Dev. Ophthal., vol. 2, pp. 77–85 (Karger, Basel 1981)

Color Vision and other Parameters of Macular Function after Retinal Reattachment

I. Kreissig, H. Lincoff, B. Witassek and G. Kolling

Univ.-Augenklinik, Tübingen; Department of Ophthalmology of the New York Hospital-Cornell Medical Center, New York, N.Y.; Inselspital, Bern; Univ.-Augenklinik, Giessen

Introduction

In a previous communication [*Kreissig,* 1977] we reported on visual acuity and light sensitivity threshold after reattachment of the retina. In this report we examine color vision and metamorphopsia and compare it with postoperative visual acuity.

Materials and Methods

Patients

50 patients with detached maculas were operated upon between October 1976 and July 1978. The macula of the fellow eye was not detached in any of the cases. The patients were selected from a group of 290 consecutive detachment cases. Patients presenting with a history of previous retinal detachment, high myopia or maculopathy were eliminated. Additionally, patients with cloudy media and patients who could not attend the required postoperative examinations were excluded. The duration of the macular detachment ranged from 1 day to 2 months. The treatment consisted of retinal cryopexy and a silicone sponge plombage. A nondrainage procedure was carried out in every patient except two. The observation period is a minimum of 1 year.

Techniques

Macular function was tested preoperatively and then postoperatively at 3-month intervals.

Visual Acuity. This was tested with the Idem projector with decimal divisions.

Color Vision. This was tested with the Farnsworth panel d-15 test and with the Ishihara plates.

Testing for Metamorphopsia. This was performed with the Amsler recording charts. The test was carried out in daylight and when necessary with the patients' reading correction.

Results

Visual Acuity

The postsurgical results in visual acuity are in agreement with our previous findings in 266 patients [*Kreissig et al.*, 1975]. In all 50 patients postsurgical visual acuity was better than before the operation. The maximum improvement in visual acuity occurred in the first 3 months after the macula was reattached (fig. 1).

Color Vision

This test was carried out in only 48 patients, because 2 patients were discovered to be deuteranopes. 3 months after retinal reattachment 26 of 48 patients had defective color vision. In the majority of cases it was a trito disturbance (fig. 2).

If the patients were divided into three groups: under 40 years, between 40 and 60 years, and over 60 years old, the disturbances in color vision were most prominent in the oldest group (fig. 3). In a comparison between the patients under 60 and over 60 years of age, postsurgical disturbances of color vision in the older age group were statistically significant (table I). Of 7 patients under 40, 1 had defective color vision (table II), a trito disturbance (fig. 4). 6 months later the color vision returned to normal in this patient. The Ishihara test did not at any time reveal evidence of dysfunction.

In the 40–60 years group, color vision disturbances occurred in 6 out of 15 patients. It was a trito disturbance in every case. Recovery of color vision in this group took place much later and to a lesser extent. At the end of 1 year, 2 out of the 15 patients still had a blue-yellow defect (fig. 5). In patients over 60, color vision was affected in 20 out of 26. The color defect was found at the first examination after surgery. At the end of 1 year 13 were still defective.

In this older age group we found for the first time different types of color vision deficiencies. While a trito disturbance was present in 14 cases, in 6 cases the color vision defect was a combined form (fig. 6).

Characteristics of the combined form were: Either a *red-green deficiency* in the Ishihara test, in addition to the trito disturbance, or the *misinterpre-*

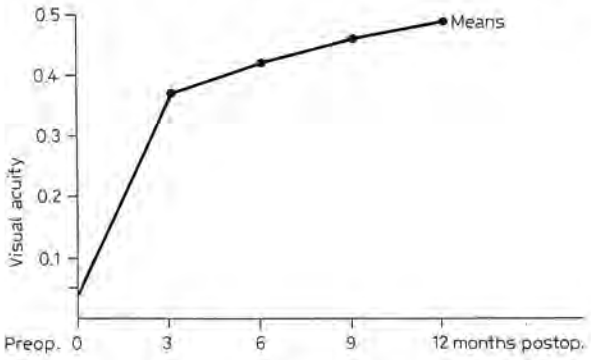


Fig. 1. Mean improvement in visual acuity in 50 patients.

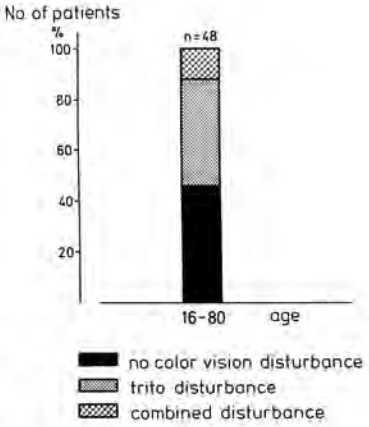


Fig. 2. Postoperative color vision in 48 patients 3 months after macular reattachment. Color vision is still defective in more than half of the patients.

tations in the Farnsworth test were so diverging that they could not be assigned to a specific color axis.

In 3 patients a pure trito disturbance evolved within 1 year (fig. 6).

A correlation was found between postsurgical color vision disturbances and visual acuity after macular reattachment (fig. 7). Patients with postoperative color disturbances had a mean visual acuity of 0,2. Patients without disturbances had a mean of 0,5. A color vision deficiency was present in every patient in whom the visual acuity was below 0,2. Conversely, no color deficiency was present when the visual acuity was above 0,6.

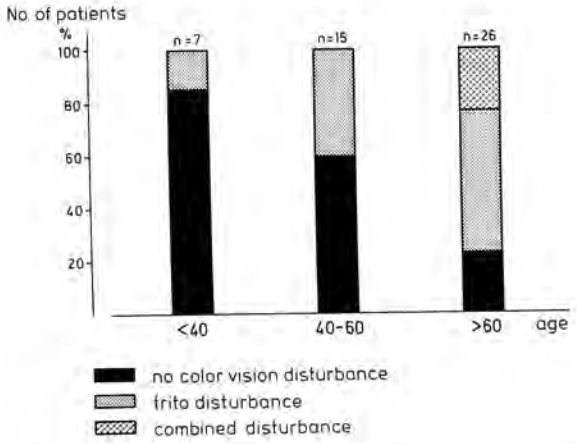


Fig. 3. 48 detachment patients are divided into 3 age groups: 3 months after macular reattachment color vision disturbance is most prominent in the oldest group.

Table I. Color vision disturbances 3 months after macular reattachment in 2 age groups

Age group years	Number of patients	Color vision disturbances	
		negative	positive
< 60	22	15	7
> 60	26	6	20
Total	48	21	27

Significance ($X^2 > 7.88$) = 0.005.

Table II. Postoperative follow-up of color vision disturbances in 3 age groups.

Group	Age, years	Number of patients	Color vision disturbances	
			3 months	1 year
I	< 40	7	1	∅
II	40–60	15	6	2
III	> 60	26	20	13

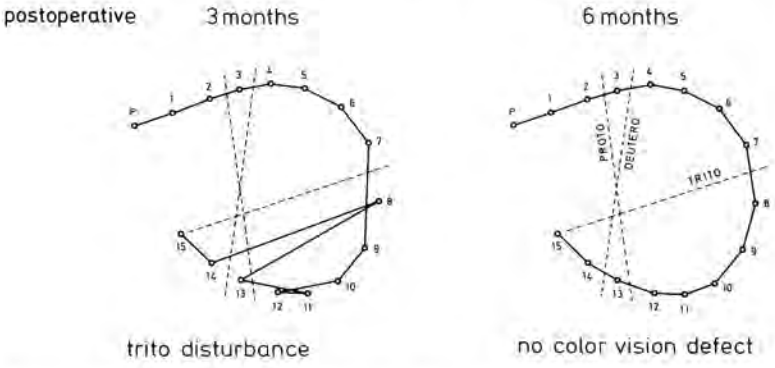


Fig. 4. Farnsworth Panel D-15 Test of a 35-year-old patient (younger age group) with a postoperative trito disturbance. Left = 3 months after macular reattachment; right = after 6 months.

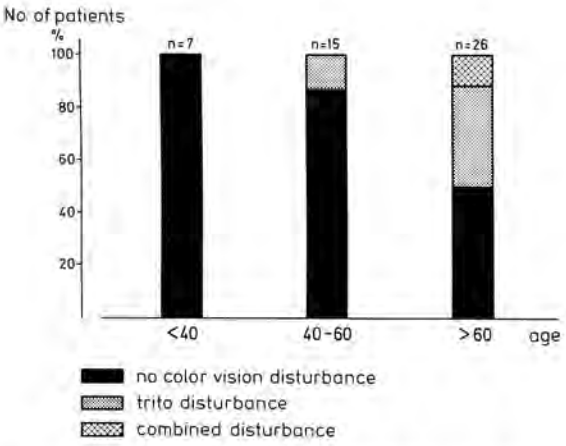


Fig. 5. 48 detachment patients are divided into 3 age groups: 1 year after macular reattachment the recovery of color vision occurs for the most part in patients under 60 years of age.

Metamorphopsia

In complete contrast to color functions, postsurgical metamorphopsia was present in all 50 patients. The disturbances manifested as distortion and blurring of the lines in the Amsler chart. The lines of the grid appeared to them as if they had been drawn by hand (fig. 8).

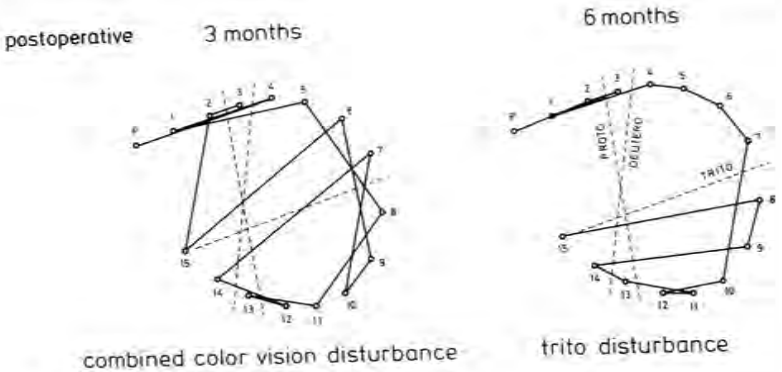


Fig. 6. Farnsworth Panel D-15 test of a 77-year-old patient (oldest group) with a postoperative combined form of colour vision disturbance; left = 3 months after macular reattachment; right = after 6 months.

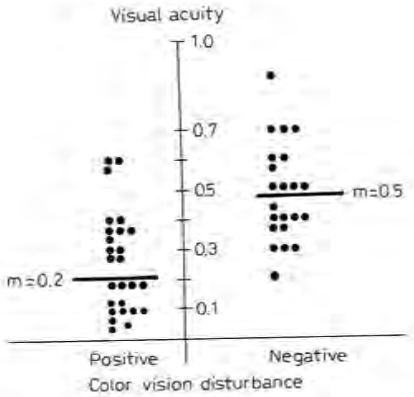
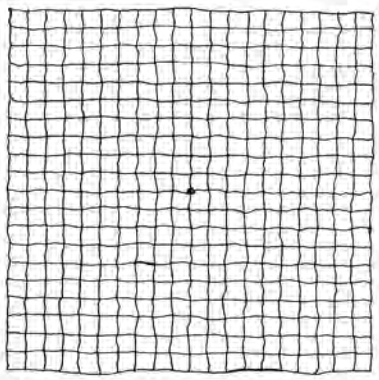
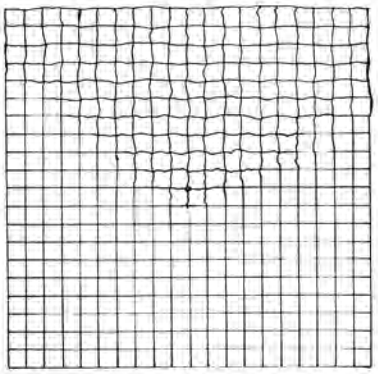


Fig. 7. Comparison of postoperative visual acuity and color vision disturbances in 48 patients 3 months after macular reattachment. Patients *with* color vision disturbances have a mean visual acuity of 0.2 and patients *without* disturbances a mean of 0.5.

Metamorphopsia diminished, but did not disappear in any of the patients at 1 year. An improvement was perceived by some of the patients at the end of the follow-up period. The extent, however, did not improve as much as the degree of metamorphopsia. The case of a 39-year-old patient deserves mention. The patient had an inferior detachment repaired, that



8



9

Fig. 8. Amsler grid after macular reattachment as described by a patient whose macula was completely detached.

Fig. 9. Postoperative Amsler grid of 39-year-old patient after repair of an inferior detachment that appeared to invade the macula. Postoperatively, on the Amsler grid she described a superior wedge of distortion, the remainder of the grid was unaffected.

appeared to invade the macula. Preoperative vision was 0,3p; the preoperative duration of the detachment was 3 weeks. Postoperatively on the Amsler grid she showed only a superior wedge of distortion of the lines, the remainder of the grid in contrast was unaffected. The postsurgical finding of this localized metamorphopsia in the upper half of the Amsler chart and the persistance of this finding for 1 year suggested retrospectively that only the inferior macula had been invaded by the detachment (fig. 9).

Discussion

Three postoperative visual functions were analized. Of these, only *visual acuity improved in every patient,* and this occurred independent of age. The improvement in visual acuity began immediately after macular reattachment and increased rapidly for 3 months. Increments thereafter were slow and minimal.

The recovery of color vision occurred more slowly and less completely than visual acuity; after 3 months only *every second patient* showed normal color vision. Postoperative disturbances in color vision were previously described by *Gaillard,* [1962], *François and Verriest* [1968], *Verriest and Koli-*

opoulos [1968], *Koliopoulos and Theodosiadis* [1972], *Foulds et al.* [1974], *Chisholm et al.* [1975] and *Alexandridis et al.* [1975].

Our data proves that the color vision disturbances are most prevalent in the older age group. Recovery of color vision takes place later than visual acuity, and only in patients under the age of 60. A precondition for normal color vision appears to be a minimum visual acuity of 0,2.

The presence of metamorphopsia after retinal reattachment was described in 1969 by *Bernardczykowa*. We found that *postsurgical metamorphopsia occurred in every patient* independent of age and was still present at the end of 1 year. Metamorphopsia could be detected even when a normal visual acuity of 1,0 and normal color vision had been recovered.

In conclusion, metamorphopsia represents the most sensitive indicator of an episode of previous macular detachment. Metamorphopsia can be considered as a 'scar in the Amsler grid'. It represents a kind of memory for a previous macular detachment.

In the discussion of our last paper on postsurgical macular function [*Kreissig*, 1977], it was suggested that metamorphopsia might occur more frequently when retinal reattachment is obtained with drainage of subretinal fluid [*Machemer*, 1977]. In the present series no drainage was carried out in all but 2 cases and postsurgical metamorphopsia was present in all of the cases. The mechanism for postsurgical metamorphopsia therefore seems to be dependent on factors other than just the method used to obtain retinal reattachment.

Summary

Patients with a preoperatively detached macula and operated upon between October 1976 and July 1978 were analyzed for three parameters of macular function after surgical repair. Reattachment was achieved by cryopexy, an external sponge plombage and non-drainage. The observation period was a minimum of 1 year.

Visual acuity increased in all patients with a maximum improvement in the first 3 months after macular reattachment. Color vision was postoperatively defective in every second patient. In the majority of cases it was a trito disturbance. The disturbance in color vision was most prominent in patients over 60 years old. During the period of 1 year, normalization of color vision occurred for the most part only in patients under 60 years of age.

Metamorphopsia proved to be the most sensitive indicator of an episode of previous macular detachment. It occurred in every patient independently of age and was still present at the end of 1 year. It could be considered as a 'scar in the Amsler grid'. The occurrence of metamorphopsia was independent of whether subretinal fluid was drained or allowed to absorb spontaneously.

References

Alexandridis, I.E.; Anagnostopoulos, C.; Lauer, H.J.: Netzhautfunktion nach operativer Behandlung der Amotio. II. Amotio mit Maculabeteiligung. Ber. dt. ophthal. Ges. *74:* 98–103 (1975).

Bernardczykowa, A.: Badania jokosciowe ostrosci wzroku testami Amslera u chorych po odwarstwienis siatkowi. Klin. Oczna *39:* 821–828 (1969).

Chisholm, I.A.; McClure, E.; Foulds, W.S.: Functional recovery of the retina after retinal detachment. Trans. ophthal. Soc. UK *95:* 167–172 (1975).

Foulds, W.; Reid, H.; Chisholm, I.A.: Factors influencing visual recovery after retinal detachment surgery. Limitations and prospects for retinal surgery. Mod. Probl. Ophthal., vol. 12, pp. 49–57 (1974).

François, J.; Verriest, G.: Nouvelles observations de déficiences acquises de la discrimination chromatique. Annls Oculist. *201:* 1079–1114 (1968).

Gaillard, G.: Résultats fonctionnels du traitement chirurgical du décollement de la rétine (Masson, Paris 1962).

Koliopoulos, J.; Theodosiadis, G.: Retinal detachment and acquired colour vision disturbances. Mod. Probl. Ophthal., vol. 11, pp. 117–121 (1972).

Kreissig, I.: Prognosis of return of macular function after retinal reattachment. Mod. Probl. Ophthal., vol. 18, pp. 415–429 (1977).

Kreissig, I.; Roth, K.; Best, W.: Über die Funktion nach wiederangelegter Netzhaut. Ber. dt. ophthal. Ges. *74:* 79–92 (1975).

Machemer, R.: Discussion of the paper of I. Kreissig. Mod. Probl. Ophthal., vol. 18, p. 437 (1977).

Verriest, G.; Koliopoulos, J.: The perception of colour vision and its defects. Ann. Ophthal., Athens *5:* 145–166 (1968).

Prof. Dr. I. Kreissig, Universitäts-Augenklinik, D-7400 Tübingen (FRG)