The use of video demonstration in teaching restorative dentistry

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ABSTRACT

To improve the effectiveness and quality of teaching among dental students, innovative methods such as video demonstrations have been proposed. This study determined the effectiveness of video demonstration as a method of instruction in teaching restorative dentistry. The pre-test, post-test control and experimental group design was utilized in this study. The study involved 28 preclinical Dentistry students enrolled in the course Restorative Dentistry 1 for the First Semester, Academic Year 2019-2020 at the University of Baguio School of Dentistry. The level of performance of students was recorded before any lecture and intervention made (Pre-test), after which utilization of traditional face-to-face lecture and live demonstration were implemented to the control group while face-to-face lecture and video demonstration were implemented to the experimental group. Both groups performed a practical examination and were assessed in relation to their performance on their cavity preparation (Post-test). The scores of the experimental and control groups were compared using the t-test for independent samples. The pre-test level of performance of students in the control group and experimental group were both poor. This indicates that they cannot execute proper cavity preparation for Class II and that they are in need of thorough knowledge about the different features as to outline form, resistance form, retention form, and finishing of the cavity walls. The post-test level of performance of students in the control group was poor and the experimental group was fair. The experimental group got a higher mean difference than the control group. This means that considering the mean differences between the pre-test and post-test of the two groups, the experimental group performed better. This proves that the use of video demonstration as a means of instruction in cavity preparation in restorative dentistry is effective in enhancing students’ performance.

Key words: Restorative dentistry, video demonstration, blended learning, face-to-face lecture, Class II, cavity preparation.

INTRODUCTION

Students nowadays are exposed to technology which has become an important source for acquiring information and relevant background knowledge. The use of an advanced technology environment offers significant potential in dental education (Buchanan, 2004) and help students develop their knowledge and skills necessary for competency in a preclinical setting. As part of the education and training of preclinical students in restorative dentistry, students undergo practical demonstrations on cavity preparation using phantom jaws with artificial teeth called typodonts. Various approaches such as lecture and laboratory exercises are being utilized in teaching restorative dentistry. In laboratory exercises, a live demonstration is being conducted in which the step-by-step procedure in doing cavity preparation is applied. This approach has been used for many years and shows
improvements to students' skills.

Available approaches with the use of Information and Communications Technology (ICT) have also been utilized in teaching operative dentistry. Among these approaches is the combination of different delivery modes that incorporate both traditional face-to-face instruction and mobile or online learning, called blended learning. Blended learning (BL) is effective and well accepted by dental students (Kavadella et al., 2012) where the learning objective tests can be successfully implemented (Reissmann et al., 2015) and with BL, students could learn and demonstrate dental skills at a high level (Maresca et al., 2013). BL is more likely than either e-learning (EL) or face-to-face learning (F2FL) alone to be both effective and accepted in delivering education to undergraduates (Bains et al., 2011).

Video-assisted learning has become an integral part of effective teaching. Using procedural or instructional videos has been shown to augment student's preparedness for real-life clinical practice and helps them to improve their skills at their own pace and learning ability. It helps in better visualization and offers simulation in various learning styles according to a student's preference and can be saved to be repeated multiple times. Several studies show that video-assisted learning has improved students' learning curve and it was suggested to be a positive supplement to traditional teaching ways. Since the teaching of dentistry involves extensive preparation for psychomotor skills, clinical trials should be done to explore further student's output of video-assisted learning (Khan et al., 2019). On the other hand, video demonstration method has the same effect on students' performance as live demonstration (Almohareb, 2016). According to Gopinath and Nallaswamy (2017), there is no apparent difference between the effectiveness of the teaching approach used in video-based education and the others. Video-assisted clinical instruction in Dentistry (VACID) is an effective educational method and efficient as a conventional demonstration in endodontics results; it can be used along with conventional teaching (Naseri et al., 2016). Although this previous study found that live demonstration and video demonstration are equally effective, other studies found that e-learning tools and methods can be more effective.

Many studies have concluded that the traditional demonstration and video demonstration methods are effective and have no significant difference. Some studies found that the video demonstration resulted in better performance of students. These contradictory results motivated the researchers to conduct further study to test whether the video demonstration will improve the performance of preclinical dentistry students in restorative dentistry. Also, the researchers believe that there is a need to conduct further study considering some limitations of the traditional demonstration method. According to Alyceeduproject (n.d.), the limitations of the traditional demonstration method are as follows: (1) When showing a step-by-step demonstration, you might move on to the next step when a low capability learner has not grasped the previous one; thus, they fall behind. (2) You might not know the students' prior knowledge; High capability students might be bored with a demonstration because they already know how to do what you are demonstrating. (3) If you keep on talking with a demonstration, students will be uninterested. (4) If there is a large class and not enough space, some students might not see the task being displayed. (5) It is hard to watch and control students who are misbehaving while focusing on the skill you are demonstrating. (6) Demonstrations in an art classroom can be messy, and health and safety issues need to be addressed. (7) Demonstrations need to be planned; this takes time out of your normal schedule. (8) Demonstrations within visual art usually require equipment, and some schools might not have these resources. (9) Your materials and tools might not work and you might have technical difficulties.

This study determined the effectiveness of video demonstration as an alternative method of instruction in teaching restorative dentistry. Specifically, it sought to determine the following: (1) The level of performance in cavity preparation of the control and experimental groups in the pre-test along with outline form, resistance form, retention form, and finishing of the cavity walls; (2) The level of performance in cavity preparation of the control and experimental groups in the post-test along with outline form, resistance form, retention form and finishing of the cavity walls; (3) The difference in the pre-test and post-test level of performance in cavity preparation of the control and experimental groups.

**MATERIALS AND METHODS**

This study utilized the two-group pre-test-post-test design with one control group and one experimental group. A total of 28 preclinical Dentistry students enrolled in the course Restorative Dentistry 1 for the First Semester, Academic Year 2019-2020 at the University of Baguio, School of Dentistry, agreed to participate in the study. The students were randomly assigned to each group through a lottery considering each level. Scores from the students' class I exercise were used to classify their level based on the scale to ensure equal distribution to the control and experimental groups by level of competency. The control group did cavity preparation after the lecture and live demonstration, while the experimental group performed cavity preparation with the use of video demonstration describing the step-by-step procedures in Class II cavity preparation along with the face-to-face lecture. Comparison of the pre-test and post-test scores from the different groups was done to determine the effectiveness of video demonstration in teaching restorative dentistry. Data collection was done in the form
Table 1: Categories of students’ level of performance.

<table>
<thead>
<tr>
<th>Scores out of 15</th>
<th>Category of Student</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Excellent performance</td>
<td>All the principles of Class II Cavity Preparation were followed</td>
</tr>
<tr>
<td>13 to 14</td>
<td>Good performance</td>
<td>1 to 2 principles were not followed</td>
</tr>
<tr>
<td>11 to 12</td>
<td>Fair performance</td>
<td>3 to 4 principles were not followed</td>
</tr>
<tr>
<td>10 and below</td>
<td>Poor performance</td>
<td>5 or more principles were not followed</td>
</tr>
</tbody>
</table>

Table 2: Pre-test performance in cavity preparation of the control group and experimental group.

<table>
<thead>
<tr>
<th>Area</th>
<th>Control Group</th>
<th>Experimental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Score per Area</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>Outline Form</td>
<td>0.7143</td>
<td>0.72627</td>
</tr>
<tr>
<td>Resistance Form</td>
<td>4.9286</td>
<td>0.99725</td>
</tr>
<tr>
<td>Retention Form</td>
<td>1.1428</td>
<td>1.68379</td>
</tr>
<tr>
<td>Finishing</td>
<td>1.5714</td>
<td>0.64621</td>
</tr>
<tr>
<td>Over-all Mean (Whole Exercise)</td>
<td>8.3571 (Poor)</td>
<td>2.36643</td>
</tr>
</tbody>
</table>

of practical examination where students are asked to do cavity preparation on a mandibular first molar. Assessment and scoring were done on their cavity preparation and were graded using a score sheet for cavity preparation that is based on the features of each principle being executed properly as formulated by the faculty members in the Restorative Dentistry Department.

The identified features of the principles of cavity preparation according to G.V. Black were scored as follows: 0 = Not properly established/executed; 1 = Properly established/executed.

The maximum score was 15 points. Data collection was done in the form of practical examination. Students were asked to do cavity preparation on a mandibular first molar before and after the utilization of video demonstration. Assessment and scoring were done on their cavity preparation and were graded.

The maximum score was 15 points. Depending on the evaluation, the students were categorized in order to determine their level of performance as shown in Table 1.

To determine the effectiveness of video demonstration in teaching restorative dentistry, the scores of the experimental and control groups were compared as follows: the t-test for independent samples was used to determine the significance of the difference between the: (a) pre-test scores of the control and experimental groups; and (b) the post-test scores of the control and experimental groups; and (c) mean difference of pre-test and post-test scores between the control and experimental groups. The assistance of the UB research center was sought for the statistical analysis using SPSS.

RESULTS AND DISCUSSION

Level of performance in cavity preparation of the control group and experimental group in the pre-test

Table 2 shows the pre-test results of the control group and experimental group along each area of the principles of cavity preparation. The performance of the control group in the pre-test showed that the students performed highest in finishing of the cavity walls, followed by resistance form and retention form. They performed lowest in outline form. For the experimental group, the students performed highest in finishing of the cavity walls, followed by retention form and resistance form. They performed lowest in outline form. Both groups performed highest in finishing of the cavity walls. Finishing the external walls of the preparation entails consideration of the degree of smoothness and cavosurface design as well as to free the preparation of visible debris. A similar feature is evident in Class I cavity preparation to which they performed previously, but some students could not perform it properly. Both groups also performed lowest in outline form. In determining the outline form, one must properly extend the preparation to include fissures and, the isthmus and S-curve termination until sound tooth structure is obtained. The addition of proximal box preparation in Class II made the students unable to perform the outline form properly. Both groups were not able to get a high score for the resistance form. The need to develop resistance form in a preparation is a result of several factors. The design features that enhance the resistance form are as follows:
flat pulpal and gingival floor, depth of pulpal and gingival floor, the width of the gingival floor and marginal ridge, the parallelism of proximal walls and axial walls to external outline and bevelling of axiopulpal line angle. Most of these features are not present in Class I cavity preparation, so the students are not familiar with these. As a result, they were not able to establish the identified features in their Class II preparations. Higher percentage of students who cannot perform retention form properly is noted in the control group. Retention form is provided by the occlusal convergence of buccal and lingual walls and by the dovetail design of the occlusal step. Although these were present in their previous cavity preparations, detailed features need to be established especially in the proximal box preparation in Class II.

The overall mean pre-test performance of the control group is 8.3571, interpreted as poor performance. Most of the students in the control group were not able to follow five or more principles of cavity preparation. In the experimental group, the mean pre-test performance is 8.9286, interpreted as poor. The experimental group was not able to follow five or more principles of cavity preparation. This means that both groups were not yet very familiar with the principles of cavity preparation. This is understandable because there was no lecture given yet before the pre-test exercise for both groups. Their exposure with cavity preparation is limited to Class I only. Although the same principle is considered as to outline form, resistance form, retention form and finishing of the cavity walls, additional features for each principle were added. The need to establish the said principles properly for Class II should be provided to students, particularly to areas where they perform the poorest to better enhance their level of performance.

Level of performance in cavity preparation of the control group and experimental group in the post-test

Table 3 shows the post-test results of the control group and experimental group along each area of the principles of cavity preparation. The performance of the control group in the post-test revealed that the students performed highest in finishing of the cavity walls, followed by retention form and resistance form. They performed lowest in outline form. For the experimental group, the students performed highest in finishing of the cavity walls, followed by retention form and outline form. They performed lowest in resistance form. Both groups performed highest in finishing of the cavity walls. The use of traditional lectures and live-narrated demonstration of cavity preparation helped the students improve their level of performance. As proven by Almohareb in 2016, live demonstration shows the same result that the students’ performance has increased and that the students prefer live demonstration because they have the chance to interact and ask questions during the live demonstration and the interaction improves student confidence (Almohareb, 2016). Although, there are instances also that some of the principles were not executed properly despite the presence of the said approach. The control performed lowest in outline form and the experimental group performed lowest in the resistance form. Resistance form accounts for a higher scoring in cavity preparation because of the different features it needs to be properly established. Resistance form has the poorest result due to the complexity of its features.

The overall mean post-test performance of the control group is 9.2857, interpreted as poor performance. The students in the control group were not able to follow five or more principles of cavity preparation. This poses a need for additional methods to support laboratory instruction, specifically in cavity preparation in restorative dentistry. The simulation is done in the laboratory fulfills a need in the teaching and learning of restorative dentistry. It teaches essential technical skills and gives students the confidence to treat patients. It also allows assessment of student restorative skills before patient contact, providing assurance of patient safety (Fugill, 2014). In the experimental group, the mean post-test performance is 11.7143, interpreted as fair. The experimental group was not able to follow three to four principles of cavity preparation.

In a study conducted to assess the most effective method of teaching dentistry to dental students when compared to video-based education, it was shown in the systematic review that there appears to be no difference in the effectiveness of the teaching method over the others. But
video-based teaching has proved better outcome as an adjunct with the other teaching methods (Gopinath and Nallaswamy, 2017).

Comparison of the pre-test mean scores of the control and experimental group

Table 4 shows the pre-test comparison of performance of the control and experimental groups. The t-test result fails to reject the null hypothesis that there is no significant difference in the mean scores of the control and experimental groups in the pre-test, t(28) = -0.564, p=0.577 > 0.05. This means that the two groups had the same level of performance in the pre-test. This is because the students in both groups just did the cavity preparation without lecture or prior discussion. Traditionally, formal large-group lectures have been an important pedagogical component of medical and dental education. It was used as the most common learning resource (Daud et al., 2017). Elements of interaction between the student and the teacher should be encouraged for a better learning experience (Thilakumar et al., 2018).

Traditionally, students receive a live clinical demonstration from an expert teacher who performs step-by-step clinical procedures that are then practiced on phantom teeth. A clinical demonstration is usually done in a small group of students, which is usually time-consuming and detailed visualization might not be possible for all students. Observation of procedure is important and by any means if teachers can improve the learning process, it will reduce the risk of procedural errors (Khan et al., 2019).

Comparison of the post-test mean scores of the control and experimental group

The t-test result rejects the null hypothesis and accepts the alternative hypothesis that there is a significant difference in the mean scores of the control and experimental groups in the post-test (t 28) = -3.348, p=0.002 < 0.05. The experimental group got a higher mean score in the post-test. This means that the experimental group performed better than the control group during the post-test. A study by Inquimbert et al. (2019) showed that nearly 95.7% of students found online classes and E-learning via the virtual learning environment useful, with the most requested type being video. Demand was stronger in conservative dentistry and endodontics (27%), prosthetics (19%), and periodontology (18%). The most apprehended disciplines were endodontics in the 3rd year, endodontics and prosthetics in the 4th year, and prosthetics in the 5th year. Regarding satisfaction, 100% of students appreciated these videos and 99.4% considered they fulfilled expectations (Inquimbert et al., 2019). Similarly, more students showed better understanding and performance after watching procedural videos in addition to a traditional demonstration by the instructor, however, the differences were not significant and traditional teaching methods are equally effective. The study further suggests that video-assisted learning as an additional tool to traditional teaching can augment students' understanding and learning process where they can accurately assess the skills required to perform a certain procedure and learn the desired outcome (Khan et al., 2019).

Comparison of the post-test and pre-test level of performance of the control and experimental group

The t-test result rejects the null hypothesis and accepts the alternative hypothesis that there is a significant difference in the mean difference of the pre-test (0.9286) and post-
test (2.7857) scores between control and experimental groups, t(28) = -2.224, p = 0.003 < 0.05. The experimental group got a higher mean difference than the control group. This means that considering the mean differences between the pre-test and post-test of the two groups, the experimental group performed better. This proves that the use of video demonstration as a means of instruction in cavity preparation in restorative dentistry is effective in enhancing students' performance.

This study is supported by a similar study conducted by Khan et al. (2019) on the use of procedure-specific videos in the performance of restorative procedures by preclinical dentistry students. Results showed that Group A's assessment (students who were taught by a hands-on demonstration) regarding cavity preparation showed that the majority of students of the group (n=11) required crucial changes in cavity design. For group B (students who were taught by live demonstration and procedure-specific video), most students (n=9) reproduced important factors of cavity design; however, improvement was required. For amalgam filling, Group A and B's majority students had similar results. T-test was conducted and a significant difference was found in the overall performance scores for group A (M=6.7, SD=1.7) and group B (M=8.0, SD=2.3); t-test p=0.04. The study further suggests that video-assisted learning as an additional tool to traditional teaching can augment students' understanding and learning process (Khan et al., 2019).

The results of this study are also supported by a similar study about the patient demonstration videos in predoctoral endodontic education by Edrees et al. (2015) who showed that the students perceived high value in the video demonstrations related to the treatment procedure. After the endodontic preclinical course, the students were introduced to the treatment protocol in the clinic by watching two live patient-demonstrated videos. The first video demonstrated how to communicate with the patient and perform diagnosis and root canal instrumentation. The second video illustrated how to perform bacterial sampling and root canal filling. After the students watched each video, a questionnaire was used to evaluate their opinions about various steps of the endodontic treatment protocol and the benefit of such educational material for their practice. Of the 75 students, 72 completed the first questionnaire (96% response rate), and 65 completed the second questionnaire (87% response rate). A statistically significant difference was observed between the perceived benefits of the first and second sessions in communication and treatment procedures (p<0.001) (Edrees et al., 2015).

Based on these findings of several studies presented, it has been found out that video demonstration is effective as a method of instruction in teaching restorative dentistry.

**CONCLUSIONS**

The poor performance of the control and experimental groups in the pre-test shows that without instructional support, students doing a cavity preparation in restorative dentistry have difficulty in following the principles of cavity preparation specifically along the area of outline form. The improved performance of the control group, although still in the same level of poor, presents the need for enhanced or more instructional support to help the students get a better grasp of the principles in cavity preparation, especially along the area of outline form. The marked improvement in the performance of the experimental group in the post-test shows that video demonstration helped in making the students understand the principles of cavity preparation. The existence of significant difference in the mean difference of scores in the pre-test and post-test between the control and experimental groups prove that use of video demonstration is effective in enhancing the learning and skills of students in cavity preparation.

**REFERENCES**


