

Effectiveness of an Early Clinical Exposure Module on the Performance of Second Year Dental Students - A Randomized Controlled Study

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Abstract

Purpose: Teaching Prosthodontics to preclinical students has been a challenge as they are not exposed to clinics their understanding is based on imagination of clinical aspects. Early clinical exposure could be used to supplement traditional lectures. This paper presents the results of a study carried out to test the effectiveness of an Early Clinical Exposure module. **Method:** A randomized controlled trial was conducted among 84 second year students in a dental college in India. Control group received didactic lectures and study group received didactic lectures accompanied by a video of the clinical procedure. Two hours of lecture and 16 hours of practical sessions were conducted for both groups. Knowledge of subjects in both the groups was assessed before and after the intervention using MCQs while skills were assessed after intervention using Objective Structured Practical Examination (OSPE). Paired t test and unpaired t test were used for data analysis. Student feedback regarding ECE was collected using self-designed proforma. **Results:** The post-intervention, mean MCQ scores in the control and study group were 12.78 ± 2.70 and 14.51 ± 2.03 respectively. There was a significant increase in the mean scores in both the groups after the intervention compared with their baseline values ($p=0.003$). The mean OSPE scores in the control and study group was 13.97 ± 3.64 and 14.69 ± 3.32 respectively, which was not statistically significant with $p=0.377$. Students felt that ECE helped in correlation of theory with practical by providing better visualization of the procedure. **Conclusion:** Early Clinical Exposure module had a positive effect on the scores of students in prosthodontics indicating that ECE could be included as a part of the curriculum.

Keywords: Early clinical exposure; Preclinical prosthodontics; OSPE; Feedback

Introduction

Traditional lectures and power-point presentations are routinely employed as a means of transmitting knowledge and skills are learnt by demonstration of procedure to small groups. Teaching prosthodontics to first and second year dental students, to make it interesting and boost learning has been a challenge. Preclinical Prosthodontics in undergraduate dental curriculum aims to impart theoretical knowledge to the student and enable them to develop skills involved in complete denture fabrication without any patient contact.^[1,2]

It has been reported that students fail to recall basic scientific concepts related to clinical fields; thus questioning the efficacy of academic education imparted in the initial years.^[2-4] Furthermore, students also experience anxiety during the transition from preclinical to clinical years.^[2-6] It is therefore recommended that students should be introduced to clinical environment in the early years of their course so that they understand the importance of preclinical exercise of denture fabrication/ replacement of missing teeth and associated

structures.^[7-9] There is evidence showing that early clinical exposure (ECE) may move education and learning towards the real context of practice.^[7]

Early clinical exposure is an "Authentic human contact in a social or clinical context that enhances learning of health, illness and disease, and the role of the health professional."^[10,11] ECE can be implemented in all or any of the three settings: Class room setting, Hospital setting and Community setting.^[12] ECE facilitates students' transition to the clinical phase, helps them develop professional identity, increases their motivation, makes them aware of the application of basic sciences and boost their confidence to handle their patients' problems in practice.^[13,14]

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ECE is one of the reforms proposed in the Medical Council of India's (MCI) Vision 2015 document for restructuring of undergraduate medical education.^[15]

Effectiveness of ECE in medical education is well established, but there is a lack of data related to its effectiveness in dental education, in the Indian context. Therefore, this study was carried out with an aim of testing the effectiveness of an ECE (Early Clinical Exposure) module in preclinical prosthodontics on the performance of second year dental students. The objectives of the study were to compare the knowledge and skills of second year dental students trained using conventional didactic lectures with those trained with a combination of didactic lectures and early clinical exposure module and to assess the perception of dental students regarding early clinical exposure.

Materials and Methods

This study was a randomized controlled trial conducted among second year dental students in a dental college after obtaining ethical clearance from the IRB and permission from the Dean. The purpose of the study was explained to the subjects. The subjects were informed that their decision to participate in the study was voluntary and their non-participation would not affect other aspects of their academics. Written informed consent was obtained from them.

Two Focus Group Discussions (FGDs) were conducted with two different groups of students and one FGD was held with prosthodontics faculty to determine the difficulties encountered during the process of learning and teaching the subject.^[16] This

Table 1: Lesson plan.

Department of Prosthodontics		Module for Pre-clinical Prosthodontics	
Course Title	Preclinical Prosthodontics		
Academic Year	2		
Course Synopsis	Development of an Early Clinical Exposure (ECE) module in Preclinical Prosthodontics related to impression making with Impression compound in completely edentulous patients in second year dental students. At the end of the course student shall be able to:-		
Learning Outcomes	<ol style="list-style-type: none"> 1. Identify the material and classify it. (C2) 2. Describe the function of each ingredient of impression compound.(C1) 3. State the properties of impression compound. (C1) 4. Identify the advantages and disadvantages of impression compound. (C2) 5. Explain the uses of impression compound. (C2) 6. Explain the movements involved in manipulating the material in different regions of the oral cavity. (C2) 7. Demonstrate the manipulation of impression compound to record the maxillary impression using edentulous die. (C3,P3) 8. Demonstrate the manipulation of impression compound to record the mandibular impression using edentulous die. (C3, P3) 		
Learning Strategies, Contact Hours	Learning Strategy	Contact Hours	
	Lecture	2 hours	
	Video demonstration	1 hour	
	Practical	16 hours (8 hrs for maxillary+ 8 hrs for mandibular)	
	Assessment A) MCQ s to assess C1,C2	A) 1 hour for pre-test and 1 hour for post-test	
	B) OSPE to assess C3,P3	B) 2 hours	
Expected Competency	The students should be able to manipulate and make impression with impression compound on metal die.		
Assessment Methods	Formative	Summative	
	Record book	MCQ	
	Viva	OSCE/OSPE	
	Assignments		
Feedback Methods	<ol style="list-style-type: none"> 1. Perception of students regarding the module will be taken at the end of the discussion. 2. Feedback regarding student performance at the end of each session will be given 		
Main References	<ol style="list-style-type: none"> 1. Z arb- Prosthodontic treatment for edentulous patients; 13 th edition CV Mosby Company,2004. 2. Skinner's Dental Materials 		
Teaching Schedule			
Lecture	Topics	Contact Hours	
1	Introduction to impression materials (Include definition, requirements and classification of impression materials ; definition and classification of Impression trays)	1 hour	
2	Introduction to rigid impression materials with emphasis on impression compound. This lecture will also include manipulation of impression compound and procedure for making impressions	1 hour	
Video Demonstration	Procedure	Contact Hours	
	Manipulation of impression compound to make maxillary and mandibular impressions.	1 hour	
Practical	Procedure	Contact Hours	
1	Making the maxillary impression on the metal die	8 hours	
2	Making the mandibular impression on the metal die	8 hours	

Table 2: Design of objective structured practical examination (OSPE) stations.

	Properly Done (Maximum marks)	Partially Done (Half of the maximum marks)	Not Done (0 marks)	Total marks awarded
1. Whether tray selection is appropriate or not? (4 marks)	-	-	-	-
2. Whether impression compound has been broken into pieces?(2 marks)	-	-	-	-
3. Whether manipulating compound at the right temperature? (4 marks)	-	-	-	-
4. Has the impression compound been kneaded correctly and the manipulated compound homogenous and void free? (3 marks)	-	-	-	-
5. Has the tray been loaded and oriented properly on the metal die? (3 marks)	-	-	-	-
6. Have all the anatomical landmarks been recorded (maxilla: labial vestibule & distobuccal area; mandible: labial vestibule & distolingual area) (4 marks)	-	-	-	-

FGD revealed that primary impression making using impression compound was one of the topics which was found to be difficult to learn by the subjects. Based on this, an ECE module was designed which consisted of Multiple Choice Questions (MCQs), Objective Structured Practical Examination (OSPE) stations, Powerpoint lectures and Video recording.

Pilot study

A pilot study was conducted among 10 second year students of the previous batch who were not a part of the main study to determine the comprehensibility of the module and to test the feasibility of the project. Based on the results of the pilot study, the necessary modifications were made and the final module was prepared.

Preparation of resources

A lesson plan consisting of list of subtopics that would be taught in lecture classes, in relation to making an impression using impression compound, was prepared [Table 1]. It was reviewed by other faculty members in the Department of Prosthodontics. Changes that were suggested were incorporated and the PowerPoint presentation was prepared.

Based on learning objectives, a 20 minute video recording on a patient consisting of the complete clinical procedure of making a primary impression of the edentulous jaws, using impression compound was prepared by one of the investigators. Written consent was obtained from the patient. The video included English audio narration with sequential steps involved in preliminary impression making for both the maxillary and mandibular arches: the armamentarium involved (such as various impression materials and impression trays), the position of patient and operator, intraoral anatomical landmarks, selection of impression trays, kneading of impression compound, loading of the impression material, making and reading an impression. The video was reviewed by other faculty members in the prosthodontics department and edited after receiving feedback. The final revised version was then used in the study.

Preparation of Multiple Choice Questions (MCQs) and Objective Structured Practical Examination (OSPE) stations

The MCQs were framed based on the learning objectives and item analysis was performed on the second year students of the

previous batch. Then the final version of MCQs was prepared by the staff. The final version contained 20 MCQs and 4 OSPE stations [Table 2].

Study procedure

84 subjects were randomly allocated to two groups using simple random technique. Control group received instruction in the form of didactic lectures and study group received it in the form of didactic lectures accompanied by a video demonstration of the procedure in the clinic [Figure 1]. A single investigator conducted didactic lectures for both groups. The study subjects comprised of second year dental students who were willing to participate in the study.

Two hours of lecture and 16 hours of practical sessions were conducted as a part of the study by the investigator for both groups. The investigator had a tutor guide consisting of points to be covered in the lecture so that the information given to both the groups was similar. A pretest using MCQs was conducted in both groups to determine students' knowledge of the chosen topic before the intervention. After the intervention an MCQ test for knowledge and skills assessment using OSPE was

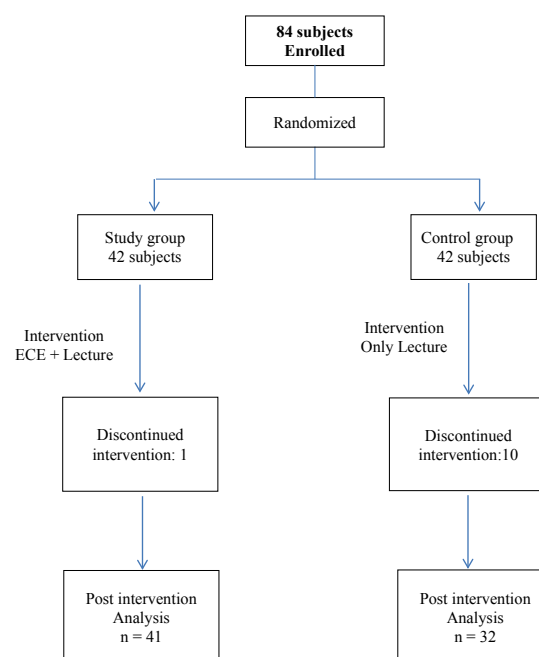


Figure 1: Flow chart of study design.

performed. Student feedback regarding ECE was obtained using self-designed proforma consisting of 6 items on 5 point Likert scale at the end of the module. The scale was coded as: 1=Strongly Disagree; 2=Disagree; 3=Neutral; 4=Agree; 5=Strongly Agree.

Data analysis

Data analysis was done using SPSS 17.0 version (Chicago, IL). Paired t test was performed to assess the improvement in each group. Unpaired t test was used to compare the scores between the groups. Statistical significance was fixed at 5%.

Results

A total of 73 subjects participated in the study. Among them, 32 belonged to the control (Lecture) group and 41 belonged to study (Lecture + Video) group. There were eleven dropouts; these students were absent on the day of the intervention.

The intergroup comparison of pretest scores revealed that at baseline there was no significant difference in the MCQ scores of both the control and study groups ($p=0.110$) [Table 3]. Post intervention there was a significant difference in the mean MCQ scores of both the groups ($p=0.003$) [Table 3].

The mean scores obtained in the pretest MCQ exam by the subjects in the control group and study group was 8.25 ± 2.40 and 9.24 ± 2.75 respectively. The post intervention means score of the control group was 12.78 ± 2.70 and in the study group it was 14.51 ± 2.03 . Intragroup comparison revealed that there was a statistically significant increase in the mean scores in

both the groups after the intervention when compared with their baseline values ($p<0.05$) [Table 4].

The mean OSPE scores of subjects in the control group and study group was 13.97 ± 3.64 and 14.69 ± 3.32 respectively. Intergroup comparison of OSPE scores revealed that the mean scores of study group were higher compared to the control group though the difference was not statistically significant ($p=0.377$) [Table 5].

Student feedback revealed that all 35(100%) of the students agreed that ECE improved understanding of the impression procedure, promoted better visualization of the handling of the impression material and motivated them to learn more. More than 90% agreed that ECE provided better retention of the topic and improved correlation of theory with practical [Table 6].

The students were also asked to provide feedback on the inclusion of video demonstration and they felt that it helped in linking theory with clinical application.

The students were also asked to comment on suggestions to further enhance the process to which they suggested sharing of video links.

Discussion

The model of traditional medical teaching includes more theoretical aspects in the first two years of the course followed by exposure to clinics only in the remaining years^[17] Dentistry and dental education are a dynamic field and therefore require periodic curricular reforms. One of the purposes of making

Table 3: Comparison of Knowledge Pre-score between control (lecture) and study (lecture and video) group.

	Group	N	Mean	Std. Deviation	Mean difference	P-value
Pre -intervention	Control (Lecture)	32	8.25	2.396	-0.994	0.11
	Study (Lecture+Video)	41	9.24	2.755		
Post- intervention	Control(Lecture)	32	12.78	2.697	-1.731	0.003*
	Study (Lecture+Video)	41	14.51	2.026		

Table 4: Comparison of Pre vs Post mean scores in control (lecture) and study (lecture and video) group.

Group		Mean	N	Std. Deviation	Mean difference	P-value
Control (Lecture)	Pre -score	8.25	32	2.396	-4.531	<0.001*
	Post-score	12.78	32	2.697		
Study (Lecture+Video)	Pre -score	9.24	41	2.755	-5.268	<0.001*
	Post-score	14.51	41	2.026		

* Statistically significant using Paired t-test

Table 5: Comparison of OSPE scores between control (lecture) and study (lecture and video) group.

Group	N	Mean	Std. Deviation	Mean difference	P-value
Control(Lecture)	32	13.969	3.641	0.726	0.377
Study(Lecture+Video)	41	14.695	3.3183		

* Statistically not significant using t-test

Table 6: Distribution of students' responses to perception to early clinical exposure.

	Strongly Agree		Agree		Neutral	
	N	%	N	%	N	%
Q1. It improved my understanding of impression procedure when supplemented by video	19	54.3	16	45.7	0	0
Q2. Video exposure promoted better visualization of the handling of the impression material	16	45.7	18	51.4	1	2.9
Q3. Video exposure provided better retention of the topic	11	31.4	21	60	3	8.6
Q4. Video exposure improved correlation of theory with practical	21	60	11	31.4	3	8.6
Q5. I felt motivated to learn more after viewing the video	18	51.4	16	45.7	1	2.9
Q6. Video exposures should be promoted	25	71.4	10	28.6	0	0

innovations in educational technology is promoting easier understanding of complex concepts. Early clinical exposure is one such educational innovative practice that will facilitate smoother transition between a theoretical concept and its clinical application. This study was carried out to test the effectiveness of an ECE (Early Clinical Exposure) module in preclinical prosthodontics on the performance of second year dental students.

Preclinical Prosthodontics is taught during the first two years of the course. During this period, the exposure of a student is limited to the laboratory, so it is difficult to understand certain topics that are taught in theory e.g. anatomical landmarks, impression making, jaw relations, occlusion, casting defects and dental ceramics. The learning of the second year student can be supplemented with clinical exposure to permit horizontal and vertical integration of basic sciences with clinical training^[8]. Introduction to patient care should take place as early as possible to make the students familiar with the task they will be pursuing as their profession^[8].

If a patient cannot be brought to the class, a paper based case vignette, video recordings, pictures or case scenarios on Power Point, animations etc. can be used to impart ECE^[12].

In this study, video recordings in class room setting were used to implement ECE. Videos provide enhancement in visualization of the oral cavity and allows creation of mental representation to encourage deep learning within the classroom dynamics^[18-20] It ensures that standardized information is imparted to students by different tutors^[18] Videos are helpful as the students can refer to the material repeatedly.^[21]

The results of the present study revealed that both the control and the study group showed significant increase in knowledge compared to baseline values. When OSPE scores were compared, there was an increase in the mean scores of the study group though it was not statistically significant. A possible explanation for this observation is that both groups did not have plenty of practice before their OSPE and improvement in skills requires time and practice. The results of our study are in agreement with those of Smith et al.^[20] who reported no statistically significant differences in practical examination results using video-clips as a teaching aide.

Tayade et al.^[22] reported statistically significant difference in the knowledge, skills and attitude of first year M.B.B.S students between ECE and Non-ECE group. Rawekar et al.^[23] also reported significant gain in the skills in M.B.B.S students as evident by the scores of OSCE.

A study by Duque et al.^[24] assessed the effects of early clinical exposure of second year medical students at McGill University to geriatric medicine. Students exposed to clinical experience found their postings more effective as a learning experience and expressed greater satisfaction in interaction with the tutors. The grades obtained by the students exposed to early clinical experience in the final examinations showed better and more effective acquisition of knowledge.

O'Brien-Gonzales^[17] described the experiences of ten Interdisciplinary Generalist Curriculum Project demonstration medical schools that incorporated early clinical experience programs as a part of their medical education and training

models. The demonstration schools believe that early clinical experience strengthened student learning, enhanced students' ability to interact with patients and improved performance on clinical skills assessment.

Obrez et al.^[9] implemented a clinically oriented complete denture program for second-year dental students in the College of Dentistry at the University of Illinois, Chicago by providing significant clinical exposure with patients. The results showed statistically significant improvement in the students' performance in the written, practical and OSCE.

In our study, students perceived that ECE improved correlation of theory with practical by promoting better visualization and understanding of impression procedure. This motivated them to learn more. Positive perception of the students towards ECE has also been reported by Rawekar et al.^[23]

Long-term performance of this batch needs to be tracked to observe if there are any changes in their performance compared to students who have received routine training. We also plan to implement ECE in future batches of second year BDS. ECE can also be started as early as the first year of their training in Prosthodontics and other specialties of dentistry as well.

Conclusion

Early Clinical Exposure module had a positive effect on the scores of students in preclinical Prosthodontics. The observed improvement in clinical knowledge suggests that ECE can be included as a part of the current dental undergraduate curriculum in India.

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Conflict of interest

The authors declare no conflict of interest.

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