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EFFECTIVENESS OF VIRTUAL MICROSCOPY IN COMPARISON TO CONVENTIONAL MICROSCOPY IN ENHANCING LEARNING OUTCOME OF PATHOLOGY STUDENTS

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ABSTRACT This study aimed to enhance pathology teaching and learning for medical students by introducing virtual microscopy and evaluating its impact on academic performance. 91 students of II MBBS were split into Groups A, B, and C. Group A used conventional microscopy, Group B used virtual microscopy, and Group C used a combination. Pretest mean scores for Groups A, B, and C were 2.36 ± 1.615, 2.23 ± 1.454, and 0.81 ± 0.931, respectively. Post-test scores significantly improved in Group A (4.82 ± 0.390), Group B (3.97 ± 0.482), and Group C (4.78 ± 0.553). Conventional microscopy yielded higher scores, attributed to specific and limited information besides skilled tutoring. However, student feedback favored virtual microscopy for comprehensive learning. While manual microscopy remains effective with skilled teaching, virtual microscopy complements traditional methods due to its user-friendly experience and positive student reception.

KEYWORDS : Conventional microscopy, virtual microscopy, Pathology

INTRODUCTION

Virtual microscopy is the technique of complete digitization of the microscopic glass slide, allowing computer based analysis. High-magnification digital images of tissue sections, stored in a multi-resolution file format can be viewed in a web browser using a suitable software.[1,2]

A profound understanding of pathology is essential for studying diseases and applying knowledge in clinical practice, thereby greatly enhancing medical education. Historically, histopathology slides have been examined using a light microscope with a limited field of view and fixed magnification. Students encounter difficulties in visualizing the entire slide due to the inability to modify the field, thus impeding comprehensive understanding. These challenges render histo-pathology learning less comprehensive, less engaging, and primarily focused on memorization for students. Furthermore, preparing a slide set for the entire class requires a significant amount of tissue and frequent slide changes to prevent fading or damage, presenting logistical challenges in the learning process.

The requirement to maintain a vast slide collection further complicates matters, placing a heavy burden on laboratory workload. Addressing these downsides highlights the necessity for an alternative approach to histopathology education, modifying conventional microscopy, and transforming the teaching-learning tool, ultimately paving the way for virtual microscopy.

Aim/Objective

- To assess the efficacy of virtual microscopy in the student performance.
- To draw a comparative analysis of efficacy of virtual microscopy with the traditional approach of conventional microscopy in the learning outcome of histopathology
- To assess the effectiveness of virtual microscopy as an adjunct to conventional microscopy in supporting student learning in pathology.
- To evaluate the overall learning experience for students with the new tool of virtual microscopy.

MATERIALS AND METHODS

- Study Design- interventional study
- Study Setting – Department of Pathology , Karuna medical college, Palakkad
- Study Population- II year MBBS students
- Study Period –November 2023 – December 2023
- Sample Size – 91students
- Sampling Technique – purposive sampling
- Method of data collection- questionnaire and feedback form
- Inclusion Criteria – all the students who are currently enrolled in the second year of MBBS and present at the time of study during routine histopathology practical classes.
- Exclusion Criteria – the students who are not willing for the study

Study Tools And Methodology

In our research, we referenced "virtual microscopy" in the context of whole slide imaging ie an approach of combining manual microscope, attached digital camera and a software which could capture the video imaging of the whole slide viewed through the microscope at various magnifications which could then be displayed on PC by an electronic interphase and also projected on the screen by an LCD proee groups completed a feedback survey via Google Form to gather their opinions on the new teaching tool used in Pathology. The survey included ten items, with responses for items 1 to 9 being recorded on a 3-point Likert scale ranging from agree (1) to disagree (3). The tenth item was an open-ended question where students were invited to share their comments and thoughts.

Data Analysis and Statistics

The study utilized SPSS version 17.0 for data analysis, with a significance level of $P<0.05$. Quantitative analysis involved comparing pre- and post-test scores within and between groups and obtaining student feedback using a 3-point Likert scale. Pre- and post-test scores were compared using Student's paired t-test. One-way ANOVA was conducted to analyze score differences between and within groups, followed by multiple comparisons using Tukey's test. Students' responses to items 1–9, recorded on a 3-point Likert scale questionnaire, were represented as percentages. Comments provided in response to item 10 were qualitatively evaluated for further insights.

RESULTS

Mean pretest scores in Groups A, B, and C were 2.36 ± 1.615, 2.23± 1.454 and 0.81±0.931. Post test scores significantly improved in Group A (4.82 ± 0.390), Group B (3.97 ± 0.482), and Group C (4.78 ± 0.553). Student's paired t-test showed statistically significant differences ($P < 0.05$) in the scores between pre- and post-test in all groups. One-way ANOVA revealed significant variation ($P < 0.05$) of the mean squares (6.997) between groups and (0.236) within groups, with degrees of freedom (df) between groups (df = 2.00) and within groups (df = 87). This indicates statistically significant differences in post test scores among all groups. Tukey's test also showed statistically significant differences ($P < 0.05$) between all groups except between Group A and C.

The results showed that the new tool of virtual microscopy indeed improved the performance of the students. However in this study, the conventional microscopy still gave the best results in comparison to the virtual microscopy as well as the combined approach of conventional and virtual microscopy. The combined approach in fact showed almost similar performance than the conventional microscopy. According to this study the virtual microscopy alone could not effectively improve the performance of the students in comparison to the traditional method of manual microscopy.

A vast majority of students, comprising 97.7%, strongly agreed to the opinion of better comprehension of the subject with virtual microscopy while95.4% agreed upon better view of microscopic slides .To add on , a significant percentage (92%) of students strongly

recommended the incorporation of virtual microscopy as regular teaching – learning tool into the pathology curriculum for the medical students.

Table 1 – ANOVA

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	Sum of Squares	Degree of freedom	Mean Square	P value
Between Groups	13.995	2	6.997	0.00
Within Groups	20.494	87	0.236	
Total	34.489	89		

Table 2 - Multiple Comparison Of Score In Group A,B and C Tukey Test

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Groups	Mean Difference	Std. Error	P value	95% Confidence Interval	
				Lower Bound	Upper Bound
Group A & B	0.854*	0.127	0.00	0.55	1.16
Group B & C	-0.806*	0.123	0.00	-1.1	-0.51
Group C & A	-0.047	0.127	0.926	-0.35	0.25
*. The mean difference is significant at the 0.05 level.					

DISCUSSION

In this study, the approach of conventional microscopy gives outstanding results than the virtual microscopy alone , though the combined approach gave almost similar results as the conventional microscopy . The most probable reason for this finding is that in virtual microscopy, though the easier and panoramic view of the slide on the big screen seems to be more comprehensive than conventional microscopy , The students who learnt by the way of conventional microscopy retained the limited, specific and the most crucial information regarding the pathological lesion , since they were exposed to only few , relevant and appropriate fields at fixed magnification under the conventional microscope. The experience of hands on learning , in addition to the excellence of the teaching skill and the experience of the teacher who taught by the way of traditional microscope also must have resulted in the targeted learning of these students , hence enabling them to score higher.

This finding is in contrast to the previous similar studies by Fred (Dick) Dee[3], a pathologist at the University of Iowa , Alka Harish Hande etal who studied with 105 students of first-year dental histology course at Sharad Pawar Dental College and Hospital, and Wardha,[4]and Krippendorf and Lough[5]who conducted the study at the Medical College of Wisconin for first year histology students.In these studies, contrary to our study , the data from examination scores indicated that use of virtual microscope significantly improved student performance and learning efficiency. However the feedback questionnaires from students in all these studies and in our study showed that the new tool of virtual microscopy was favorably received and recommended by vast majority of students.

CONCLUSION

The traditional method of conventional microscopy, inspite of its own limitations, can still be an excellent mode of teaching and learning , if used meticulously and at the hands of an experienced and skilled teacher. According to this study , virtual microscopy is not as effective as the conventional microscopy and it cannot be a substitute for manual microscopy , however it can be an adjunct to the conventional microscopy owing to its ease of learning , gratifying acceptability by the students and other advantages.

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