ABSTRACT

Introduction: With declining exposure to the ophthalmologic examination in medical school, medical students and their instructors need a simple, effective method for teaching direct ophthalmoscopy.

Objective: Evaluation of canisters as direct ophthalmoscopy teaching aids for medical students.

Methods: Two ounce plastic canisters were designed to simulate an eye with 35mm fundus photographs placed at the base and an 8mm hole drilled in the center of the cap to simulate a dilated pupil. These tools were used as an optional supplement to the instruction of ophthalmoscopy. Participants included 102 second-year medical students from the Medical College of Wisconsin and 11 residents and instructors from The Eye Institute in Milwaukee, Wis.

Results: Effectiveness and ease of use of the canisters were assessed by analyzing questionnaires completed by the medical students and instructors. According to 76% of students and 93% of instructors, the canisters “supplemented their learning/teaching.” Most students (90%) and instructors (88%) found them “easy to use.”

Conclusion: This device is a simple and effective tool for teaching direct ophthalmoscopy to medical students.

INTRODUCTION

The general ophthalmologic examination is an increasingly neglected part of medical education.1-3 Neither the University of Wisconsin School of Medicine and Public Health nor the Medical College of Wisconsin (MCW) currently require a rotation in ophthalmology. In fact, only 8 of the 126 medical schools in the United States have a mandatory rotation.1 Thus, medical students receive very little, if any, formal training to help them develop the skill of direct ophthalmoscopy. In a review of medical records at University of California-Davis, 11% of third-year medical students performed a funduscopic examination on complete history and physical examinations, and fewer than 2% documented actual visualization of the fundus.1

Nevertheless, the skill of direct ophthalmoscopy continues to be important in a primary care setting. As of 1994, in an older urban population, 50% of visitors to a primary care office have clinically significant ocular pathology.4

A number of innovative ideas have been developed to aid in the teaching of direct ophthalmoscopy to medical students.5,6 The objective of this study was to assess the value of one of those innovations in a medical education setting.

MATERIALS AND METHODS

Each year, second-year medical students at MCW receive a half-day introduction to the ophthalmologic examination course. The instructors of this course include ophthalmologists and ophthalmology residents at MCW. Instructors demonstrate basic ocular examination techniques, including direct ophthalmoscopy, in small group sessions. Students have 1 eye dilated for the teaching session and practice direct ophthalmoscopy on each other.

A device was fashioned and evaluated based on a design described by Chung and Watzke.6 Using Adobe Photoshop and Illustrator, digital fundus photographs or designs were cropped to 1.8” x 1.5” to fit the base of 2 ounce round plastic canisters with hinged caps and flat bases (Figure 1). Adobe InDesign was used to create a PDF file for printing. Images were printed on glossy digital photo paper from an inkjet printer. An 8 mm round hole was drilled into each canister lid to simulate a dilated pupil. Students were able to use their ophthalmoscope to visualize the base of the canisters through the opening in the lid, thereby simulating visualization of the fundus. Fundus photographs depicted a normal fundus, diabetic retinopathy, papilledema, and glaucoma with an enlarged cup-to-disk ratio (Figure 2).
Another image used in the canisters was a linear array of words in 3.28 point font, simulating retinal vasculature (Figure 2). If the students could read the sentence to the instructor, this confirmed that the details inside that canister were seen. Canisters were not labeled with the name of the disease process, and no directionality was indicated.

Five canisters (1 for each type of image) were placed in each instruction room. Students and instructors were informed about the canisters both verbally and in writing prior to the course. Students were also informed that use of the canisters was optional and would not affect their grade for the course.

Separate questionnaires for students and instructors were provided next to the canisters on the day of the course (Appendix). Completion of the questionnaires was optional and anonymous. Incomplete questionnaires were excluded from analysis. SPSS software was used to analyze data using descriptive statistics.

RESULTS
Of a possible 201 enrolled second-year students, 102 completed the questionnaire. Seventeen complete instructor questionnaires were also collected. All respondents reported trying the canisters, and 71% of the students reported they were able to identify all or some of the disease processes. Results from the questionnaires are summarized in Table 1.

The majority of students were enthusiastic about using the canisters as an adjunct to the direct ophthalmoscopic examination and hoped they would be used again. Written feedback was largely positive. Comments included: “They helped my understanding of how to focus,” and “[The canisters are great… [we] should start with them first and then go to the real eye.” A few students suggested they should be available for practice.

Two recurrent suggestions for improvement of the canister design were to substitute matte for glossy paper to avoid glare from the ophthalmoscopic light and to use high-resolution digital images to avoid pixilation.

DISCUSSION
The effectiveness of previously described canisters was discussed as a teaching tool for direct ophthalmoscopy for medical students. Based on responses from the completed questionnaires, the canisters were valuable aids. These canisters have a number of advantages. Medical students can continue to practice direct ophthalmoscopy using these canisters outside of the formal teaching session. Practicing direct ophthalmoscopy on the human eye may be limited by patient cooperation or light sensitivity, neither of which is an issue with the canisters. In addition, instructors may use these canisters as a testing device. Medical students can be asked to describe the findings seen in each canister in order to verify that they are using the ophthalmoscope correctly. By using a small font for the writing in the base, medical students can be asked to “read the sentences,” thereby demonstrating adequate visualization of the base as their first assignment, then moving on to the clinical pictures.

The canisters have some inherent limitations. Students may not completely appreciate the technique of focusing because the canister depth is fixed and does not simulate the varying axial lengths of the human eye.

Based on comments written on the questionnaire, as well as on subsequent verbal and written communication, we recommend a few simple design changes: (1) indicate directionality on the lid by using “n” for nose so students practice using each eye to examine the corresponding eye of the patient and become used to the orientation of structures in the right versus the left eye; (2) have an answer key available for the different images; (3) use matte photo paper; (4) use high-resolution photographs; and (5) consider using 3-4 mm holes in the canister lid to simulate a non-dilated examination.

This survey allowed students to anonymously critique a new learning tool without fear of it adversely affecting their grade for the course. The “yes” or “no” questions (Table 1) are easily interpreted and likely to be an accurate representation of student and instructor opinion. However, the “all,” “some,” or “none” question (Appendix) with regard to the amount the students could visualize or instructors could teach was more difficult to interpret, and this study was unable to assess the quality of learning and teaching. Students and instructors had an overall favorable opinion of the learning tool.

This device would be most effective used as an adjunct to teaching direct ophthalmoscopy during a
physical diagnosis course in the second year of medical school. Direct ophthalmoscopy would then ideally be taught again during a required rotation during the third or fourth year of medical school, when students would presumably have a better understanding of the disease processes they are viewing. At that point, instruction could involve both the canisters and real patients.

The device is a simple and effective tool for introducing direct ophthalmoscopy to medical students. Though not a substitute for learning on human subjects, it can be a simple, inexpensive, and highly effective adjunct to the instruction of this important skill.

**Funding/Support:** We thank Deb Wahlers of the Medical College of Wisconsin and Cathy Mikkelson Fischer of Gundersen Lutheran for their assistance with the preparation of the manuscript. This study was supported by an unrestricted grant from Research to Prevent Blindness, Inc., New York USA.

**Financial Disclosures:** None declared.

**REFERENCES**


The mission of the Wisconsin Medical Journal is to provide a vehicle for professional communication and continuing education of Wisconsin physicians.

The Wisconsin Medical Journal (ISSN 1098-1861) is the official publication of the Wisconsin Medical Society and is devoted to the interests of the medical profession and health care in Wisconsin. The managing editor is responsible for overseeing the production, business operation and contents of Wisconsin Medical Journal. The editorial board, chaired by the medical editor, solicits and peer reviews all scientific articles; it does not screen public health, socioeconomic or organizational articles. Although letters to the editor are reviewed by the medical editor, all signed expressions of opinion belong to the author(s) for which neither the Wisconsin Medical Journal nor the Society take responsibility. The Wisconsin Medical Journal is indexed in Index Medicus, Hospital Literature Index and Cambridge Scientific Abstracts.

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