752	...	...	R 1/2	...	...	5	L 3.5	Prisms 1.5 up and down Entire relief
3568	1	...	...	4	...	6	R 4	Prisms 2 up and down Entire relief
3072	...	2	...	6	...	8	L 2	Prisms 3/4 up and down. Left internus shortened Entire relief after operation. Prisms had given some relief
3034	...	2	...	9	...	2	R 2	Prisms 1/2 up and down. Shortening of internus advised Operation refused. Six years ago had seven partial tenotomies of the externi, which proves the fact that tenotomies are negative procedures and do not give needed power to the opponent Entire relief
3465	...	...	R 1	...	2	...	L 2 reversal	Prisms 1 up and down Mechanical result of operation perfect being esophoria 1; convergence to 3 inch with no change in vertical deviation. Patient is a bedridden neuroathenic of the worst type. No appreciable symptomatic relief
3435	...	...	...	10	...	8	L 2.5	Left internus shortened. Later prisms 1 up and down Almost entire relief. "Able to read a long time"
3430	...	1	...	5	...	5	L 3	Prisms 1 up and down "Eyes better than in years." A confirmed neurotic girl
3418	...	...	...	...	...	6	L R	Prisms 1.5 up and down One month after operation tested exophoria 1; vertical orthophoria; convergence to 3.5 inches. An out-of-town case who has not returned since
3397	...	2	...	7	...	10	L 1	Left internus shortened Entire relief. A most enthusiastic patient.
3708	...	...	...	...	...	6	R 2	Prisms 1 up and down
128	...	1	...	6	...	3	R 2.5	Prisms 1 up and down Reads without much trouble."

3663	...	1	R 1	...	...	...	5	R 3	Prisms 1 up and down	"Very much better, especially for reading"
3614	...	...	R 1/2	5	...	...	5	L 2 reversal	Ordinary lens correction	Has not returned; a good sign in view of the fact that she is a doctor's mother
3621	...	...	...	...	...	...	1	L 3	Prisms 1.5 up and down	Entire relief
3607	2	...	...	...	...	...	2	R 1.5	Prisms 1 1/2 up and down	"Very much better except for near which is no better." There is an esophoria with diplopia when <i>chewing</i> and when looking down
3592	1	...	...	4	...	...	2	L 5	Prisms 2 up and down	Left for Honolulu the day after getting glasses and has failed to report results
466	...	1	...	4	...	...	4	L 2	Prisms 3/4 up and down	Almost entire relief. She has been disabled for years. I had treated her in 1917 without relief and at various times she had been under the care of many oculists
2869	1	...	...	5	...	...	8	L 2.5	Prisms 3 bases in 15 up and down	Relief except for near. Remaining symptoms probably due to weak convergence for which operation was advised
3456	...	...	...	5.5	...	...	5	R 2	Prisms 3/4 up and down	"Much better." Read as long as have to without trouble "
2230	...	...	...	...	...	...	5	L 3.5	Prisms 1.5 up and down	"No headaches: never felt so good." Always headaches with absolute eye disability
3383	6	...	...	...	6	...	...	L 2	Prisms 2 bases out 15 up and down	Almost entire relief. "But little headache or neck pain "
3474	...	...	R 2	...	...	...	3	L 1 reversal	Prisms 1 up and down on basis of first test	"Reads as long as wants to without trouble "
3699	3.5	...	R 3	...	...	...	...	R 6	Prisms 2 up and down	"Eyes are fine; no more headaches, nausea or neck pain "
3799	5	...	L 5	...	...	...	...	L 3	Prisms 1 up and down	"All troubles over—can't get along without glasses "
264	...	...	...	...	...	...	3	L 1	Prisms 1/2 up and down	"Less uncomfortable." A confirmed neurasthenic woman
2233	8	...	...	...	...	...	...	L 3	Prisms 1 up and down	"Two months later tested esophoria 2; vertical orthophoria with glasses. In spite of this there was no improvement
430-F	...	3	...	...	...	...	5	L 2	Prisms 3/4 up and down	"Entire relief
469-F	...	...	...	...	...	...	8	R 2	Prisms 3 bases in 15 up and down	"Entire relief. "First genuine comfort in years"
549-F	...	...	R 1/2	...	...	...	...	R 2.5	Prisms 1 up and down	Entire relief from severe headaches

Case No.	Before Patching.			Maximum Deviation.			Treatment.	Results and Remarks.
	Eso.	Exo.	Hyper.	Convergence. (inches)	Eso.	Exo.	Hyper.	
491-F	1	...	R 1 1/2	...	...	5	L 8	In spite of a perfect mechanical result not much symptomatic. Very neurotic
583-F	3	...	L 1 1/2	...	...	...	R 2	Later had some intranasal operative work
478-F	3	...	R 1 1/2	...	1	...	L 1	Headaches not so bad or so frequent. An anaemic woman (R.B.C.'s down to 1.5 million)
239-F	...	...	...	...	...	6	R 4.5	Almost entire relief even in the presence of excessive use
499-F	...	...	...	...	...	1	R 1	"Better but still trouble." Nasal operation needed. Neurotic
468-F	...	1	...	...	...	11	L 9.5	Very much better. Gets around without cane and able to walk 20 blocks. Very little dizziness. A bad case of neurasthenia. She had been unable to walk or read before
462-F	...	2	L 1	...	...	1	R 3 reversal	Very much better. Patched again a year later and tested, orthophoria
1671	3	...	...	...	...	4	R 4	Much better. Had had a pelvic operation in hopes of relieving headaches. Showing how important it is to eliminate <i>all possible causes</i> before carving the belly
3982	...	...	...	9	...	5	L 2	Entire relief from headaches and eye disability of 15 years standing. This was my first case of monocular occlusion
4049	...	...	...	...	...	6	L 2	Some better. No trouble except for near. Almost certainly a case of weak convergence for which operation was advised
584-F	...	...	...	6	...	...	L 4	Emmetropic each eye. Presbyopic correction only. No eye symptoms. Eye had been occluded in treatment of a central neuropathic corneal ulcer
4226	2	...	...	...	...	...	1	No headaches with patch although kept at work as stenographer. Some relief with prisms. Continued symptoms due probably to weak convergence
								Entire relief from car-sickness, headaches, stomach symptoms and photophobia