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Comparison of patient satisfaction with red-free (green) versus yellow light using binocular indirect ophthalmoscope for retinal examination

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Purpose: Comparison of patient satisfaction with red-free (green) versus yellow light using binocular indirect ophthalmoscope for retinal examination. **Methods:** This is an observational questionnaire-based study of 100 myopes in the age group of 18–40 years coming for a routine check-up or for refractive surgery workup. The examination was done using an indirect ophthalmoscope and a 20D lens with green or yellow light and was assigned in two groups randomly using the coin toss method, following which, a questionnaire was used to assess the following parameters: a) level of comfort, b) any complaints of discomfort during examination, d) preference of the used light source in future, e) grading of discomfort on a linear scale, and f) patient cooperation and duration of examination. **Results:** Patients were randomized for observation with IDO using either green light (n = 55) or yellow light (n = 45) filter. In the study, 46 patients (83.6%) were very comfortable and only 9 patients (16.4%) experienced mild discomfort when using red-free (green) light, while only 3 patients (6.7%) were very comfortable and 31 (68.9%) had mild discomfort when using yellow light. The complaints of watering with yellow and green light were noted in 36 patients (80.0%) and 15 patients (27.3%), pain in 13 patients (28.9%) and 3 patients (5.5%), light sensitivity in 29 patients (64.4%) and 4 patients (7.3%), respectively, all being significantly more in yellow light category ($P < 0.001$). The time of examination was significantly more in yellow light category with 83 ± 10.75 seconds ($P < 0.001$). **Conclusion:** Retinal examination using the green filter of indirect ophthalmoscope is more comfortable in examining the patients as compared to routine yellow light with decreased number of complaints, lesser examination time, and better patient cooperation.

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The incidence and prevalence of myopia is rising globally in significant proportion and will affect nearly five billion people by 2050. This has important implications in planning comprehensive eye care services for diagnosis, management, and prevention of myopic ocular complications amongst people with high myopia.[1]

Individuals with myopia have an increased risk of myopic retinopathy, which involves the posterior pole and includes peripheral retinal changes, such as posterior staphyloma, lacquer cracks, Fuchs' spot, chorioretinal atrophy, lattice, paving stone degeneration, white-without-pressure (WWOP), and pigmentary degenerations, as well as retinal tears.[2]

Proper evaluation of myopic eye requires detailed ophthalmoscopic evaluation by an experienced ophthalmologist. Patient cooperation is mandatory for complete assessment although the examination is at times uncomfortable due to plentitude of findings, need for adequate and prior pupillary dilatation requiring long OPD wait times and observer dependence of subjective findings. The technique for examination using yellow light versus green light has also been hypothesized to have an effect on patient experience.[3]

Therefore, this whole experience can always affect the patient's cooperation during the examination, compliance with further follow-up visits, and general patient comfort which are observed in this study.

Methods

This was an observational, prospective, questionnaire, survey-based study conducted on myopes in the age group of 18–40 years of age coming for routine fundus evaluation in a tertiary care eye clinic in North India during the time period of January 2021 to August 2021. The study was conducted according to the tenets of the Declaration of Helsinki and was approved by institutional ethics committee and review board after taking proper consent from the patients. The subjects' pupils were dilated by instilling commercially available combination of tropicamide (0.8%) and phenylephrine (2.5%) eye drops, 30–45 minutes prior to the examination. For each subject, age, gender and refractive correction, and BCVA (best-corrected visual acuity) were noted. Myopia was classified as mild myopia (defined as spherical equivalent

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refraction (SER) < −0.5 diopters (D)), moderate (SER 0.5 to 6.0), and high myopia (defined as SER < −6.0 D). The examination was conducted by using an IDO and a 20D condensing double aspheric lens with scleral depression by two trained vitreo-retina surgeons. The anterior segment was examined on a slit lamp. The study cohort and the light source—red-free (green) or yellow—were chosen by the examining doctor using simple randomization (coin toss method).

The inclusion criteria were all literate myopes (with no previous retinal examination) who were 18–40 years of age presenting to ophthalmology OPD for routine peripheral retina examination with a pupil dilatation of more than 6 mm. The exclusion criteria were corneal opacity, lenticular opacity, glaucoma, history of any previous chorioretinal disease, media opacity precluding adequate fundal view, previous ocular surgery, and any other significant ocular comorbidity. Subjects were explained about the presence or absence of any treatable or normal myopic degenerative changes by the screening ophthalmologist. Following this, a questionnaire survey in English (supplementary files attached) was administered by a single trained ophthalmic assistant. We developed survey questions based on qualitative data, which were validated by all the authors in the study, for patients. Multiple-choice and open-ended questions were used to assess the subjects. The parameters assessed in the questionnaire were a) level of comfort during the indirect ophthalmoscopy examination, b) complaints of patients during the examination which caused discomfort like watering, pain, light sensitivity post examination, and after images, c) the patients were asked whether the used light source would be preferred on a repeat examination if the patient was given a choice, d) the grading of patient comfort was done on a linear scale of 1–10 with 10 being most uncomfortable.[4] The clinician examining the patients, answered open-ended and multiple-choice questions regarding the e) subject's comfort and the type of light source used. The time taken by the doctor in examining both fundi using the chosen light source was recorded by the ophthalmic assistant using a manual stopwatch.

Statistical analysis

All the data was analyzed using SPSS version 26.0. The comparison between two groups was done using independent *t* test or Mann–Whitney *U* test. The association between categorical variables was done using the Chi-squared test. $P < 0.05$ was considered significant.

Table 1: Demographic comparison between green and yellow light filters during indirect ophthalmoscopy

	Type of light used		*P*
	Green (*n*=55)	Yellow (*n*=45)	
	n (%)	*n* (%)	
Age groups (years)			
≤20	16 (29.1)	10 (22.2)	0.732
21-30	33 (60.0)	30 (66.7)	
31-40	6 (10.9)	5 (11.1)	
Mean±SD	25±5.34	24±4.47	0.662
Gender			
Man	25 (45.5)	15 (33.3)	0.218
Woman	30 (54.5)	30 (66.7)	
Refractive correction (Mean±SD)			
Right	-4.71±2.11	-4.48±2.65	0.622
Left	-4.30±2.37	-4.53±2.44	0.645

Results

In our study the average age of the patients was 25 ± 4.95 years, out of which 40 were men (40%) and 60 were women (60%). The refractive error ranged between SER -0.25 D and -11.00 D. Patients were randomized for observation with IDO using either green light (n = 55) or yellow light (n = 45) filter. The responses of the patients were analyzed for comfort during the examination. Of the patients who had an examination performed using green light, 46 patients (83.6%) were very comfortable during the examination as compared to 3 (6.7%) in the case where the examination was performed using yellow light. 31 patients (68.9%) felt mild discomfort with yellow light

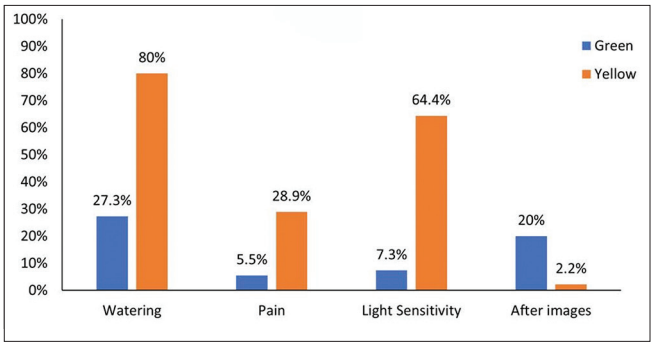

Figure 1: Bar graph for the assessment of comfort level and source of light used

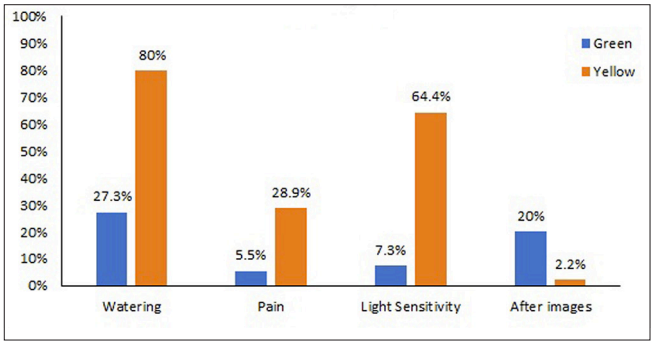

Figure 2: Bar graph for assessment between complaints and source of light used

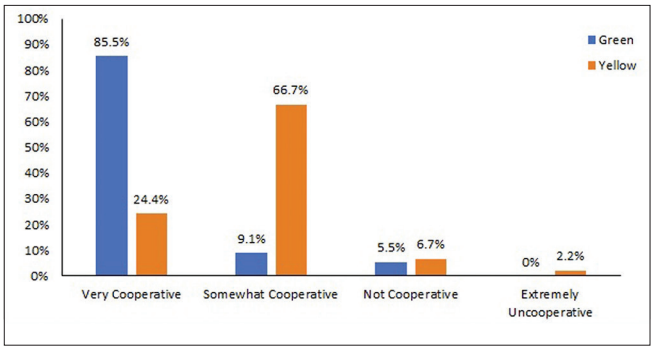

Figure 3: Bar graph for assessment of patient cooperation by the clinician and source of light used

compared to 9 (16.4%) with green light. The patients were more comfortable with green light as compared to yellow light which was statistically significant ($P < 0.001$) [Fig. 1]. The demographic data is shown in Table 1.

In the study, 36 of the patients (80%) with yellow light examination complained about watering in comparison to only 15 (27.3%) with green light ($P < 0.001$). The pain was noted by 13 patients (28.9%) with yellow light compared to 3 (5.5%) with green light ($P = 0.001$). Similarly, light sensitivity was also more in patients examined using yellow light ($P < 0.001$). However, after images were noted more in patients with green light (11 patients (20%) vs 1 patient (2.2%); $P = 0.006$). The complaints after the examination were statistically significantly more in patients with yellow light compared to green light [Fig. 2]. When the patients were asked about their preference of choosing the same light when repeating the examination, 52 (94.5%) preferred the same green light while only 13 (28.9%) preferred the same yellow light. No statistically significant difference was noted in examining peripheral fundus lesions with either light source.

In the study, the examining clinician noted 47 patients (85.5%) with green light to be more cooperative in comparison to 11 (24.4%) with yellow light, which was statistically significant ($P < 0.001$) [Fig. 3]. The time taken by the clinician for examination was observed to be more in patients with yellow light, with 83 ± 10.75 seconds, in comparison to 70 ± 7.77 seconds with green light which was statistically significant ($P < 0.001$.)

Discussion

Myopia has become a major global public health concern. In urban areas of East Asian countries, 80%–90% of children completing high school are now myopic. A large meta-analysis from India showed that the overall crude prevalence of myopia over the last four decades is 7.5% in the 5- to15-year age group.[5]

The need for periodic examinations with scleral depression can make the examination difficult for the clinician, and poor cooperation from the patient may hinder the peripheral retina examination due to the high level of retinal illuminance being uncomfortable for the patient due to the use of condensing lenses with yellow filters.[6]

We observed that, 46 patients (83.6%) were very comfortable during the examination using green light and 9 patients (16.4%) experienced mild discomfort during the examination of the peripheral retina. A similar explanation was given by Henry Schneiderman, that all patients experience anxiety prior to and during examination with yellow light, rendering it difficult to view peripheral retinal degeneration associated with myopia.[7]

With regard to complaints by the patients, we observed that 36 patients (80%) complained of watering with yellow light examination in comparison to only 15 (27.3%) with green light. Similar results have been observed in literature.[3]

We observed a higher preference for the use of green light for IDO by the patients as it was associated with minimal discomfort and allowed for lesser time in the peripheral retinal examination since green light limits the spectral range of the illuminating source, thereby enhancing the visibility of various fundus structures, and minimizes discomfort.[8]

The pros and cons of yellow versus green light are that the detection of retinal breaks by ophthalmoscopy is facilitated by the use of green light. The low reflection of the exposed RPE is contrasted well against the surrounding intact retina. The nerve fibers and their atrophy can be demonstrated better with green light. The penetration of red light through blood permits the visualization of the fundus through a vitreous hemorrhage, which is opaque to green light. Thus the green light, especially 570 nm, provides excellent visualization of the fundus by IDO and requires less intense illumination levels than yellow light. The 570-nm illumination can be advantageously used in conjunction with other techniques (fluorescein angiography, photocoagulation) for optimal visualization and focusing.[7]

There are three potential limitations to our study. First, it is an OPD-based study and selection bias could have accentuated some estimates and masked others. The overall participation rate in our survey was 90% of what is comparable to other OPD-based studies.[9] Second, our study was performed in a tertiary care eye hospital and our study population was therefore definitely not typical for the population of India as a whole. Third, there is a possibility of operator bias as two different ophthalmologists evaluated the patients with differing levels of expertise.

Conclusion

Retinal examination using the green filter of IDO is more comfortable in examining the patients as compared to routine yellow light. Thus retinal examination with green light can provide an easier learning curve for budding retinal specialists with lesser examination time, and better patient cooperation for detailed peripheral retinal examination.

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Conflicts of interest

There are no conflicts of interest.

References

1. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, *et al*. Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. Ophthalmology 2016;123:1036-42.
2. Gözüm N, Cakir M, Gücukoglu A, Sezen F. Relationship between retinal lesions and axial length, age and sex in high myopia. Eur J Ophthalmol 1997;7:277-82.
3. Vignal R, Gastaud P, Izambart C, Daubas P, Freton A. Improved visualization of fundus with green-light ophthalmoscopy. J Fr Ophtalmol 2007;30:271-5.
4. Haefeli M, Elfering A. Pain assessment. Eur Spine J 2006;15:17-24.
5. Agarwal D, Saxena R, Gupta V, Mani K, Dhiman R, Bhardawaj A, *et al*. Prevalence of myopia in Indian school children: Meta-analysis of last four decades. PLoS One 2020;15:1-18.
6. Lewallen S. A simple model for teaching indirect ophthalmoscopy. Br J Ophthalmol 2006;90:1328.
7. Schneiderman H. The Fundoscopic Examination. In: Walker HKHW, Hurst IW, editors. Clinical Methods: The History, Physical, and Laboratory Examinations. 3. Boston, MA: Butterworth; 1990.
8. Delori FC, Gragoudas ES, Francisco R, Pruett RC. Monochromatic ophthalmoscopy and fundus photography. The normal fundus. Arch Ophthalmol (Chicago, Ill 1960) 1977;95:861-8.
9. Mindell JS, Giampaoli S, Goesswald A, Kamtsiuris P, Mann C, Männistö S, *et al*. Sample selection, recruitment and participation rates in health examination surveys in Europe-experience from seven national surveys. BMC Med Res Methodol 2015;15:78.