

Virtual Microscopy as an Effective Tool for Oral Pathology Teaching at Undergraduate Level



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OBJECTIVE: Is to report the usefulness of virtual microscopy in oral pathology teaching at undergraduate level.

METHODOLOGY: A cross sectional study was done at Rehman College of Dentistry, Peshawar. After a verbal informed consent 40 students of third year Bachelor of Dentistry who were present on day of data collection were included. Universal sampling technique, where all the students viewed conventional glass slides on first day followed by virtual slides of the same pathological lesions on webscope software of University of Leeds on second day. A structured questionnaire using a Likert scale was implemented. GraphPad Prism version 6.04 for Windows was used to analyse the data. Student's t-test was used to compare the differences in responses.

RESULTS: There was a significant difference (p value $< .05$) between the pre and post group. Clarity, navigation, scanning, and magnification of slides, improved the overall learning of the students as compared to traditional method along with time efficiency.

CONCLUSIONS: Virtual microscopy represents an effective tool for teaching histopathology of oral pathological lesions at undergraduate level.

KEYWORDS: Digital microscopy, conventional microscopy, virtual microscopy, undergraduate students, oral pathology.

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INTRODUCTION

Conventional teaching methods have been in use for centuries. Although, these are time-tested and effective methods, the current global pandemic has led us to explore newer and more convenient options for teaching. Most teaching institutions have shifted towards online teaching due to the current pandemic which has given us an opportunity to search for teaching strategies better suited for online teaching.

Microscopes have been in use for studying pathological slides for more than 200 years.¹ Very little advancements

have been made since then to improve the quality of teaching microscopic slides. The process of archiving, moving and replacing glass microscopic slides is cumbersome and has many limitations. Conventional microscopy pose many challenges to students as well as teachers and these have been well documented earlier.² Therefore, many international educational institutes have shifted from conventional to virtual microscopy.³

A virtual slide is a digitally captured glass slide that can be viewed and zoomed on a computer screen. These are usually high-quality images captured with advanced technology which can be zoomed considerably without loss of quality. Using virtual microscopy can simplify the whole process of teaching histopathology by eliminating the need for most equipment and materials used to prepare and view slides on conventional microscopes.² This in turn can decrease the overall cost of teaching pathological slides. In addition, virtual slides are useful for teaching large groups of students, teaching online and eliminates the variability associated with

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glass slides while maintaining high quality.^{2,4} Moreover, virtual microscopy is a better tool for online assessments of pathological slides.⁵

The effectiveness of virtual microscopy in teaching pathological slides has already been documented elsewhere.⁶ To the best of our knowledge, such an evaluation has not been carried out in Pakistan. We hypothesized that virtual slides would enhance students' interest in learning the histopathological features and enhance their understanding. Therefore, the purpose of this study was to assess the effectiveness of virtual slides in teaching histopathology of oral pathological lesions at undergraduate level.

METHODOLOGY

This cross-sectional study was carried out at the department of oral pathology, Rehman College of Dentistry, Peshawar, Pakistan in February 2020. Verbal informed consent was obtained from all the participants and the study protocol was approved from the institutional ethical committee. Conventional glass slides (n = 10) of various pathological lesions that are taught in our practical oral pathology course, were used for the study. In total, forty 40 out of 50 enrolled 3rd year Bachelor of Dental Surgery (BDS) students who were present on the day of data collection, participated in the study. The virtual pathology slide library of the University Leeds was used for the purpose of evaluation. It is an open source, free for all slide library which can be accessed online at: <http://www.virtualpathology.leeds.ac.uk/slides/>.

All students first viewed the conventional glass microscope slides under the light microscope at 10X and 20X magnifications. The students received instructions about the histological features of the slides from three teachers. The students were asked to fill a structured questionnaire at the end of the session. On the second day, the same students viewed virtual slides of the same pathological lesions on the "webscope" software of the University of Leeds virtual slide library and were supervised by the same teachers. The students were able to zoom in and zoom out the virtual slides according to their preference.

At the end of the session participants filled a structured questionnaire consisting of Likert scale with (5 = strongly agree; 4 = agree; 3 = neutral; 2 = disagree; 1 = strongly disagree), and comparison was made between conventional glass microscopy and virtual microscopy. Student's t-test was used to compare the differences in responses to each question. GraphPad Prism version 6.04 for Windows (GraphPad Software, La Jolla California USA) was used to analyse the data.

RESULTS

Out of 50, 40 3rd year dental students were included in the study. The students reported significantly better performance (p = 0.01) with virtual microscopy compared to conventional glass microscopy. Use of virtual microscopy needed significantly less time in selecting, navigating and focusing as compared to conventional microscopy. Moreover, the accessibility, scanning and magnification was found to be much easier in case of virtual microscopy as compared to conventional glass microscopy. Students had better understanding of histopathological features using virtual microscopy as they were able to focus and navigate slides with ease as compared to manual focussing of conventional microscopy (Table 1).

Table 1: Comparison of use of Conventional and virtual microscopy

Question	Conventional Microscopy	Virtual Microscopy	P value
I used time more efficiently	2.2 (± 0.7)	4.3 (± 0.5)	0.03*
Instructions for use were clearer	4.1 (± 1.4)	4.5 (± 1.8)	0.4
Microscopic images were clearer	2.6 (± 0.6)	4.2 (± 0.4)	0.02*
Slide navigation was easier	1.3 (± 1.1)	4.6 (± 0.8)	0.001*
My efficiency of learning pathological features was better	2.5 (± 1.2)	4.4 (± 0.5)	0.02*
Accessibility to microscopy was better and more convenient	3.5 (± 0.9)	4.2 (± 0.6)	0.3
Selecting a slide was easier	1.1 (± 1.7)	5.0 (± 0)	0.001*
Scanning a slide was easier	2.2 (± 0.6)	4.1 (± 0.7)	0.04*
Changing magnification was easier	2.3 (± 0.5)	4.8 (± 0.6)	0.03*
Adjusting focus was easier	2.5 (± 0.4)	4.5 (± 0.8)	0.01*
I got more motivation to study pathological slides	2.6 (± 0.8)	4.6 (± 0.7)	0.01*
Cumulative score	2.5 (± 0.8)	4.5 (± 0.3)	0.01*

DISCUSSION

Teaching of histopathological features of oral lesions at undergraduate level is a challenging job. Textbooks are a good source of knowledge however certain aspects can only be covered by microscopic study of the histopathological slides.⁶ Recently, the switching of teaching process from a conventional microscope to a virtual microscope has shown an increased motivation of undergraduate students, significant improvement in understanding of histopathological features and have increased the standard of teaching methodology.⁴

The present study results have shown increased efficiency of the virtual microscope as compared to the conventional glass microscope. Students have shown a drastic interest in friendly handling, selecting focusing and navigation of a certain lesion oral pathology lesion. Apart from usage, their identification and understanding towards a lesion's histopathological structures have greatly increased their learning skills and thus, making them more motivated towards their subject.

Results of the present study were in line with previous reports^{4,5,6,8,11} where students have shown increased inclination towards the virtual microscope instead of light microscope because of its easy handling, efficiency and accessibility. The digital microscope does not require any kind of readjustments, refocusing and redirection as needed by a light microscope. Moreover, the increased effectiveness of virtual microscopy is partly due to ease of accessing slide just on a single click from a computer or a cell phone. The available digital slides are usually scanned using high quality equipment, therefore, the image resolution and contrast are much better compared to glass microscopy. This enhances the students' ability to visualize histopathological features much better.⁵ Virtual microscopy is much less technique sensitive compared to conventional microscopy.

Additionally, virtual slides can be visualized by multiples students at the same time.¹⁴ Teaching virtual slides are much more convenient and less time consuming for the instructor since more than one student can be engaged at the same time and understanding is easier due to collaborative learning.⁵ According to Rosas C. et.al.¹³ some of the students still prefer traditional teaching methodology for learning histopathological features and are therefore, not receptive to the transition from a traditional teaching methodology to a digital one. However, virtual microscopy has the potential to raise teaching standards provided that enough computer and information technology support is available in the institute.⁵

CONCLUSION

We conclude that oral pathology teaching and learning with virtual microscopy is more efficient compared to conventional glass microscopy.

CONFLICT OF INTEREST

Nil

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