RED FILTER TREATMENT IN ECCENTRIC FIXATION*†

BY

S. R. K. MALIK, A. K. GUPTA, S. CHOUDHRY, AND D. K. SEN

Department of Ophthalmology, Maulana Azad Medical College, New Delhi, India

RED filter treatment was devised by Brinker and Katz (1963) to overcome some of the disadvantages inherent in conventional pleoptic methods—the necessity for regular attendance at hospital, lengthy sessions with the ophthalmologist, expensive equipment, and the difficulty of obtaining full co-operation and attention from the younger patients.

The principle of the red filter is related to the fact that the cones are more sensitive to the red end of the visual spectrum. In the central fovea, which measures little less than one degree, the cones which are the only light receptors, number approximately 147,000 per sq. mm. Their density decreases towards the periphery, and at 1.5 degrees from the centre there are more rods than cones per unit area. It thus seems logical to try to stimulate the cones by a light with a wavelength above the rod threshold. If this is possible, it may be expected that the area where the cones are most dense, *i.e.* the fovea, will be selected as the point of fixation in preference to an eccentric point, provided these receptors are free from any organic lesion.

Recent work by von Noorden (1965) indicates that amblyopia may be regarded as a suppression of form or photopic vision (cone vision). Since the red filter inhibits scotopic vision, the amblyopic patient is forced to use the suppressed photopic cone vision. It is because of this mechanism that vision and fixation may improve in an amblyopic.

Material and Methods

Red filter treatment was tried in nineteen cases of eccentric fixation, after the maximum improvement had been obtained by occlusion of the amblyopic eye. A "Kodak Wratten Gelatin Red Filter 92", which transmits light in the region of 580–700 microns, was fixed between two plane glass lenses and clipped to the frame of the patients' corrective spectacles. The patient was encouraged to do close work with the unaffected eye occluded and the red filter in front of the eye with eccentric fixation. The treatment time was gradually increased from 30 minutes to about 4 to 5 hours per day. When the red filter was not in use the eccentrically-fixing eye was occluded. The minimum period of treatment was 2 months and the maximum 18 months.

Observations

Nineteen patients aged from 5 to 32 were treated.

(1) *Overall improvement*: Vision, fixation, or both improved in nine cases (47.4 per cent.), of which six (31.6 per cent.) improved in both visual acuity and fixation, two (10.5 per cent.) in vision only, and one (5.3 per cent.) in fixation only.

* Received for publication January 18, 1968.

† Address for reprints: as above.

(2) *Improvement in visual acuity*: Fig. "a" indicates the initial and final visual acuity of the nineteen cases treated. Fig. "b" represents the percentage improvement in vision. It is evident that in cases of gross amblyopia (vision 6/60 or less) no improvement occurred.

(3) *Improvement in fixation*: Fig. "c" indicates the initial and final fixation pattern. Better results were obtained in cases of parafoveal (PF) and erratic (E) fixation than in those with paracaecal (PC), centrocaecal (CC), and paramacular (PM) fixation.

FIGURE.—Response to red filter treatment

- (a) Improvement in visual acuity
 (b) Percentage improvement in visual acuity
 (c) Improvement in fixation

(4) *Time after which improvement occurred:*

Duration of Treatment	Number of Cases
2 to 4 wks	3
1 to 2 mths	Nil
2 to 3 mths	2
3 to 4 mths	Nil
4 to 5 mths	1
5 to 6 mths	Nil
6 to 7 mths	1
7 to 8 mths	1
8 to 9 mths	1

Our results are compared with those of other authors in the Table (opposite).

TABLE

Authors	Date	No. of Cases Treated	Percentage Improvement
Brinker and Katz	1963	8	62.5
Binder and others	1963	8	87.5
Von Noorden	1965	20	55.0
Aichmair	1965	40	82.5
Thorleifsson	1966	10	10.0
Cowle	1967	10	70.0
Present series	1967	19	47.3

Discussion

After a course of red filter treatment, 47.3 per cent. of our patients showed improvement in vision, fixation, or both. Those with lesser degrees of eccentric fixation (*i.e.* erratic and parafoveal) showed a better response to treatment, the best results being obtained in cases of parafoveal fixation.

The improvement in vision and fixation was not always interdependent. An improvement in vision without a corresponding improvement in fixation (two cases) could be due to a decrease in the active suppression of the eccentric point (antidiplopia mechanism) with treatment.

The shortest time in which improvement was noticed was 2 weeks, but in one case 9 months elapsed before any improvement was seen. The improvement has been maintained for up to 18 months.

Brinker and Katz (1963) used a red filter in the Visuscope to assess prognosis. Where fixation changed to foveal from eccentric the prognosis was better than when it was unchanged. Cowle (1967) found this method of examination not very satisfactory, as the macula could not easily be observed through the filter. Binder, Engel, Ede, and Loon (1963) treated eight cases of paramacular fixation, and obtained central fixation and an improvement in visual acuity up to 6/12 in seven cases. The red filter was used for 2½ months in each case.

Von Noorden (1965) treated twenty cases of peripheral fixation. As soon as the fixation changed from peripheral to paramacular or parafoveal, the filter was removed from the deviating eye and occlusion of the sound eye was continued. To rule out the possibility of improvement by occlusion, only those who did not respond to occlusion were studied. Eleven patients (55 per cent.) showed significant improvement.

Aichmair (1965) studied the response of forty amblyopes with eccentric fixation. Vision and fixation became normal in 21 (52.5 per cent.) and some improvement was noted in another twelve.

Thorleifsson (1966) tried the red filter in ten patients aged 4 to 7 years who had not responded to occlusion and glasses. An initial decrease in the degree of eccentricity was observed in eight children but this was not maintained during the follow-up period. Only one child achieved central fixation and a considerable increase in visual acuity. The angle of squint remained unaltered. The red filter was used for 2 months in all cases.

Cowle, Kunst, and Philpotts (1967) treated ten patients aged 4 to 10 years: six cases of paramacular fixation, two of parafoveal, and two of fixation loss. Nine cases (90 per cent.) showed improvement in visual acuity up to 6/12, and seven (70 per cent.) achieved central

fixation. Both cases of parafoveal fixation and one of paramacular fixation failed to show any improvement in fixation. The red filter was used for an average of 7 months. Once central fixation was achieved, the occluder was changed to the normal eye for 5 months. In between, to maintain the central fixation, the filter was used for short intervals each day.

Our rather poor results may be due to the age of our patients; none was below the age of 5 years. In our series no case of grossly eccentric fixation showed any improvement.

Summary

Of nineteen cases of eccentric fixation treated with red filter, only nine (47.4 per cent.) showed improvement in vision, fixation, or both. Those with less marked eccentric fixation (*i.e.* parafoveal and erratic) had a better chance of improvement. The best results were obtained in cases of parafoveal fixation.

REFERENCES

- AICHMAIR, H. (1965). *Klin. Mbl. Augenheilk.*, **146**, 247.
 BINDER, H. F., ENGEL, D., EDE, M. L., and LOON, L. (1963). *Amer. orthopt. J.*, **13**, 64.
 BRINKER, W. R., and KATZ, S. L. (1963). *Amer. J. Ophthal.*, **55**, 1033.
 COWLE, J. B., KUNST, J. H., and PHILPOTTS, A. M. (1967). *Brit. J. Ophthal.*, **51**, 165.
 THORLEIFSSON, H. (1966). *Acta ophthal. (Kbh.)*, **44**, 57.
 VON NOORDEN, G. K. (1965). *Arch. Ophthal. (Chicago)*, **73**, 776.