OPEN ACCESS
Saudi Journal of Medical and Pharmaceutical Sciences
Abbreviated Key Title: Saudi J Med Pharm Sci
ISSN 2413-4929 (Print) |ISSN 2413-4910 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com/journal/sjmps/home

Original Research Article

A Study of White Without Pressure Peripheral Retinal Lesions in Emmetropia, Myopia and Hypermetropia

Dhull VK[1*], Nada Manisha[1], Sood Sundan[2], Gahlawat Rachana[3]
[1]Professor, Ophthalmology, RIO, Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences (PGIMS), Rohtak, SH 16A, Haryana 124001, India
[2]Professor, Ophthalmology, GMC, Chandigarh, India
[3]Sr. Resident, RIO, Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences (PGIMS), Rohtak, SH 16A, Haryana 124001, India

***Corresponding author:** Dr. V. K Dhull
| **Received:** 03.06.2019 | **Accepted:** 10.06.2019 | **Published:** 22.06.2019
DOI: 10.36348/sjmps.2019.v05i06.007

Abstract

This research work was carried out in 360 eyes of 180 patients to study the white without pressure (WWOP) lesions regarding its incidence, morphology, distribution, associated retinal and vitreous changes and its predisposition to retinal detachment in 60 patients each of emmetropes, myopes and hypermetropes. The patients were examined by indirect ophthalmoscopy and Goldman-three mirror lens. The maximum numbers of patients were in the second to fifth decade of life. Maximum number of eyes had 0-2 diopters of refractive error. The WWOP lesions were detected in 3.61% eyes. The WWOP lesions were found to be more common in the third decade of life. There was no predilection for sex in patients of WWOP. The lesions were found more frequently in myopic eyes compared to other groups. These lesions were observed between the ora serrata and equator. Isolated lesions were more common than the confluent lesions. The superotemporal quadrant of the retina was the most frequently involved. The peripheral retinal lesions capable of causing retinal detachment were seen more frequently in myopic eyes with WWOP. The vitreous changes were observed in all the eyes with WWOP irrespective of the type of refractive error. The WWOP lesion as such may not be having any potential for causing retinal detachment, but because of the more frequent association to the predisposing peripheral retinal degenerations and retinal breaks, it has been suggested that these eyes should be examined more exhaustively and followed up more frequently to prevent the development of retinal detachment.

Keywords: Chorioretinal atrophy, Goldman three-mirror lens, indirect ophthalmoscopy, peripheral retinal degenerations, posterior vitreous detachment, retinal break, vitreous liquefaction.

INTRODUCTION

The term white without pressure (WWOP) refers to geographic areas of relative whiteness of the peripheral retina, which is seen by indirect ophthalmoscopy without scleral indentation. When the whitening of the retina appears over the scleral depressor, the term used is white with pressure (WWP). Tolentino *et al*. and Curtin have regarded WWOP as an exaggerated form of white with pressure (WWP) [1, 2]. The subject of WWOP lesions is controversial as, there are not many reports in the available literature as regards to its incidence, morphology, distribution and significance [3-9]. Moreover, the association of WWOP with subsequent retinal breaks and detachment was not yet established. A detailed study of these lesions was required in this regard.

Routine histopathological examination of these lesions in various sites is not possible. It is only the inspection of the retina, which gives us an insight into the significance, and natural history of these lesions. The advent of improvised binocular indirect ophthalmoscopy by Schepens, has lead to its development as a procedure of paramount importance in the stereoscopic examination of the periphery of the retina [10].

Various peripheral retinal lesions such as lattice degeneration, snail track degeneration, retinoschisis, and chorioretinal atrophy have been exhaustively studied. Their incidence, morphology, associated vitreous changes like posterior vitreous detachment (PVD), vitreous liquefaction and their predisposition to retinal detachment (RD) have been established. This enables one to know the course of the disease and to devise various prophylactic and therapeutic measures to prevent occurrence of RD. Though a lot of work has been carried out for these lesions, not much is known about the WWOP lesions.

The incidence of WOW lesions in emmetropic, myopic and hypermetropic eyes needed to be established. The exact morphology, distribution and significance, if known, can give a meaning to their detection The association of WWOP with various retinal degenerations and vitreous changes, if any, needed to be verified. This should be specifically looked for when a WWOP lesion is observed. It needed to be clarified whether WWOP lesion is a forerunner of a subsequent retinal detachment. Such an association can be of great help in order to prevent RD, once the exact course of the disease is known.

For a better understanding of WWOP lesions a well-framed study of these lesions was required. This work is a step in this regard to find out the incidence, morphology, distribution and significance of WWOP retinal lesions in emmetropic, myopic, and hypermetropic patients.

MATERIAL AND METHODS

The present study was carried out in 180 patients attending the out patient department of a tertiary care institute of ophthalmology in northern India. They were divided into three groups of 60 patients each. Group I consisted of patients of emmetropia, group II of myopia and group III of hypermetropia.

Patients suffering from diabetes, hypertension, haemoglobinopathies, Eales' disease, uveitis, glaucoma and patients of trauma were not included in the study. History was taken in all the patients with special reference to the complaints of floaters, flashes of light, failing vision and defects in the field of vision. Subsequently, a meticulous ocular examination consisting of retinoscopy and slit lamp biomicroscopy of the anterior segment was done. The refractive error and best-corrected visual acuity (BCVA) was recorded in all cases. The pupils were dilated by instilling a combination of phenylephrine (5%) and tropicamide (1%) eye drops. Then, the retina of the patients was examined by binocular indirect ophthalmoscopy and the vitreous was examined with Goldman three-mirror contact lens biomicroscopy.

In the present study the peripheral retina was examined first without scleral depressor in order to detect specifically WWOP lesions. The morphology and distribution of WWOP lesions, presence/absence of retinal holes were recorded on a retina chart. Subsequently, depressor indirect ophthalmoscopy was performed in order to record most peripheral retinal lesions, if any. Vitreous examination was carried out by Goldman three-mirror contact lens biomicroscopy under topical anesthesia. The vitreous changes were recorded.

The results of the study were compiled and compared statistically using Student's 't' test (two-ended) and Fisher' exact test. Clinical data was expressed as mean ± standard deviation (SD) and percentage. The difference was considered significant when the p value was < 0.05.

RESULTS AND ANALYSIS

In the present study, a total of 180 patients were included and were divided into 3 groups of 60 patients each. Group I included emmetropes, group II myopes and group III consisted of hypermetropes.

The age of the patients ranged from 11-72 years, with maximum number of patients (91.67%) in second to fifth decade of life. Though, the numbers of females were more than males in all the three groups, but it was statistically significant in group III (Table-1).

Table-1: Showing Age and Sex distribution in total patients of three groups

Sr. No	Age (years)	Group I (n=60)		Group II (n=60)		Group III (n=60)		No. of patients n
		Male	Female	Male	Female	Male	Female	
1	11-20	11	10	10	8	8	5	52
2	21-30	9	13	8	9	4	13	56
3	31-40	2	4	2	9	1	12	30
5	51-60	-	-	2	2	2	4	10
6	61-70	1	-	-	1	1	1	4
7	71-80	-	-	-	1	-	-	1
Total (%)		28 (46.67)	32 (53.33)	25 (41.67)	35 (58.33)	19 (31.67)	41 (68.33)	180 (100)

In the myopic group, 53 patients were having bilateral myopia whereas rest of the 7 patients was having unilateral myopia and accordingly 113 eyes had refractive error. In hpermetropic group, 55 patients were having bilateral hypermetropia and 5 patients had unilateral hypermetropia and accordingly 115 eyes had refractive error. Thus, in the present study there were 228 (63.33%) eyes with refractive error and rest 132 (36.67%) eyes were not having any refractive error. Of these 228 eyes, the maximum number of 64.5% eyes were having 0.25-2 diopters of refractive error, and 25% eyes had refractive error of 2.25 – 6 diopters, and rest 10.5% eyes had > 6 diopters of refractive error (Table-2)

.

Table-2: Showing distribution of refractive error in eyes of group II and III

Sr. No	Refractive Error (Diopters)	Group II (n=120)		Group III (n=120)		Total eyes n
		RE	LE	RE	LE	
1	No error	4	3	2	3	12
2	0.25-2	29	31	42	45	147
3	2.25- 4	5	5	11	12	33
4	4.25- 6	11	9	4	-	24
5	6.25 -8	3	3	-	1	7
6	>8	8	9	-	-	17
Total		60	60	60	60	240

In the present study the maximum number of 311 eyes (86.4%) in all three groups had best corrected visual acuity (BCVA) of 6/6 (Table-3).

Table-3: Showing Best Corrected Visual Acuity (BCVA) in total eyes

Sr. No	BCVA	Group I (n=120)		Group II (n=120)		Group III (n=120)		Total eyes (n=360)		Total eyes (%)
		RE	LE	RE	LE	RE	LE	RE	LE	
1	6/6	60	60	46	44	50	51	156	155	311
2	6/9- 6/12	-	-	4	5	6	6	10	11	21
3	6/18- 6/24	-	-	4	5	4	3	8	8	16
4	6/36- 6/60	-	-	4	1	-	-	4	1	5
5	< 6/60	-	-	2	5	-	-	2	5	7

In the present study, the WWOP lesions were seen in 11 (6.11%) patients, and these lesions were bilateral in 2 patients and unilateral in 9 patients. Thus, 13 eyes (3.61%) of 11 patients were having WWOP lesions. Therefore, the incidence of WWOP lesion was found to be 3.61% in the present study. The incidence of WWOP lesion in emmetropes myopes and hypermetropes was found to be 0.61%, 2.70% and 0.30% respectively.

Out of 11 patients of WWOP, 7 were males and 4 were females. This predilection for sex in present study was statistically insignificant (p>0.05). The age of the patients of WWOP ranged from 18 years to 43 years and the maximum number of patients (54.55%) were seen in the third decade of life (Table-4).

Table-4: Distribution of age and sex in patients of White without Pressure (WWOP)

Sr. No	Age (years)	Number of patients n		Total number of patients n
		Male	Female	
1	11-20	1	-	1
2	21-30	3	3	6
3	31-40	1	-	1
4	41-50	2	1	3
Total		7	4	11

Out of 13 eyes having WWOP lesions, 15.4% were emmetropic, 77% were myopic and 7.7% s hypermetropic, thereby, signifying predilection of myopic eyes for WWOP lesions. This was found to be statistically significant (p <.001).

Eight eyes (61.5%) with myopia had refractive error > -2.25D, whereas 15.4% had refractive error < -2.25D. This means that myopes with refractive error > -2.25D were more frequently having WWOP lesions. This was statistically highly significant (Table-5).

Table-5: Showing type and amount of refractive error in eyes with WWOP

Sr. No	Amount of Refractive error	Group I n	Group II n	Group III n	Total no. of eyes
1	0 - 2	2	2	1	5
2	2.25 - 4	-	3	-	3
3	4.25 - 6	-	3	-	3
4	6.25 - 8	-	-	-	-
5	> 8	-	2	-	2
Total (%)		2 (15.4)	10 (76.9)	1 (7.7)	13

Out of total 13 eyes with WWOP lesions, 69.2% eyes had BCVA of 6/6 and the rest were having BCVA < 6/9 (Table-6).

Table-6: Showing distribution of BCVA in all 13 eyes of WWOP

Sr. No	BCVA	Group I		Group II		Group III		Total eyes N (%)
		RE	LE	RE	LE	RE	LE	
1	6/6	1	1	5	1	-	1	9 (69.2)
2	6/9-6/12	-	-	-	-	-	-	-
3	6/18-6/24	-	-	1	1	-	-	2 (15.4)
4	6/36-6/60	-	-	-	-	-	-	-
5	<6/60	-	-	1	1	-	-	2 (15.4)
Total eyes (%)								13 (100)

In the present study two types of WWOP lesions were observed: Confluent and Isolated. The confluent lesions were circumferential to ora serrate involving more than one quadrant with sharp and well defined scalloped posterior border and fuzzy anterior border, and were found to be almost parallel to ora serrata. The isolated lesions were either tongue-shaped or finger-like with rounded and well-defined posterior border, which merged with the anterior retina imperceptibly and were confined to one quadrant only.The isolated lesions were observed more frequently than confluent lesions. Eleven out of 16 lesions (68.8%) of WWOP were isolated type of lesions and 5 lesions (31.2%) were of confluent type (Table-7).

Table-7: Showing distribution of type of WWOP lesions in all groups

Sr. No	Type of WWOP lesions	Group I n (%)	Group II n (%)	Group n (%)	Total n (%)
1	Isolated	2 (12.5)	8 (50)	1 (6.25)	11 (68.75)
2	Confluent	-	5 (31.25)	-	5 (31.25)
Total		2 (12.5)	13 (81.25)	1 (6.25)	16 (100)

The superotemporal quadrant was the most (50%) and inferonasal the least (6.25%) frequently involved quadrant in this study. This difference in occurrence was found to be highly significant statistically as per Fisher's Exact Test.

Table-8: Showing the distribution of WWOP lesions in various quadrants

		Quadrant involved			
Sr. No	Groups	Superonasal	Superotemporal	Inferonasal	Inferotemporal
1	I	-	2	-	-
2	II	3	5	1	4
3	III	-	-	-	1
Lesion (%)		3 (18.75)	7 (43.75)	1 (6.25)	5 (31.25)

In the present study it was found that in group I white without pressure lesions were associated coincidently with salt and pepper fundus in 2 eyes. In group II, these lesions were associated with 2 eyes each of lattice degeneration, pigmentary clumps, chorioretinal atrophy and retinal holes, whereas, in Group III no associated retinal lesions were observed (Table-9).

Table-9: Showing other associated peripheral retinal lesions in the eyes with WWOP

Sr. No	Associated lesions	Group I (n=2)	Group II (n=10)	Group III (n=1)
1	Lattice degenerations	-	2	-
2	Pigmentary clumps	-	2	-
3	Chorioretinal atrophy	-	2	-
4	Retinal holes	-	2	-
5	Salt and pepper fundus	2	-	-
Total (eyes)		2	8	-

Eight out of ten myopic eyes (80%) with WWOP had associated retinal lesions. This association of WWOP in myopic eyes with various retinal lesions was found to be statistically significant (Z 4.23, $p < .01$) when compared with emmetropic and hypermetropic eyes.

The most frequent retinal degeneration observed was chorioretinal atrophy in 3.61% eyes, and all the patients happened to be in myopic group. Group II had the maximum number of associated retinal lesions (Table-10).

Table-10: Showing the distribution of various retinal degenerations in the three groups

Sr. No	Retinal degeneration	Group I (120 eyes) n (%)	Group II (120 eyes) n (%)	Group III (120 eyes) n (%)	Total (360 eyes) n (%)
1	Lattice degenerations	-	6 (5.0)	-	6 (1.7)
2	Pigmentary clumps	2 (1.7%)	4 (3.3)	-	6 (1.7)
3	Chorioretinal atrophy	-	13 (10.8)	-	13 (3.6)
4	Retinal breaks	-	5 (4.2)	-	5 (1.4)
5	Salt and pepper fundus	2 (1.7%)	-	-	2 (0.6)
Total (%)		4 (3.3)	28 (24.8)	-	32 (8.9)

The incidence of peripheral retinal degenerations like lattice degeneration, pigmentary clumps, chorioretinal atrophy and retinal breaks was 5.3%, 3.5%, 11.5% and 4.4% respectively in myopic eyes of group II, whereas the incidence was 20% of each of the above lesions in myopic eyes with WWOP. The higher incidence of these lesions in myopic eyes with WWOP as compared to myopic eyes of group II was found to be statistically significant.

Table-11: Showing associated peripheral retinal degenerations in myopic eyes with and without WWOP – a comparative analysis

Sr. No	Retinal lesion	Myopic eyes (113 eyes) n (%)	Myopic eyes with WWOP (10 eyes) n (%)	Significance (Z value)
1	Lattice degeneration	6 (5.3)	2 (20)	6.9
2	Pigmentary clumps	4 (3.5)	2 (20)	9.5
3	Chorioretinal atrophy	13 (11.5)	2 (20)	2.8
4	Retinal breaks	5 (4.4)	2 (20)	8.1
Total (%)		28 (24.8)	8 (80)	Z=4.23

Out of 120 eyes in group II, thirty-five eyes (29.2%) showed vitreous changes whereas, only 7 eyes (5.8%) of group I and 4 eyes (3.4%) of III showed vitreous changes. This difference was statistically highly significant ($p < 0.001$).

Table-12: Showing the vitreous changes in all the patients in three groups

Sr. no	Groups (eyes)	Synchysis/ liquefication n (%)	PVD n(%)	Vitreoretinal adhesions n(%)	Total n(%)
1	I (120)	6 (5)	1 (0.83)	-	7 (5.8)
2	II (120)	14 (11.7)	12 (10.0)	9 (7.5)	35 (29.2)
3	III (120)	2 (1.7)	2 (1.7)	-	4 (3.4)

All the patients with WWOP lesions, irrespective of type of refractive error, showed vitreous changes. However, these were observed more frequently in group II as compared to group I and III and were found to be statistically highly significant (p <0.001). The most common vitreous change observed in the present study was PVD in 76.9% eyes followed by vitreoretinal adhesions in 61.5% eyes and synchisis in 38.5% eyes as shown in Table 13.

Table-13: Showing the vitreous changes seen in 13 eyes of 11 patients of WWOP

Sr. No	Groups	Synchysis/cavitation eyes (%)	PVD eyes (%)	Vitroretinal adhesions eyes (%)
1	I	2 (15.4)	1 (7.7)	-
2	II	2 (15.4)	8 (61.5)	8 (61.5)
3	III	1 (7.7)	1 (7.7%)	-
Total (%)		5 (38.5)	10 (76.9)	8 (61.5)

DISCUSSION

In the present research work, 360 eyes of 180 patients were studied to find out the incidence, morphology, distribution and clinical significance of WWOP retinal lesions in 60 patients each of emmctropia, myopia and hypermetropia.

The WWOP lesions were detected in 13 eyes. The incidence in emmetropes, myopes and hypermetropes was found to be 0.6%, 2.7% and 0.3% respectively. Thus, the overall incidence of WWOP in present study was 3.61%. This was found to be in accordance with Shukla & Ahuja on Indian subjects who reported the incidence of to be 2.75% [7]. However, it was found to be higher than the reported incidence of 0.6% by Halpern, in whites of New York)

[3]. While reviewing the literature, we could find only one study by Hunter in 1982 that was carried out in white and black races. The incidence of WWOP was 2.5% in the former and 23% in the latter [6]. Thus, it was noted that the incidence of WWOP in Indians was almost the same as that observed in the Caucasians.

The WWOP lesions were found to be more common in the third decade of life as 6 out of 11 patients (54.55%) were found to be in this age group. This was in accordance with a study by Shukla & Ahuja on Indian patients [7]. However, the occurrence of WWOP lesions was more common in the fourth decade of life according to a study by Karlin & Curtin [4].

As regards to the gender, no statistically significant predilection was seen in the present study, which was in accordance with various investigators who also observed sex to be an insignificant determinant in the prevalence of WWOP lesions [5, 7, 11].

In the present study, WWOP lesions were found significantly more commonly in myopic eyes (77%) as compared to emmetropic (15.4%) and hypermetropic (7.7%) eyes.

The myopes having refractive error of more than 2.25 diopters were more commonly affected (80%). Similar observations were made by Karlin & Curtin and Shukla & Ahuja [4, 7]. Karlin & Curtin, reported the incidence to be 54% in myopes [4]. Hunter noted the similar prevalence and recommended yearly re-evaluation of WWOP lesions in patients with high myopia [6].

The BCVA in eyes with WWOP was 6/6 in 69.2% eyes. This could be due to the relatively more peripheral occurrence of these lesions without the involvement of the macula. The rest of 30.8% eyes with less visual acuity happened to be high myopes with macular involvement.

In this study, the WWOP lesions were observed between the ora serrata and the equator. These lesions were either parallel to ora serrata with sharp scalloped posterior borders and fuzzy anterior borders, or localized tongue shaped patches. This finding was in accordance with the study by Nagpal *et al*. and Hunter [5, 6]. However, in another study on Indian subjects by Shukla & Ahuja, these lesions were seen to affect the equatorial and post equatorial regions being separated from ora serrata by white with pressure lesions [7]. Though, the post equatorial distribution of these lesions were reported in some instances by Nagpal *et al*., Hunter and Bell & Stenstrom [5, 6, 12], but it was not observed in the present study.

The isolated lesions of WWOP were found to be significantly more common (68.8%) than the confluent lesions (31.3%). This was in contrast to the observation of the study done by Nagpal *et al*. where confluent lesions were found to be more than the isolated lesions [5]. Both the isolated and the confluent lesions were seen in another study but the prevalence was not mentioned [6].

In the present study, islands of normal retina surrounded by areas of WWOP resembling the pseudoholes were not observed. However, these were reported by Hunter and Bell & Stenstrom [6, 12].

In this study, bilateral WWOP lesions were observed in only 18.2% patients, and so, there was hardly any tendency for bilaterality of these lesions. This was found to be comparable with the study by Shukla & Ahuja on Indian subjects [7]. However, Karlin and Curtin had reported a tendency of bilaterality in WWOP lesions in their study of 1437 eyes [4]. This difference could be due to the large sample of 1437 eyes exclusively of myopia as compared to smaller sample of 360 eyes consisting of only 113 myopic eyes in the present study.

The temporal retina was found to be more frequently involved with WWOP lesion than the nasal retina in the present study, and it was in accordance with Nagpal *et al*., Hunter and Shukla & Ahuja [5-7]. In our observations, the most frequently involved retinal quadrant was superotemporal and least frequent being inferonasal. This was statistically significant. However, it was found in other studies that inferotemporal followed by the superotemporal quadrant were the most frequently involved [5, 6].

Various retinal degenerations like lattice degeneration, chorioretinal atrophy, pigmentary clumps, and atrophic retinal holes were most frequently (24.8%) observed in mypic eyes. And 80% of myopic eyes with WWOP had these associated peripheral retinal degenerations. In the present study, there was not even a single patient in hypermetropes who was having associated peripheral retinal degenerations. These were almost non-existent in emmetropes as well. The association of salt and pepper fundus in 15.3% emmetropic eyes was merely a coincidental finding. This happened to be an inflammatory condition and not a peripheral retinal degeneration.

The lattice degeneration was observed in 5.31% of myopic population. However, the incidence increased to 26% in myopic eyes of more than 6 diopters of refractive error. This was in accordance with observations of Karlin & Curtin, Schepens & Bahn and Kirker & McDonald, whose reported incidence of lattice degeneration in myopia of more than 6 diopters ranged from 11% to 22% [4, 13, 14].

In the present study, out of 13 eyes with WWOP lesions 10 eyes were myopic and the association of various peripheral retinal lesions was observed in 80% of these myopic eyes. The associated lattice degeneration in eyes with WWOP was observed in 20% eyes as compared to 5.3% in myopic group. This difference was found to be statistically highly significant. Though, the other authors had also reported the association of lattice degeneration with WWOP but, the exact percentage had not been mentioned.[5, 6] However, it was obvious from the present study that the lattice degeneration, a predisposing factor to RD was found more frequently in myopic patients with WWOP than in myopic patients without WWOP.

The pigmentary clumps are known to occur at sites of vitreoretinal adhesions. These were observed in 3.3 % patients of myopia as compared to 1.7% of emmetropia. Incidence of pigmentary clumps was found to be much less than what had been reported by Karlin & Curtin in patients of less than 20 years of age [4]. This appeared to be because of the fact, that all the patients with pigmentary clumps were in the younger age group of less than 30 years as was seen in myopic patients in our study.

In this study, the association of pigmentary clumps with WWOP was seen in 20% of myopic eyes as compared to 3.5% myopic eyes without WWOP. Thus, this association occurs significantly more frequently in myopic eyes with WWOP as compared to myopic eyes without WWOP. Since, the presence of pigmentary clumps is an established risk factor predisposing to RD. Therefore, it appeared that the association of these lesions with WWOP makes the eye more vulnerable to develop RD.

In the present study, chorioretinal atrophy was observed in 10.8% myopic eyes, and the incidence increased to 30.4% in myopic eyes of refractive error of more than 6 diopters. This was found to be comparable with a study by Curtin, Shukla & Ahuja where an incidence of 23% of chorioretinal atrophy was found in myopic subjects [2, 8].

The association of chorioretinal atrophies with WWOP were observed in 20% of myopic eyes as compared to 10.8 % eyes in myopic group. This difference was found to be statistically significant.

In the present study, retinal breaks were found in 4.2% eyes of myopics and in none of the eyes of emmetropics or hypermetropics. If myopic eyes of more than 6 diopters were taken into consideration, the incidence of retinal breaks increased to 13%. This was found to be similar to the studies by Hyams & Newmann, Karlin & Curtin who also found the occurrence of retinal breaks in high myopes [15, 16].

The retinal breaks were observed in 20% of myopic eyes with WWOP lesions as compared to 4.4% in myopic group. The atrophic holes were also found more frequently in eyes with WWOP, and this difference was found to be statistically highly significant.

The WWOP lesion as such may not be having a potential for causing RD, but because of its association with peripheral retinal degenerations a suspicion should arise and such eyes should be followed up more frequently to prevent the development of RD.

In the present study, the vitreous changes consisting of liquefaction, PVD and vitreoretinal adhesions (VRA) were seen to occur significantly more frequently (30.9%) in myopic group as compared to emmetropic (5.8%) and hypermetropic groups (3.4%). Vitreous liquefaction was observed in 12.4% eyes, PVD in 10.6% eyes and VRA in 8% eyes of myopics. This was comparable with studies by Singh *et al*. and Takahashi *et al*. [17, 18].

The degenerative changes in vitreous gel were seen in lesser percentage of cases in emmetropic and hypermetropic groups, as compared to that reported by Singh *et al*., Teng & Chi, Goldman and Gloor & Daicker [17, 19-21]. This could be because of the fact that the patients were relatively of younger age in both these groups (40-50 years) as compared to the samples of these authors. However, these changes were observed in relatively still younger patients of myopia in our study as found by these authors.

Vitreous changes in eyes with WWOP were found much more frequently in myopes than emmetropes and hypermetropes, and the difference was found to be statistically highly significant. The common vitreous changes observed were PVD (76.9%), VRA (61.5%) and vitreous liquefication (38.5%). These were observed in areas corresponding to the WWOP as confirmed by Goldman three mirror examination. This was found to be in accordance with findings of other studies [1, 4, 5, 7, 11, 12, 21].

Since, in the majority of eyes with WWOP lesions, PVD and VRA were observed, therefore, it could be postulated that the VRA caused some kind of traction on the retina making it appear greyish white than the adjoining adhesion-free normal looking retina. Thus, the association of PVD and VRA with WWOP lesions was found to be in accordance with other studies [5, 6, 12, 16].

Tolentino considered white without pressure just an abnormal light reflex originating at the vitreoretinal interface without structural abnormalities [1]. Other evidence suggesting that white without

pressure was only due to an abnormal light reflex include the observations that these areas migrate and / or disappear [5], and are seen far more frequently in young patients [4, 7]. In the present study, we did not observe any abnormal light reflexes, which further lends support to the hypothesis that WWOP lesions are probably as a result of VRA only in the areas of WWOP following the synchisis and syneresis of vitreous.

On the basis of the frequent presence of PVD and VRA visualised in the area corresponding to WWOP, it was postulated that vitreoretinal traction at the base of the vitreous was probably responsible for the occurrence of WWOP.

Since, WWOP was found significantly more frequently in myopic eyes as compared to non-myopic eyes and the associations of peripheral retinal lesions predisposing to retinal detachment were also observed significantly more commonly in myopic eyes with WWOP than in the myopic eyes without WWOP lesions. Therefore. the eyes with WWOP should not be disposed off after establishing the presence of WWOP lesion. Infact, a suspicion should arise warranting more close and frequent follow-up for the timely detection and treatment of predisposing lesions in such eyes so that the potential to cause retinal detachment is warded off.

CONCLUSION

The present study was carried out in 360 eyes of 180 patients in order to study the peripheral retinal lesion- WWOP as regards to its incidence, morphology, distribution, associated retinal and vitreous changes and its predisposition to cause retinal detachment. These were divided into three groups of 60 patients each of emmetropia, myopia and hyperopia. The age of the patients ranged from 11 to 72 years with maximum number of patients were in second to fifth decade of life. There were 40% males and 60% females. Maximum numbers of eyes were observed in 0-2 diopters of refractive error .The maximum number of patients in all age groups had their best corrected visual acuity of 6/6. The incidence of WWOP was found to be 3.61%. The incidence in emmetropes, myopes and hypermetropes was found to be 0.61%. 2.7% and 0.3% respectively. These lesions were found to be more common in the third decade of life. There was no predilection for sex. The WWOP lesions were found more frequently in myopic eyes (76.9%) as compared to emmetropic (15.4%) and hypermetropic eyes (7.7%). Eighty percent of these myopes with WWOP had refractive error of more than -2.25 diopters. These lesions did not affect the visual acuity of the patients. These lesions were observed between the ora serrata and equator. The isolated WWOP lesions were more frequent than the confluent. There was no tendency for bilaterality of these lesions. The superotemporal quadrant of the retina was the most frequently involved and inferonasal quadrant the least frequently. The association of other peripheral retinal degenerations like lattice degeneration, pigmentary clumps, chorioretinal atrophy and retinal breaks were found only in myopic group. The associated peripheral retinal degenerations were observed in 24.8% of myopic eyes as a whole whereas these were seen in 80% myopic eyes with WWOP lesions. Vitreous changes like PVD, liquefaction and VRA were observed significantly more frequently in myopes (30.9%) as compared to emmetropes (5.8%) and hypermetropes (3.4%). Although, the vitreous changes were observed in majority of the eyes with WWOP irrespective of the types of refractive error, but these occurred significantly more frequently in myopes than in emmetropes and hypermetropes. Since, the occurrence of PVD and vitreoretinal adhesions were observed in areas corresponding to WWOP lesions, therefore, it could be postulated that the latter caused some kind of traction on the retina making it appear greyish-white than the adjoining adhesion free normal retina.

The WWOP lesion as such may not be having any potential for causing retinal detachment but because of its more frequent association with the predisposing peripheral retinal degenerations and vitreous changes, it had been advocated that these eyes should be examined more exhaustively and followed up more frequently to prevent the development of retinal detachment.

REFERENCES

1. Tolentino, F. I., Schepens, C. L., & Freeman, H. M. (1976). Vitroretinal disorders Diagnosis and Management. Philadelphia: W.B. Saunders, 328.
2. Curtin, B. J. (1985). The Myopias: Basic Science and Clinical Management. New York: Harper and ROW; 339-403.
3. Halpern, J. I. (1966). Routine screening of the retinal periphery. *American journal of ophthalmology*, *62*(1), 99-102.
4. Karlin, D. B., & Curtin, B. J. (1976). Peripheral chorioretinal lesions and axial length of the myopic eye. *American journal of ophthalmology*, *81*(5), 625-635.
5. Nagpal, K. C., Huamonte, F., Constantaras, A., Asdourian, G., Goldberg, M. F., & Busse, B. (1976). Migratory white-without-pressure retinal lesions. *Archives of Ophthalmology*, *94*(4), 576-579.
6. Hunter, J. E. (1982). Retinal white without pressure: review and relative incidence. *American journal of optometry and physiological optics*, *59*(4), 293-296.
7. Shukla, M., & Anuja, O. P. (1982). White with pressure (WWP) and white without pressure (WWOP) lesions. *Indian journal of ophthalmology*, *30*(3), 129-132.

8. Shukla, M., & Ahuja, O. P. (1983). Peripheral retina in myopia. *Indian journal of ophthalmology*, *31*(6), 719-722.
9. Augsburger, J. J. (1988). Peripheral retinal degenerations. In: David, A. Newsome, editor. Retinal dystrophies and degenerations. New York: Raven Press, 302.
10. Schepens, C. L. (1947). A new ophthalmoscope demonstration. *Transactions-American Academy of Ophthalmology and Otolaryngology. American Academy of Ophthalmology and Otolaryngology*, *51*, 298-301.
11. Rutnin, U., & Schepens, C. L. (1967). Fundus appearance in normal eyes: IV. Retinal breaks and other findings. *American journal of ophthalmology*, *64*(6), 1063-1078.
12. Bell, F. C., & Stenstrom, W. J. (1983). Peripheral retinal appearances and degenerations. In: Atlas of the peripheral retina. Philadelphia: WB Saunders; 24.
13. Schepens, C. L., & Bahn, G. C. (1950). Examination of the ora serrata: its importance in retinal detachment. *AMA archives of ophthalmology*, *44*(5), 677-690.
14. Kirker, G. E., & McDonald, D. J. (1971). Peripheral retinal degeneration in high myopia. *Canadian journal of ophthalmology. Journal canadien d'ophtalmologie*, *6*(1), 58.
15. Hyams, S. W., & Neumann, E. (1969). Peripheral retina in myopia. With particular reference to retinal breaks. *The British journal of ophthalmology*, *53*(5), 300-306.
16. Karlin, D. B., & Curtin, B. J. (1974). Axial length measurements and peripheral fundus changes in the myopic eye. In: Pruett, R. C., & Regan, C. D. J., editors. Retina congress. New York: Appleton - Century - Crofts; 629.
17. Singh, A. (1970). A clinical study of vitreous body (in emmetropia & refractive errors). *Orient Arch Ophthalmol*, *8*, 11-17.
18. Takahashi, M., Jalkh, A., Hoskins, J., Trempe, C. L., & Schepens, C. L. (1981). Biomicroscopic evaluation and photography of liquefied vitreous in some vitreoretinal disorders. *Archives of Ophthalmology*, *99*(9), 1555-1559.
19. Teng, C. C., & Chi, H. H. (1957). Vitreous changes and the mechanism of retinal detachment. *American journal of ophthalmology*, *44*(3), 335-356.
20. Goldmann, H. (1961). The diagnostic value of biomicroscopy of the posterior parts of the eye. *The British journal of ophthalmology*, *45*(7), 449-460.
21. Gloor, B. P., & Daicker, B. C. (1975). Pathology of the vitreo-retinal border structures. *Transactions of the ophthalmological societies of the United Kingdom*, *95*(3), 387.