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Comparison of Knowledge Perceived by Final-Year Dental Students for a Lesson on the Apical Barrier in the Premature Root by Clinical Case Demonstration as Compared to the Didactic Teaching Method

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Abstract

Introduction: *The present dental education uses using didactic teaching method, which is teacher-centered with minimal or no active participation from the students. Case-based learning (CBL) is defined as learning that is based upon the description of a patient's problems, analysis and interpretation of all the relevant data obtained from history, examination, and investigations, and planning for further management of patient. The goal of CBL is to prepare students for clinical practice, by linking theory using authentic clinical cases and its application using inquiry-based techniques in learning. There is a scarcity of information about the educational benefits and practicality of clinical case-based demonstration in our local setup.* ***Method:*** *The present cross-sectional questionnaire study was conducted after getting ethical approval and written informed consent. The subjects were final-year BDS students (40) and were divided into groups of 20 each (following the odd-even method). The subjects were taught regarding apical barrier formation techniques for premature teeth. For Group A - the didactic lecture was conducted and for Group B, a demonstration was given in the same manner. A questionnaire consisting of 15 questions was formulated. Analysis was done using SPSS software and the Chi-square test.* ***Results:*** *All the subjects from both groups answered that clinical case-based demonstration strengthens the link between theory and clinical practice.* ***Conclusion:*** *It can be concluded that the incorporation of CBL in the undergraduate curriculum would enhance critical thinking skills and boost overall students' confidence in diagnosis as well as clinical treatment.*

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INTRODUCTION

Current dental education relies primarily on didactic teaching methods. This traditional teaching method is teacher-centered, with minimal or no active participation from students, making it difficult to incorporate the theoretical aspect of the subject clinically. One of the major disadvantages of this method is the pedagogical issues and information overload that led to dissatisfaction among students [1].

Various novel and alternative teaching methods, such as problem-based learning (PBL), case-based learning (CBL), and clinical case-based demonstration (CBD), have been used by multiple

authors to enhance the comprehension and understanding of the subject at undergraduate and postgraduate levels in the medical and dental curriculum [2–5]. PBL is seen as a student-driven process in which the student sets the pace, and the teacher becomes a guide, facilitator, and resource. However, CBL involves the use of clinical cases by instructors to raise awareness about a specific issue, dramatize the importance of a particular health problem or treatment strategy, and introduce new topics [6].

A clinical CBD is an interactive, student-centered, instructor-led learning approach for instructors to impart knowledge to students in dentistry, as it includes providing explanations while performing the clinical procedure. This method incorporates a demonstration of the clinical procedure and simultaneously explains each step along with the rationale behind it. It promotes insight, critical thinking, reflection, and concept-making. Moreover, it creates interest in learners in a particular subject, as they can link it to real-life patient cases and understand the importance of the method for following proper protocols in clinical practice [7, 8]. Nonetheless, the ultimate goal of these methods is to educate students in a way that encourages them to consider the complete scope of a patient's situation while planning treatment.

Dentistry is a field in which theoretical knowledge can be applied clinically. The subject needs to be taught with comprehension of concepts and mechanisms, along with the orientation of clinical aspects of treatment for a variety of cases encountered in practice. Demonstration of a special clinical case is a simple and effective way of sharing knowledge and skills. It acts as a bridge between knowledge and skill components and can be used with individuals and small training groups.

The present study aimed to explore the knowledge perceived by final-year dental students regarding the efficacy of didactic teaching methods and clinical CBDs and their effect on their performance and satisfaction levels.

MATERIAL AND METHOD

The present cross-sectional questionnaire study was conducted after obtaining approval from the institutional research committee (project approval number: MPDC 177/PEDO-07/19).

Inclusion Criteria

1. All the final-year students of Bachelor in Dentistry enrolled in the institution.
2. Completely and rightly filled questionnaire responses were included.

The subjects selected were final-year students (n=40) enrolled in dental colleges. Prior written informed consent was obtained from all subjects. The subjects were ranked in ascending order based on their third-year marks from 1 to 40. Then, they were divided into two equal groups using a simple random sampling method (odd and even method), each having 20 subjects. After this, they were allocated to respective groups, that is, Group A: Didactic teaching group (20 subjects), and Group B: A clinical case demonstration group (20 subjects) for participation in the chit system.

To introduce a novel topic, raise awareness about its importance, and explain the treatment protocol, a lesson was chosen that was new, theoretically important, and not covered in their curriculum prior. The lesson teaching chosen was “Procedure of apical barrier formation in the permanent premature root.” For Group A, the didactic teaching group, the didactic lecture was conducted by the first author through an audio-visual presentation with the help of PowerPoint slides with video clips. Group B received a procedural chairside demonstration by the second author of a real case on how to form an apical barrier in the outpatient department. Both the demonstrations and lectures were conducted simultaneously at the same time.

To check students' intellect regarding the efficacy of both methods, a questionnaire with 17 questions was formulated, which consisted of both open- and close-ended questions with components such as

knowledge, skill, and feedback on the teaching method. After the completion of the didactic lecture and case demonstration on "Apical barrier formation," the questionnaire sheet was distributed among the subjects. They were asked to provide the most appropriate answer to the multiple-choice questions in the questionnaire. The evaluation for the answer was done by the second coinvestigator based on the answer key prepared beforehand for the knowledge component set of questions. Coded answer sheets were given to the coinvestigator for unbiased evaluation.

Statistical Analysis

The data collected were entered into a master chart using Microsoft Excel. Analysis was performed using SPSS software, and the chi-square test was used to evaluate the knowledge, skills, and feedback on teaching methodologies.

RESULT

Of the 40 subjects in the present study, 28 were female and 12 were male. The results derived from this study are presented in Tables 1.

For the open-ended question, that is, choice of material for apical barrier formation, 19 subjects from the didactic teaching group answered Biodentine and $Ca(OH)_2$, and one subject answered only Biodentine. In the clinical case demonstration group 7, subjects answered Biodentine and $Ca(OH)_2$, six subjects answered Biodentine, $Ca(OH)_2$, and MgO, four subjects answered Biodentine, $Ca(OH)_2$ and ZnO, one subject answered only $Ca(OH)_2$, one subject answered Biodentine, $Ca(OH)_2$ and BaO, and one subject answered only Biodentine as the material used for apical barrier formation. The p-value calculated by the chi-square test was 0.003, which was significant.

Table 1. Results of knowledge component from the questionnaire.

Item statements of the questionnaire	Didactic teaching group (Group A) N (%)		Clinical case demonstration group (Group B) N (%)		P-value (chi-square test)
	Correct Answer	***Incorrect Answer***	***Correct Answer***	***Incorrect Answer***	
Indication of case selection for apical barrier formation.	19 (95%)	1 (5%)	20 (100%)	0 (0%)	0.31
Material selection for apical barrier formation.	20 (100%)	0 (0%)	20 (100%)	0(0%)	NA
Technique for MTA placement in the apical third.	1 (5%)	19 (95%)	16 (80%)	4 (20%)	**<0.001**
Determination of working length for open apex tooth.	17 (85%)	3 (15%)	10 (50%)	10 (50%)	**0.018**
Working length assessment during biomechanical preparation.	18 (90%)	2 (10%)	14 (70%)	6 (30%)	0.11
Initial setting time for MTA.	15 (75%)	5 (25%)	20 (100%)	0 (0%)	**0.016**
The thickness of the apical plug.	13 (65%)	7 (35%)	19 (95%)	1 (5%)	**0.017**
After apical barrier formation with MTA, when gutta-percha obturation can be done.	16 (80%)	4 (20%)	20 (100%)	0 (0%)	**0.03**
The irrigating solution is used in cases of apical barrier formation.	7 (35%)	13 (65%)	19 (95%)	1(5%)	**0.0001**

DISCUSSION

Clinical CBDs have been described in dental literature as an important method of distilling the basic knowledge learned in texts and lectures and applying it to a patient. Certain clinical procedures can be better taught using demonstration methods to gain a better understanding of the knowledge domain. It acts as a bridge between theoretical knowledge and clinical skills, which are equally important for learning in the field of dentistry. In addition, the clinical skills of the learner can only be enhanced by

simulation exercises and performing the procedure on the patient. One benefit of a CBD is that it clears the doubts of students related to a procedure or subject at the time of the demonstration itself. It thereby helps in building more curiosity among students and boosting interest in learning procedural steps. This enhances students' knowledge and interaction on the topic by reducing distraction and increasing attention [9–11]. Thus, this study paves the way for useful learning and applications in clinical practice. Hence, the present study was conducted to evaluate final-year dental students' intellect as well as their performance and obtain their reviews and opinions on didactic learning and clinical CBD learning methods.

As small group demonstration is an effective way of learning, all final-year students enrolled in dental colleges were considered. The total number of dental students enrolled in the institution for the final year was 40, and all students were enrolled in the study after their informed consent (n=40). The participants were allocated into two groups by maintaining the accuracy of the results for questions to be evaluated based on the knowledge component and avoiding allocation bias. The lesson teaching chosen was "Procedure of apical barrier formation in the permanent premature root." The chosen lesson provided theoretical knowledge on clinical diagnosis, along with practical clinical skills in the treatment protocol. As the lesson chosen was unique to both groups, a prior assessment using a questionnaire was not conducted. Both groups were simultaneously given information on apical barrier formation to avoid intergroup disclosure of answers. A questionnaire-based evaluation was performed to determine the correct conceptual knowledge gained by the participants in both groups. It also revealed the subject's ability to apply skills clinically and their attitudes toward both teaching methods.

The gender proportion was the same in both groups in our study, with 4 males and 16 females, and was found to be statistically insignificant. As shown in Table 1, most students in both groups were able to correctly answer questions regarding case selection for apical barrier formation and the choice of material used in the present case. The majority of students from both groups mentioned Biodentine and Calcium hydroxide for open-ended questions regarding the use of other materials for apical barrier formation. However, some students from the clinical case demonstration group were also able to provide multiple answers, such as Zinc Oxide, Magnesium Oxide, and Barium oxide as an alternative material. This is because they were explained chairside about the usage of different materials based on the clinical case scenarios. The majority of subjects from the didactic lecture group answered Biodentine and Ca $(OH)_2$ based on the theoretical explanation. Regarding the choice of technique (instrument) used to place MTA in the root apex, MTA pluggers were chosen as options by 95% and 20% of the subjects from the didactic lecture and clinical case demonstration groups, respectively, as they are ideally used as explained in theory. However, 80% of subjects from the clinical demonstration group opted for amalgam carrier as an option, as it was used for MTA placement during the demonstration. This technique was used to demonstrate how amalgam carriers can replace MTA pluggers in a clinical setting.

For the question about working length determination in the open apex, as shown in Table 1, variation in answers was seen among subjects in the clinical case demonstration group because, during the time of the demonstration, the tentative working length was measured based on the preoperative radiograph to avoid apical irritation and was later confirmed with the working length radiograph and apex locator. All subjects from the clinical case demonstration group answered that the initial setting time of MTA was 4 hours, while 5 subjects from the didactic group opted for option b, which was 8 hours. Regarding the thickness of the apical plug, 95% of subjects from the clinical case demonstration group chose 3-4 mm and 65% from the didactic lecture group chose option 1-3 mm p-value (Table 1). This was because, during the demonstration, the subjects were told that a minimum apical plug thickness of 3 mm should be present clinically, which was present in both options.

All subjects from the clinical case demonstration group answered correctly regarding the time to obturation with gutta-percha after apical closure, which was 3 days. Only 80% of the subjects from the

didactic lecture group gave correct answers with a significant p-value (Table 1). This was because the patient was given an appointment and called for obturation after 3 days in front of the subjects from the clinical case demonstration group, which made it easier for them to remember.

It is difficult to directly compare the knowledge component results of the present study with those of other studies, as each has a different topic and methodology. In the present study, students from both groups were able to answer the majority of the questions correctly. However, students from the clinical case presentation group gave more correct and appropriate answers than those from the didactic lecture group. Previous studies have shown similar results to our study, with improvements in the knowledge component domain in the case-based group [12, 13]. However, a study by Arias et al. (2016) showed no significant differences in the acquisition of knowledge between small group discussions and traditional lecture-based learning groups [14].

As it was a challenging and tedious process to simulate a model and perform the procedure of apical barrier formation for assessing the clinical skill components, two questions based on skill components were incorporated to evaluate their confidence in the application of clinically perceived knowledge. As shown in Figure 1, 85% of students from the clinical case demonstration group and only 15% from the didactic lecture group accepted that they would be able to determine the working length of an extracted tooth with an open apex. While 80% of students from the clinical case demonstration and 35% of students from the didactic lecture group accepted that they could perform the procedure of mixing MTA chairside clinically. This indicates an increase in subject integration and confidence among the students in the clinical demonstration group. A study by Heinrich et al. (2012) also suggested that utilizing a case-based methodology increases students' satisfaction and the level of their learning motivation, thus leading them toward higher academic achievement [15].

However, in the present study, the majority of the subjects were satisfied with lecture-based learning. However, all the students were also in favor of student participation during case-based demonstration learning, which enhances the clarity of a topic and increases clinical intellect for the diagnosis and treatment of a particular case along with theory (Figure 2). Further, they agreed that it improved the teacher-student relationship. Along with our findings, earlier research has demonstrated that group discussion offers space for students to develop rapport and explore their doubts [10–12].

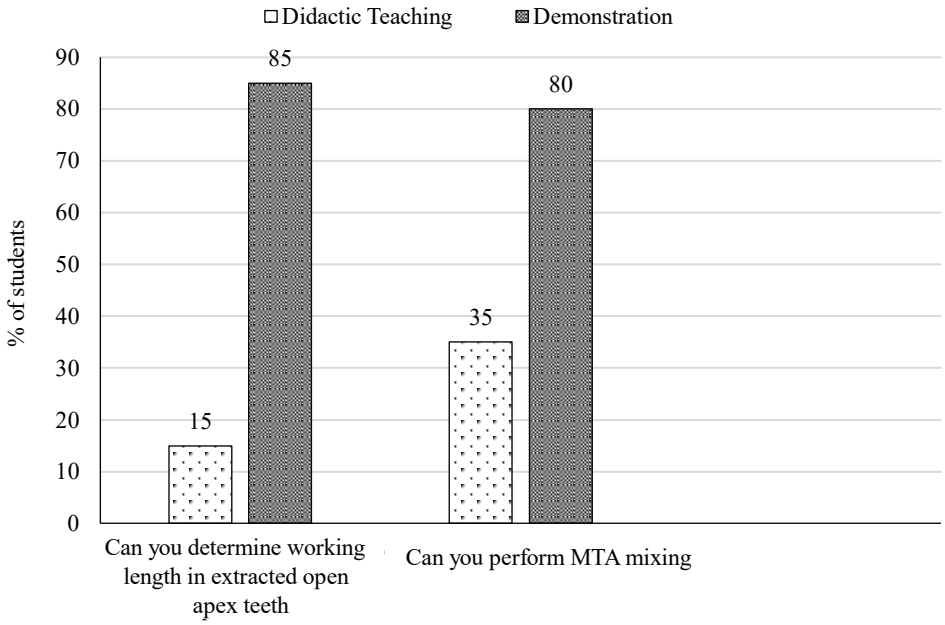

Figure 1. Percentage of students who agreed for their ability to perform clinical steps.

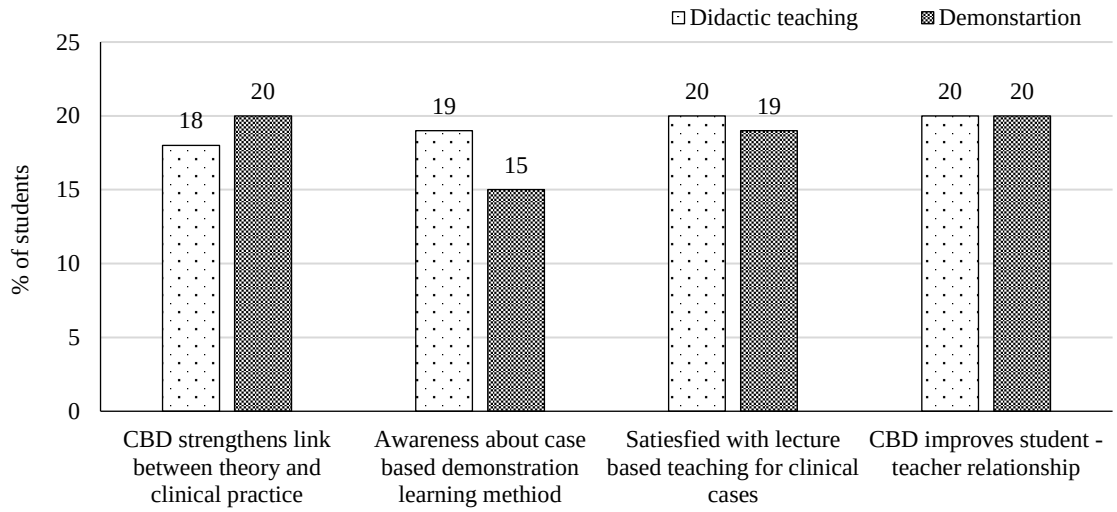

Figure 2. Percentage of students who agreed to consider case-based demonstration (CBD) as a better learning method.

Packer et al. (1999) found that live demonstrations increased student confidence, improved communication skills, and provided a better understanding of procedures [8]. Another study by Bazyk et al. showed that their students expressed a preference for live demonstrations because they allowed them the opportunity to ask questions, interact with the instructor, and understand difficulties and errors during the progress of the procedure [16].

Another randomized controlled trial by Rosa et al. also concluded that the best results were obtained in lecture plus live demonstration groups and that it is a more efficient educational method. It also supports the idea that the use of visual methodologies is appropriate for developing and supporting students' learning experiences [17]. Another pilot study by Jeyapalan et al. (2016) also concluded that live demonstrations with video-assisted teaching, followed by other methods, have shown better results. In addition, live demonstrations increase immediate learning absorption, followed by lectures with PowerPoint presentations and group discussions for the retention of knowledge and memory retrieval [18]. A 2019 study conducted by Deshpande et al. mentioned that CBL simulates the clinical environment and encourages students' clinical thinking more effectively than conventional teaching [12].

Thus, the clinical case-based demonstration learning method can be implemented as an adjunct to didactic learning, framing a proper protocol to enhance the academic and clinical skills of dental students. The results derived from this study will be helpful to educators and policymakers in bringing about necessary reforms in the curriculum, along with making arrangements for resources that may be required, leading to improved standards of dental education with ultimate benefits for patients and the community. Furthermore, it will add to the scholarly research and literature on dental education, especially in the local context.

CONCLUSION

Thus, the overall clinical case-based demonstration teaching method provides the following learning benefits:

- Helps in the propagation of new information along with the supplementation of existing knowledge.
- Encourages self-evaluation and critical thinking.
- Allows scientific inquiry and the development of support provisions for their conclusions.
- Integration of knowledge and practice in learning the treatment skills.

Hence, case-based demonstrations should be incorporated into the undergraduate curriculum instead of taking only a didactic lecture for a clinical case-based topic. This would enhance critical thinking skills and boost students' confidence in diagnosis as well as in performing clinical treatment.

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