e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(8); 1605-1609

Original Research Article

Introduction of Smartphone Ophthalmoscopy as a Digital Teaching Tool for MBBS Phase III Students

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Received: 01-05-2025 / Revised: 15-06-2025 / Accepted: 21-07-2025
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Conflict of interest: Nil

Abstract

Background: Mastering direct ophthalmoscopy requires extensive practice, and its single eyepiece limits simultaneous observation, creating challenges for teaching. Smartphone ophthalmoscopes address these limitations by enabling real-time group viewing for teachers and students, facilitating peer-to-peer learning. These devices are also more cost-effective than traditional ophthalmoscopes. User acceptance is crucial for successful adoption. This study aimed to explore medical students' perspectives on a commercially available smartphone ophthalmoscope for fundus examination and compare its usability with the traditional direct ophthalmoscope, incorporating both student and patient viewpoints.

Objectives: 1. To assess the effectiveness of smartphone ophthalmoscopy as a teaching–learning method in ophthalmology. 2.To evaluate perceptions of students and faculty regarding digital teaching aids in ophthalmology.

Methodology: A cross-sectional study was conducted with 25 Phase 3 MBBS students at the Ophthalmology Department of N.C. Medical College and Hospital, Israna, following Institutional Ethics Committee approval. Participants attended a 45-minute training session on smartphone ophthalmoscopy, comprising a 10-minute lecture on the working principle, a 5-minute demonstration, and a 30-minute supervised practice on standardized patients. Student and faculty perceptions were collected through structured questionnaires and analyzed.

Results: Most students reported that smartphone ophthalmoscopy was easy to use, satisfying, and student-friendly, enhancing their ability to learn fundus imaging and identify disease pathologies. A majority (84%) strongly agreed that smartphone ophthalmoscopy should be incorporated into the medical curriculum.

Conclusion: Replacing the direct ophthalmoscope with a smartphone-based alternative may improve the accuracy and effectiveness of fundus examinations by undergraduate students, while enhancing the teaching–learning experience in ophthalmology.

Keywords: Ophthalmoscopy, Smartphone Ophthalmoscopy, Medical Education.

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Introduction

Digital tools play a crucial role in undergraduate teaching in ophthalmology, enhancing the learning experience for students and providing valuable resources for educators. Digital tools provide visual representations of complex ophthalmic concepts, making it easier for students to understand and remember them.

By incorporating digital tools into the teaching of ophthalmology, MBBS students can benefit from interactive and engaging learning experiences, improved access to resources, and enhanced practical skills development. Smartphone ophthalmoscopy provides students with a hands-on learning experience, allowing them to directly examine the eye structures. This practical exposure is crucial for developing clinical skills and competence in performing ophthalmic examinations. It contributes to a more comprehensive understanding of ophthalmic concepts and prepares students for their future careers in healthcare.

For frontline clinicians such as general practitioners and ophthalmologists, direct ophthalmoscopy is an essential investigative skill. [1] On the other hand; direct ophthalmoscopy is difficult to learn technically. First off, many medical students lack confidence and competence because of the conventional direct ophthalmoscopy short working

distance and narrow field of view. [2,3] Second, the single eyepiece makes it difficult for instructors to supervise students, demonstrate the procedure, and evaluate their proficiency with ophthalmoscopy. [4] This setup allows only one examiner to view the image at a time. It has been acknowledged that teaching direct ophthalmoscopy to medical students is challenging in light of these factors. There has been a proposal to remove direct ophthalmoscopy from the medical student curriculum. [5]

Several studies have been done on the comparison of Smartphone Ophthalmoscopy and Direct ophthalmoscopy. In a study done by Wang et al they found that using Smartphone Ophthalmoscopy instead of direct ophthalmoscopy, they reported better fundus visualization and also found improved ophthalmoscopy performance by the students. So, they advised using Smartphone Ophthalmoscopy as a supplemental tool to increase the efficacy of ophthalmoscopy instruction. [6]

Similarly, a study was done by Qader et al on the effectiveness of Smartphone Ophthalmoscopy compared to Direct ophthalmoscopy as a teaching tool they found that competency assessment scores using the Smartphone Ophthalmoscopy were significantly higher than those using the Direct ophthalmoscopy. They also found that students were more confident in detecting fundus abnormalities using the Smartphone Ophthalmoscopy as a digital teaching tool and appreciated the comfortable working distance, ease of use, and collaborative learning. [7]

Aim and Objectives:

Aim: To introduce smartphone ophthalmoscopy as a digital teaching tool for Phase III MBBS students.

Objectives

1. To assess the effectiveness of smartphone ophthalmoscopy as a learning method in ophthalmology.
2. To assess the perception of students and faculty about the digital teaching aids as teaching-learning methods in ophthalmology.

Methodology

The study was prospective in nature and was conducted on Phase III MBBS students at NCMCH, Israna. Approval from the Institutional Ethics Committee was taken. Twenty-five Phase-III MBBS students, who had prior experience with direct ophthalmoscopy, and without experience in smartphone ophthalmoscopy, were recruited to participate in this study during the academic year 2024–2025 at NC Medical College and Hospital. The students attended one training session on smartphone ophthalmoscopy of approximately 45 min.

The training session included a 10-minute didactic lecture on the working principle of the instrument, a 5-minute demonstration, and a 30-minute practice on standardized patients under the supervision of an ophthalmologist.

In the next two sessions, participants were taught how to do a fundus examination using Smartphone Ophthalmoscopy. Pre- and post-session MCQs were given on Google Forms.

Pre-validated feedback forms in which students and faculty were asked to grade their perceptions using a Likert scale were collected after the session.

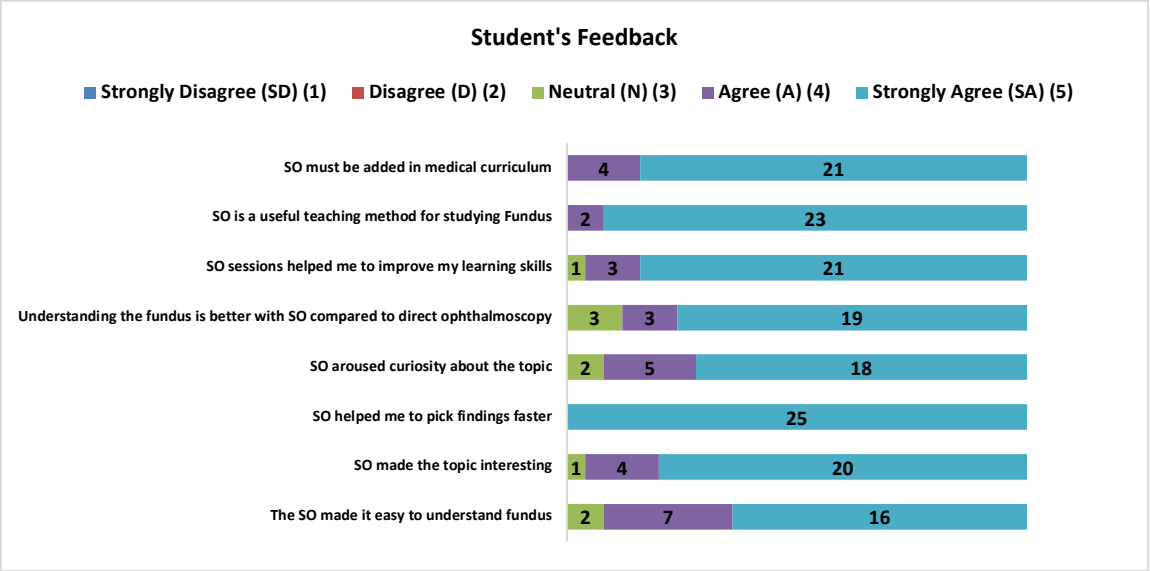
Data was analyzed using appropriate statistical methods.

Observations and Results

The responses were recorded from 25 students.

Table 1: Students' Feedback

Q. No	Questions	Strongly Disagree (SD) (1)	Disagree (D) (2)	Neutral (N) (3)	Agree (A) (4)	Strongly Agree (SA) (5)
1.	The Smartphone Ophthalmoscopy made it easy to understand fundus	0	0	2	7	16
2.	Smartphone Ophthalmoscopy made the topic interesting	0	0	1	4	20
3.	Smartphone Ophthalmoscopy helped me to pick findings faster	0	0	0	0	25
4.	Smartphone Ophthalmoscopy aroused curiosity about the topic	0	0	2	5	18
5.	Understanding the fundus is better with Smartphone Ophthalmoscopy compared to direct ophthalmoscopy	0	0	3	3	19
6.	Smartphone Ophthalmoscopy sessions helped me to improve my learning skills	0	0	1	3	21
7.	Smartphone Ophthalmoscopy is a useful teaching method for studying Fundus	0	0	0	2	23
8.	Smartphone Ophthalmoscopy must be added in the medical curriculum	0	0	0	4	21

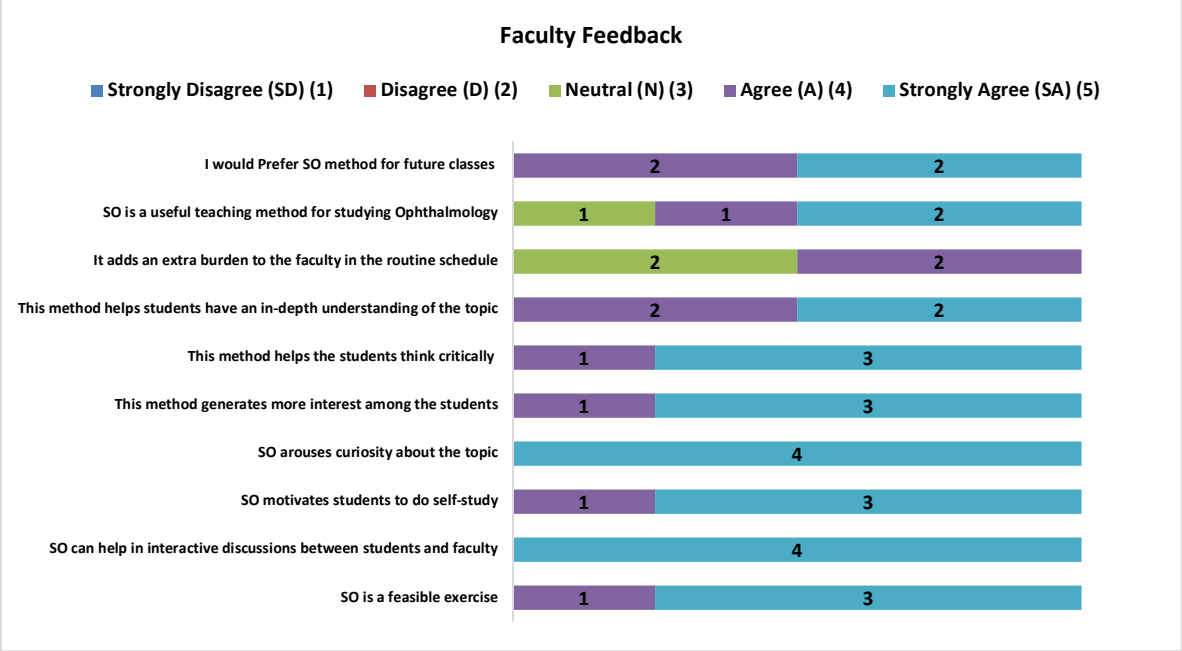


Graph 1: Students' Feedback

The feedback from students regarding Smartphone Ophthalmoscopy reveals overwhelmingly positive perceptions. A significant majority found that it greatly facilitated their understanding of fundus-related topics, with 16 students agreeing strongly and 7 agreeing that it made it easier to comprehend. Similarly, 20 students strongly agreed and 4 agreed that Smartphone Ophthalmoscopy made the topic more interesting. All students unanimously reported that it helped them identify findings faster. Moreover, there was notable enthusiasm as 18 students strongly agreed and 5 agreed that it sparked curiosity about the subject. In terms of educational impact, 21 students strongly agreed, and 3 agreed that the sessions improved their learning skills, while 23 students strongly agreed and 2 agreed that it is a useful teaching method for studying the fundus. Finally, 21 students agreed and 4 strongly agreed that Smartphone Ophthalmoscopy should be integrated into the medical curriculum. These findings underscore the potential of Smartphone Ophthalmoscopy to enhance both student engagement and learning outcomes in the field of ophthalmology education.

Table 2: Faculty Feedback

Q. No.	Question	Strongly Disagree (SD) (1)	Disagree (D) (2)	Neutral (N) (3)	Agree (A) (4)	Strongly Agree (SA) (5)
1	Smartphone Ophthalmoscopy is a feasible exercise	0	0	0	1	3
2	Smartphone Ophthalmoscopy can help in interactive discussions between students and faculty	0	0	0	0	4
3	Smartphone Ophthalmoscopy motivates students to do self-study	0	0	0	1	3
4	Smartphone Ophthalmoscopy arouses curiosity about the topic	0	0	0	0	4
5	This method generates more interest among the students	0	0	0	1	3
6	This method helps the students think critically	0	0	0	1	3
7	This method helps students have an in-depth understanding of the topic	0	0	0	2	2
8	It adds an extra burden to the faculty in the routine schedule	0	0	2	2	0
9	Smartphone Ophthalmoscopy is a useful teaching method for studying Ophthalmology	0	0	1	1	2
10	I would Prefer Smartphone Ophthalmoscopy method for future classes	0	0	0	2	2



Graph 2: Faculty Feedback

The survey findings on Smartphone Ophthalmoscopy reflect predominantly positive feedback from respondents. All participants (100%) strongly agreed that this method arouses curiosity about the topic and facilitates interactive discussions between students and faculty. Additionally, 50% of respondents agreed that Smartphone Ophthalmoscopy motivates students to engage in self-study. Furthermore, 50% of respondents agreed that this method helps students think critically and provides an in-depth understanding of the subject matter. However, concerns were noted regarding the potential additional workload for faculty, with 50% of respondents expressing neutrality on this matter. Overall, while there is a robust endorsement for its educational benefits and potential future use, logistical considerations regarding faculty workload remain pertinent among the surveyed participants.

Discussion

There are clear advantages of Smartphone Ophthalmoscopy as a digital teaching tool for fundus examination. Smartphones appeal to users due to their convenience and effectiveness in capturing images, displaying them on screens, and sharing them in real time. Consequently, Smartphone Ophthalmoscopy finds extensive application in clinical practice and medical education, particularly in ophthalmology, where detailed morphological features are crucial for accurate diagnosis.

Direct Ophthalmoscopy, with its single inspection window and challenging working distance, contrasts with Smartphone Ophthalmoscopy excellent screen display and ability to maintain a comfortable distance between doctors and patients. This distance is particularly beneficial in minimizing close contact, a significant concern in the COVID-19 era. These advantages explain why medical students prefer Smartphone Ophthalmoscopy as a digital tool for fundus examination. They also believe that Smartphone Ophthalmoscopy can offer substantial assistance to non-ophthalmologists and anticipate its widespread adoption in clinical settings.

Limitations: Due to time constraints, this study could only provide a preliminary evaluation of the teaching-learning method. To comprehensively assess its effectiveness, additional sessions involving a larger number of students are necessary. The limited enrollment resulted in insufficient data to achieve statistical significance. Furthermore, the study was conducted at a single center, which may limit the generalizability of the findings.

Conclusion

Our research indicates that substituting the direct ophthalmoscope with a smartphone-based alternative could enhance the precision and effectiveness of fundus examinations conducted by undergraduate students. The integration of smartphone technology in medical and healthcare settings is advancing swiftly. Based on our findings, it seems plausible that smartphone-based fundus imaging technologies could eventually supplant the traditional direct ophthalmoscope in undergraduate teaching and also in clinics.

Implications: Smartphones are increasingly recognized as valuable tools in ophthalmology for

capturing images of both the anterior and posterior eye segments. They provide easy access to professional literature and educational resources for patients. Smartphones can store vast amounts of information, facilitating long-term monitoring, though patient confidentiality must be carefully maintained. Despite their potential diagnostic utility, standards for smartphone use in this capacity are not yet established, and results should be interpreted cautiously. Nevertheless, the innovative role of smartphone technology in research, education, and information sharing positions smartphones as a promising future advancement in ophthalmology and medicine. With this innovative method, the students learn better clinical correlation of the topic taught in Ophthalmology.

Acknowledgements

I am thankful to God and my family who constantly motivated me to pursue this fellowship.

I am extremely grateful to the management of NCMCH, Israna, and MEU Coordinator Dr. Isha Gupta for motivating me to do the fellowship.

I am grateful to Dr. Dinesh Badyal, Dr. Monika Sharma, my project mentor Dr. Aroma Oberoi and all faculty and staff of the Department of Medical Education, CMC Ludhiana for the guidance they gave me.

All my colleagues Dr. B.K. Gupta, Dr. Kritika Garg from Ophthalmology who gave support in the implementation of Smartphone Ophthalmoscopy and also they were the observers. The questionnaire was verified by the faculty of the ophthalmology department.

Lastly and most importantly I am highly grateful for the support given by my sons Kavish and Kiaan.

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