Peripheral retina in myopia

With particular reference to retinal breaks

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Since Gonin (1921, 1930) established the role of retinal breaks in the aetiology of retinal detachment, the closure or isolation of retinal breaks has become an essential part of all procedures for the treatment of this condition. The "prophylactic" treatment of retinal breaks is practised in many centres, but in recent years it has been shown that asymptomatic retinal breaks without detachment are a frequent finding in "normal" eyes (Halpern, 1966; Byer, 1967; Rutnin and Schepens, 1967).

About two-thirds of retinal detachments occur in myopic eyes (Duke-Elder and Dobree, 1967). The present report deals with degenerative changes in the peripheral retina of asymptomatic myopic eyes, with special reference to retinal breaks.

Material and methods

Biomicroscopical examination of the peripheral fundus of 332 myopic eyes was performed using the Goldmann three-mirror contact lens and the Haag-Streit 900 slit lamp. The first two myopic patients appearing in the eye clinic of the Rothschild Government-Municipal Hospital, Haifa, on any receiving day during a 14-month period were included in the study provided that they fulfilled the following criteria:

- (1) Age between 10 and 65 years and reasonably co-operative.
- (2) Myopia of at least one dioptré.
- (3) Clear media, normal macula, and corrected central vision of 6/12 or better.
- (4) No spontaneous complaint of photopsies or entopsies. The patient was not questioned about such complaints until the results of the fundus examination had been recorded.
- (5) No evidence of uveitis, vascular retinopathy, or glaucoma.
- (6) No history of ocular surgery or antiglaucoma treatment.

It was felt that the cases examined represented an unselected group of myopes, asymptomatic with regard to retinal disease.

Maximum dilatation of the pupil was achieved by one or more instillations of 0.5 per cent. tropicamide and 10 per cent. phenylephrine. The cornea was anaesthetized with 0.4 per cent. novesine. The entire peripheral fundus was examined using both fundus mirrors of the contact lens, turning the slit into the horizontal position for examination of the nasal and temporal periphery. Each eye was examined only once, 5 to 10 minutes being allotted to each examination. Only one eye was examined at each session and all the patients were invited to attend for examination of the second eye at a later date; 21 patients did not attend for examination of the fellow eye and in these cases the results of the examination of only one eye were included in the results.

Results

RETINAL BREAKS

For the purpose of the present report, a retinal break is defined as a full-thickness discontinuity of the retina. "Microholes", doubtful retinal breaks, and partial thickness breaks are not included (see below).

37 eyes of 34 subjects, out of a total of 332 eyes examined, had retinal breaks. There were 48 retinal breaks in all, including thirteen horseshoe tears and 35 round holes. A free operculum on the posterior vitreous face was found in association with nine of the 35 round holes (Table I and the Figure). Thirty of the breaks were smaller than $\frac{1}{4}$ disc diameter in size, fifteen were $\frac{1}{4}$ to $\frac{1}{2}$ disc diameter in size, and three were larger than $\frac{1}{2}$ disc diameter (Table I).

FIGURE Schematic analysis of 48 asymptomatic retinal breaks according to type of break and position

Table I Analysis of 48 retinal breaks, by size

Size (disc diameters)	Horse-shoe tears	Round holes		Total
		With free operculum	Without operculum	
Less than $\frac{1}{4}$	6	4	20	30
$\frac{1}{4}$ - $\frac{1}{2}$	5	4	6	15
$\frac{1}{2}$ - 1	1	1	0	2
More than 1	1	0	0	1
Total	13	9	26	48

24 of the 48 retinal breaks were in the upper temporal, fifteen in the lower temporal, eight in the upper nasal, and one in the lower nasal quadrant. Nineteen of the 48 breaks

were in the oral region of the peripheral retina and 29 in the equatorial region* (Figure and Table II).

Table II *Distribution of 48 retinal breaks, by quadrant*

Quadrant	Horse-shoe tears	Round holes		Total
		With free operculum	Without operculum	
Upper temporal	6	7	11	24
Lower temporal	1	0	14	15
Lower nasal	1	0	0	1
Upper nasal	5	2	1	8
Total	13	9	26	48

Elevation of the retina extending to a distance of $\frac{1}{2}$ disc diameter from the edge of the retinal break was found in association with eight of the 48 retinal breaks in six eyes, and elevation of the retina to a distance of one disc diameter from the edge of the break was found in association with three additional retinal breaks in three eyes. A line of pigment partially or completely surrounding the retinal break or the adjacent area of elevated retina was found in association with thirteen retinal breaks. Pigmentation of the underlying choroid was found in association with seven retinal breaks.

Table III shows the incidence of retinal breaks according to age and degree of myopia. There is a direct correlation between the number of eyes with holes and age: in the 10 to 20-year age group six out of 94 eyes examined had retinal breaks (6.4 per cent.); in the 21 to 40-year age group eleven out of 120 eyes examined had retinal breaks (9.2 per cent.); among subjects over the age of 40, twenty out of 118 eyes examined had retinal breaks (16.9 per cent.). No significant correlation was found between the frequency of retinal breaks and the degree of myopia; eleven out of 105 eyes with myopia of 3 D or less had breaks (10.5 per cent.); sixteen out of 150 eyes with myopia of 3.25 to 6 D had retinal breaks (10.7 per cent.); ten out of 77 eyes with more than 6 D of myopia had retinal breaks (13 per cent.).

* The peripheral retina extends from the middle of the pars plana backwards to a distance of 6 disc diameters from the ora serrata. It consists of an oral region and an equatorial region, separated by a line 2 disc diameters posterior and parallel to the ora serrata (Rutnin, 1967).

Table III *Number of eyes with retinal breaks, by age and degree of myopia*

Age (yrs)	Degree of myopia (dioptres)			Total (all myopes)
	1-3	3.25-6	More than 6	
10-20	0/19	5/60	1/15	6/94 (6.4%)
21-40	4/47	4/44	3/29	11/120 (9.2%)
41-65	7/39	7/46	6/33	20/118 (16.9%)
Total	11/105 (10.5%)	16/150 (10.7%)	10/77 (13%)	37/332 (11.1%)

The figures in each group represent the number of eyes with retinal breaks and the number of eyes examined

PARTIAL-THICKNESS RETINAL BREAKS

A free operculum overlying what appeared to be a partial-thickness retinal break was found in seven eyes, in two of which a full-thickness break was also present

“MICROHOLES”

These appear as pin-point red areas, often in groups and frequently associated with snail track degeneration (see below). There were seven eyes with microholes, two of which also had retinal breaks. In five eyes the microholes were situated in an area of snail track degeneration and in one they were associated with an area of lattice degeneration.

VITREO-RETINAL ADHESIONS

Adhesions between the vitreous and the peripheral retina with or without retinal pull were a common finding. Vitreo-retinal adhesions without pull (vitreous tags) were present in eleven eyes. Vitreo-retinal adhesions with slight retinal pull as seen by distortion of a retinal vessel or slight tenting of the retina were present in seventeen eyes. Vitreo-retinal adhesions with marked pull were present in five eyes. In fourteen additional eyes there were vitreo-retinal adhesions with pull so marked that the retina was raised in the form of a tongue-shaped operculum, giving the impression that a retinal break must be present. Since a retinal break could not be clearly seen in these cases, they are not included among the 37 eyes with retinal breaks.

LATTICE (FISH-BONE OR PALISADE) DEGENERATION

Lattice degeneration is characterized by a lacework of interlocking white lines interspersed in the later stages with small white flecks and irregular patches of pigmented or depigmented areas (Duke-Elder and Dobree, 1967). Lattice degeneration was present in fifteen eyes in five of which it was associated with a retinal break. The lattice was confined to one quadrant in every case, the upper temporal quadrant being involved in thirteen of the fifteen eyes.

SNAIL TRACK DEGENERATION

Snail track degeneration consists of areas of closely spaced, pin-point white dots usually in rows. The appearance is like that of a path of slime left by a passing snail. Snail track degeneration was present in 36 of the 332 eyes examined. The temporal quadrants were more frequently affected than the nasal, and in eleven eyes more than one quadrant was affected. Seven of the eyes with snail track degeneration also had a retinal break. In one eye the break was adjacent to the area of snail track degeneration.

CYSTOID DEGENERATION

Cystoid degeneration of the peripheral retina was present in 59 of the 332 eyes examined. It was not found in patients under the age of 20 years. It was present in sixteen of 120 eyes (13 per cent.) of patients aged 21 to 40 years and in 45 of 118 eyes of patients over the age of 40 (38 per cent.). There was no correlation between the incidence of cystoid degeneration and the degree of myopia. The temporal quadrants were more frequently affected than the nasal. Seven eyes with cystoid degeneration also had a retinal break. In one eye a hole was situated in an area of cystoid degeneration.

RETINOSCHISIS

Senile retinoschisis was present in fourteen eyes, all but one of them in patients over the age of 40 years. In every case the retina of the inner wall of the schisis was covered with yellowish flecks as described by Shea, Schepens, and von Pirquet (1960). In 28 additional eyes, similar flecks were seen on the retina in the extreme periphery, but careful examination did not reveal schisis. One eye had a hole in the inner wall of an area of schisis.

Discussion

The most significant finding in the present survey was the fact that 37 of the 332 eyes examined had full-thickness retinal breaks (11.1 per cent.).

Several clinical and *post mortem* studies have dealt with the peripheral retina in "normal" eyes but generally without selection with regard to refraction. Only a very approximate comparison can be made between these studies and the present one because the results obtained depend on age, refraction, and perhaps the method of examination.

Hanssen (1919, 1925) examined 37 myopic eyes *post mortem* and found three eyes with complete retinal breaks and four eyes with incomplete retinal breaks. Adams (1956) reported three eyes with retinal breaks among eleven eye-bank eyes. Okun (1961) found retinal breaks in twelve out of 494 autopsy eyes (2.4 per cent.); all those with breaks were of subjects over the age of 40 years. Foos and Raymond (1967) found retinal breaks in 33 of 312 autopsy eyes (10.5 per cent.); all but thirty of the 312 eyes were of subjects over the age of 40 years.

In a clinical study, Rehsteiner (1928) examined 175 subjects by direct ophthalmoscopy. He found pigmented or atrophic lesions in the peripheral retina in 86 of the subjects and retinal detachment in one eye. Retinal holes were present in both eyes of the patient with retinal detachment.

The occurrence of retinal breaks without detachment was considered rare enough to warrant publication by Jeandelize and Baudot (1933), and Knapp (1943).

Halpern (1966) examined 500 asymptomatic eyes of subjects over the age of 10 years. He found 29 eyes with one or more retinal breaks (5.8 per cent.). Eleven eyes had lattice degeneration and one eye had a retinal detachment.

Av-Shalom, Berson, Gombos, Landau, Michaelson, and Zauberman (1967) found fourteen eyes with holes among 257 emmetropic African subjects and two eyes with holes among thirteen myopic subjects.

Byer (1967) studied the prevalence of retinal breaks in 1,700 consecutive patients aged 10 and over, using the indirect ophthalmoscope and scleral indentation. Areas of definite or suspected retinal breaks were examined with the slit lamp, using the Goldmann three-mirror contact lens. Full thickness retinal breaks were found in 98 subjects (5.8 per cent.), 111 eyes being affected. The incidence of breaks increased until the age of 40, and the subjects with breaks showed a slight shift towards myopia. Byer concluded that the prophylactic treatment of asymptomatic retinal breaks is justified only in very exceptional cases.

Rutnin and Schepens (1967) examined 204 asymptomatic eyes without selection with regard to refraction. They found sixteen eyes with retinal breaks (7.8 per cent.). There were eighteen retinal breaks altogether, including one horse-shoe tear and seventeen round holes. Their size varied from pin-point to $1\frac{1}{2}$ disc diameters. The number of retinal breaks and the number of subjects affected did not increase with age. Furthermore, the retinal breaks were three times as common in the oral region as in the equatorial

region—the opposite of the case in eyes with retinal detachment. The authors concluded that retinal breaks in normal eyes compared to breaks in eyes with retinal detachment are smaller, generally single, located near the ora serrata, non-progressive, and not related to age.

In contrast, nearly two-thirds of the 48 retinal breaks discovered in the present series were in the equatorial region, and the breaks were more frequent with increasing age. Round holes were most frequently found in the upper temporal quadrant, followed by the lower temporal, upper nasal, and lower nasal quadrants in order of frequency. Horseshoe breaks were most often found in the upper temporal quadrant, followed by the upper nasal, lower temporal, and lower nasal quadrants in order of frequency. This distribution of retinal breaks corresponds to the distribution of retinal breaks in myopic eyes with detachment reported by Tulloh (1965).

The high incidence of retinal breaks in the present series of asymptomatic myopic eyes compared to the incidence of breaks in the general population accords with the greater frequency of detachment in myopia.

The incidence of myopia varies from 5 to 12.5 per cent. in different countries (Blegvad, 1927; Betsch, 1929; Strömberg, 1936); in Japan the incidence is 31.1 to 44.6 per cent. (Takahashi, 1939; Kirisawa, Oyama, and Sato, 1941; Sato, 1957). The incidence of myopia in Israel where the present survey was carried out, is not known but if we assume it to be as low as 5 per cent., there will be approximately 125,000 myopes in the country (250,000 myopic eyes). In the present series 11.1 per cent. of the 332 myopic eyes examined had retinal breaks and if we assume that the subjects examined are representative of the general population, we can conclude that there are 27,750 myopic eyes in the country with asymptomatic retinal breaks.

There are about ninety cases of primary retinal detachment a year in Israel, in myopic eyes which are not aphakic nor “second eyes” of patients who have suffered from retinal detachment in the fellow eye (Michaelson, 1968). It is therefore obvious that only a very small proportion of myopic eyes with asymptomatic retinal breaks will develop retinal detachment. Even if we take into account the size and position of the break, the presence or absence of vitreous pull and other factors, there is no infallible way of distinguishing dangerous retinal breaks from benign ones. A long-term follow up study of a large number of eyes with untreated retinal breaks may provide the answer to this problem.

Summary

The peripheral retina of 332 asymptomatic myopic eyes was examined with the Goldmann three-mirror contact lens; 37 eyes of 34 subjects had full-thickness retinal breaks (11.1 per cent.), eight eyes had microholes, four had partial-thickness retinal breaks, and fourteen had retinoschisis.

Retinal breaks were more frequent with increasing age.

It is pointed out that only a very small proportion of asymptomatic myopic eyes with retinal breaks will develop detachment.

The literature on the subject of asymptomatic retinal breaks is reviewed.

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