









# Assessment of impact of early clinical exposure in the understanding, visualization and comprehension of primary impression in undergraduate students

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Utilization of early clinical exposure (ECE) model in undergraduate dental education can help to contextualize theory with skill development. **Aim:** To compare the knowledge and skills of dental students trained using conventional method with those trained with a combination of didactic lectures and early clinical exposure module. **Methods:** This randomized controlled study was conducted among second year dental students in preclinical prosthodontics and was randomly allocated to 2 groups of 36 each. Control group received theory and practical class in Manipal College of Dental Sciences Mangalore India whereas, study group in addition to above, a video demonstration of the impression procedure in the clinic was given. Cognitive assessment done using Multiple Choice Questions (MCQs) and psychomotor skills assessed by using Objective structured Practical Evaluation (OSPE). Student feedback regarding ECE, by 5point Likert scale was obtained. **Results:** In the pretest and post intervention mean scores obtained by the subjects in the control group was 5.41±1.09, 6.69±0.85 and study group 7.31±1.24, 8.64±1.42. Comparison of intragroup showed that there was a statistically significant increase in the mean scores in both groups after the intervention when compared with their baseline values. (p<0.001) Students response to perception of early clinical exposure revealed improved understanding of impression procedure (85.7% strongly agreed and 14.3% agreed). **Conclusions:** Knowledge and skills of students trained with combination of didactic lectures and early clinical exposure module showed improved scores when compared with students trained using conventional method.

**Keywords:** Cognitive psychology. Psychomotor performance. Colloids.



## Introduction

Periodic curricular reforms are required in the field of dentistry and dental education as it is dynamic in terms of new materials used and knowledge imparted to dental students. Dental teaching model traditionally involves more of theory subjects during first two years of the course followed by clinical subjects involving hands on training during next two years. Innovative educational practice is the need of the hour as it promotes easier understanding of complex clinical skills. One of the educational tools that help during transition from theoretical concept to clinical application is early clinical exposure (ECE).

The study on early clinical exposure (ECE) has a positive impact on the development of students' professional knowledge, problem-solving skills, motivation, active learning, and community orientation<sup>1</sup>. Authors who reviewed on the outcomes and discussed different ECE settings stressed on crucial role of its implementation in medical curriculum<sup>2</sup>. This method can be applied to modify the curricula to meet tomorrow's need. There is better understanding of disease conditions, learning health stream by direct contact with patients in clinical or social setup<sup>3,4</sup>. The objective here is to provide a context for basic science learning by integrating it with clinical dimension. ECE bridges a chasm between preclinical and clinical training of undergraduate dental students<sup>3</sup>. Undergraduate dental curriculum has preclinical prosthodontics that aims to teach theoretical knowledge to the student and facilitate them to develop skills without any patient contact in complete denture fabrication<sup>4,5</sup>. Students should be made to understand the significance of preclinical practical work of denture fabrication/replacement of missing teeth and associated structures by introducing clinical environment<sup>6-8</sup>. ECE can be implemented in various settings including Hospital setting, Class room setting, and Community setting<sup>9</sup>.

One of the dental studies tried to determine if ECE correlated with earlier clinical competency assessments<sup>10</sup>. There are very few studies in dentistry especially in the subject of prosthodontics. This study was carried out with an aim to compare the cognitive and psychomotor skills of second year dental students trained using traditional theory lectures with those trained with a combination of theory lectures and early clinical exposure teaching method and to determine the perception of dental students regarding early clinical exposure teaching method.

## Subjects and Methods

This randomized controlled study was conducted among second year dental students. Institutional ethical committee approval was taken to conduct the study from Manipal college of Dental Sciences, Mangalore with approval no.22068. The purpose of the study was explained to all subjects who were participated in the study voluntarily. The ECE module in this study consisted of power point lecture presentation, video demonstration followed by evaluation through MCQs (Multiple Choice Question) and OSPE (Objective Structured Practical Examination). This method of

evaluation was followed in accordance with study conducted by Shigli et al.<sup>11</sup>. All questions were decided and validated by consensus of six subject experts.

### **Preparation of resources**

Lecture class lesson plan was prepared to teach primary impression making with irreversible hydrocolloid (alginate) material. Course synopsis included, Classification and identification of each impression material. Describe the composition and significance of each ingredient of alginate, State the properties of alginate impression material. Explanation of advantages and disadvantages of alginate. Explanation on the uses of alginate. Explain the lip and cheek movements involved in moulding the material in different areas of the oral cavity. The lecture class material was reviewed by other faculty members in the Department of Prosthodontics. Changes suggested was incorporated in the lecture content that was prepared. Students were trained to mix alginate material and to do impression on phantom head typodont models. Based on objectives of learning, a 15minute video recording on a partially edentulous patient consisting of impression tray selection, chair position, patient position, mixing, loading and clinical procedure of making a primary impression, using irreversible hydrocolloid was prepared by the investigator. Patient written consent was obtained. The video involving audio narration with all steps of preliminary impression making for both the maxillary and mandibular arches: the steps include: selection of impression trays, the chair position, position of patient and operator, observation of intraoral anatomical landmarks, proper mixing of alginate powder and water, loading and orientation of the impression material on the impression tray, moulding the impression material, removal of an impression from oral cavity and finally, reading it properly. The video demonstration was utilized for test group students.

### **Study Procedure**

Our final year undergraduate students were 72 in number, thus an in-toto sample was taken for evaluation in our study. Undergraduate students who are studying in preclinical prosthodontics was randomly allocated to 2 groups of 36 each. Control group received instruction in the form of theory lectures and practical class as in the lesson plan and study group received it in the form of theory lectures and practical class as in lesson plan accompanied by a video demonstration of the procedure in the clinic. Only one investigator conducted theory lectures for both groups. Objectively structured and validated questionnaire was used as a pre-test and post-test. Before the intervention, a pre-test using MCQs (10 Questions) was conducted for both groups to determine student's knowledge on the topic of impressions and on alginate impression. After the intervention, an MCQ test (10 Questions) for cognitive and psychomotor skills assessment using OSPE was performed. Design of objective structured practical examination (OSPE) as given (Table 1).

**Table 1.** Assessment of psychomotor skills by Objective Structured Practical Examination (OSPE)

| Assessment Criteria  | Maximum Score | Properly Done (Max Score) | Partially Done (half Score) | Not Done (0) |
|--|---------------|---------------------------|-----------------------------|--------------|
| Appropriateness of tray selection  | 4             | 4                         | 2                           | 0            |
| Water powder ration in correct Proportio   | 2             | 2                         | 1                           | 0            |
| Proper mixing is done or not   | 4             | 4                         | 2                           | 0            |
| Has the impression mix is devoid of granular mix or excessively thin/liquid  | 3             | 3                         | 1.5                         | 0            |
| Proper loading of the impression and Orientation with partially edentulous acrylic model?  | 3             | 3                         | 1.5                         | 0            |
| Recording of anatomical landmarks (maxillary arch: labial vestibule & distobuccal area; mandibular arch: labial vestibule & distolingual area) | 4             | 4                         | 2                           | 0            |

Self-designed proforma was used to obtain the student feedback regarding ECE, consisting of 6 parameters on 5 point Likert scale at the end of this teaching method. The scale was coded as: Strongly Agree =5; Agree =4; Neutral=3; Disagree =2; Strongly Disagree =1.

ECE was given for the students in control group after recording the data for ethical reasons.

### Statistical Evaluation

Comparative Evaluation of the results between the groups was done using descriptive Analysis. Paired 't' test was done to compare the values of MCQ scores between the groups and Independent 't' test was done to compare the values of OSPE. In our study p value <0.05 was considered as statistically significant.

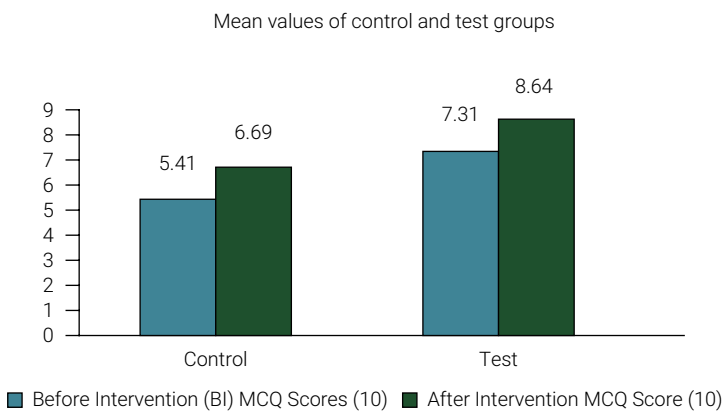
### Results

In this study, a total of 65 subjects were participated. In the control group, there were 29 subjects, and in study group there were 36 subjects. There were seven students who were absent on the day of intervention, and were considered as dropouts.

Paired 't' test was done to compare the values of MCQ scores. In the pretest MCQ exam the mean scores obtained by the subjects in the control group and study group was  $5.41 \pm 1.09$  and  $7.31 \pm 1.24$  respectively. The mean scores of post intervention was  $6.69 \pm 0.85$  for control group and it was  $8.64 \pm 1.42$  for study group. Comparison of intragroup showed that there was a statistically significant increase in the mean scores in both groups after the intervention when compared with their baseline values. ( $p < 0.001$ ) [Table 2, Chart 1]

**Table 2.** Comparison of mean values of MCQ scores before and after intervention by using Paired t test.

|         |        | n  | Mean $\pm$ SD   | Mean difference $\pm$ SD | t      | p value          |
|---------|--------|----|-----------------|--------------------------|--------|------------------|
| Control | Pair 1 | 29 | 5.41 $\pm$ 1.09 | -1.28 $\pm$ 0.92         | -7.45  | <b>&lt;0.001</b> |
|         |        | 29 | 6.69 $\pm$ 0.85 |                          |        |                  |
| Test    | Pair 1 | 36 | 7.31 $\pm$ 1.24 | -1.33 $\pm$ 0.68         | -11.83 | <b>&lt;0.001</b> |
|         |        | 36 | 8.64 $\pm$ 1.42 |                          |        |                  |

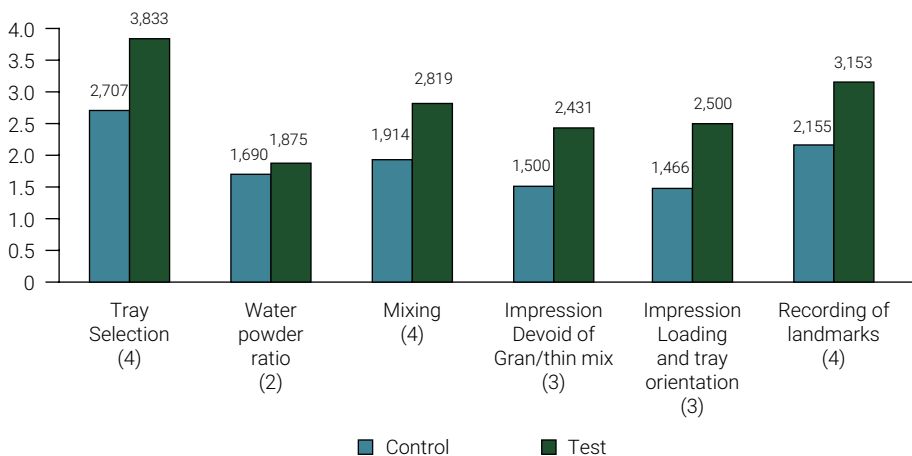
**Chart 1.** Showing mean values of control and test groups

Independent 't' test was done to compare the values of OSPE. The OSPE evaluation criteria namely proper tray selection, comparison of mean values between the two groups shows that tray selection has higher value in Test group with a t value of -8.235 and is statistically significant with a p value of <0.001. The Water powder Ratio, comparison of mean values between the two groups shows higher value in Test group with a t value of -1.956 and is statistically non-significant with a p value of 0.058. Comparison of the Mixing (maximum score of 4) the mean values are, control group 1.91 $\pm$ 0.55 and test group 2.82 $\pm$ 0.76. Comparison between the two groups shows that Mixing had higher mean value in Test group with a t value of -5.386 and is statistically significant with a p value of <0.001. Next criteria, impression devoid of grain/thin mix (maximum score of 3). Comparison between the two groups shows higher mean value in Test group with a t value of -7.27 and is statistically significant with a p value of <0.001. Impression loading and tray orientation (maximum score of 3), the mean value of control group 1.47 $\pm$ 0.6 and test group 2.5 $\pm$ 0.43. Comparison between the two groups shows that impression loading and tray orientation had higher mean value in Test group with a t value of -8.11 and is statistically significant with a p value of <0.001. Recording of landmarks (maximum score of 4), the mean value of control group 2.16 $\pm$ 0.66 and test group 3.15 $\pm$ 0.71. Comparison between

the two groups shows that recording of landmarks had higher mean value in Test group with a t value of -5.846 and is statistically significant with a p value of <0.001 [Table 3, Chart 2].

**Table 3.** Mean values of the scores achieved by students in test and control groups in each OSPE using independent t test

| Evaluation Criteria and their mean values   | Control(n=29) | Test(n=36) | t      | p Value |
|---|---------------|------------|--------|---------|
|   | Mean ± sd     | Mean ± sd  |        |         |
| Tray Selection (4)                          | 2.71±0.69     | 3.83±0.29  | -8.235 | <0.001  |
| Water powder Ratio (2)                      | 1.69±0.47     | 1.88±0.22  | -1.956 | 0.058   |
| Mixing (4)                                  | 1.91±0.55     | 2.82±0.76  | -5.386 | <0.001  |
| Impression Devoid of Grain/thin mix (3)     | 1.5±0.48      | 2.43±0.54  | -7.27  | <0.001  |
| Impression Loading and tray orientation (3) | 1.47±0.6      | 2.5±0.43   | -8.11  | <0.001  |
| Recording of landmarks (4)                  | 2.16±0.66     | 3.15±0.71  | -5.846 | <0.001  |
| Before Intervention (BI) MCQ Scores (10)    | 5.41±1.09     | 7.31±1.24  | -6.464 | <0.001  |
| After Intervention MCQ Score (10)           | 6.69±0.85     | 8.64±1.42  | -6.862 | <0.001  |
| Score_Difference                            | 1.28±0.92     | 1.33±0.68  | -0.29  | 0.773   |



**Chart 2.** Showing OSPE Criteria with their mean values.

Students response to perception of early clinical exposure measured with 5-point Likert scale was measured and revealed that impression procedure supplemented by video demonstration had improved their understanding of impression procedure (Q1) There was better handling of the impression material which was promoted by video exposure (Q2) The topic of impression with alginate is better retained because of video exposure (Q3) Correlation of theory with practical improved with video exposure(Q4). After viewing the video, student felt motivated to learn more (Q5) Video exposures should be promoted (Q6)

In a 5 point Likert scale, there was disagree and strongly disagree points other than Strongly Agree, Agree and Neutral. None of the participants had entry with disagree and strongly disagree points. Hence, those were not mentioned in the results.

## Discussion

Above study is conducted to check the efficacy of an ECE teaching method in pre-clinical prosthodontics. The cognitive and psychomotor skills of second year dental students was measured after the given exercise of making alginate impression on a typodont partially edentulous model.

Pre-clinical training for dental students is restricted to theory and practical labs. The exposure and understanding of many theoretical aspects are confined preclinical labs. Video recordings, pictures or case scenarios on Power Point, A paper-based case vignette, animations etc. can be used if a patient cannot be brought to the class to impart ECE<sup>11-16</sup>. In the above study, video recording of alginate impression making in the clinical setting was done and shown to students before they make impression with phantom simulators. Previous studies showed that, deep learning within the classroom dynamics is enhanced by videos that provide visualization of the oral cavity<sup>17-19</sup>.

The results of this study revealed, the mean values of MCQ scores at baseline when compared with mean scores after intervention there was statistically significant increase in the mean scores in both groups after the intervention. The mean OSPE scores were higher in test groups with statistically significant with following factors, tray selection, mixing of alginate, mix of the impression devoid of grains/thin mix, impression material loading and tray orientation, recording of landmarks. The above result is not in agreement with other study done by Smith et al.<sup>16</sup> who stated no statistically significant differences in skill assessment examination results using clinical video as teaching supplement. The mean OSPE score was higher in test group with water powder ratio when compared with control group but statistically not significant. Only this factor of the OSPE score agrees with other study conducted by Smith et al.<sup>16</sup>. The above results indicate improvement in knowledge after intervention. The higher OSPE scores of test group indicate application of ECE is beneficial for skill development. This agrees with other studies conducted by Tayade et al.<sup>17</sup> in which authors showed statistically significant difference in the skills, attitude and knowledge with first year medical students between non-ECE and ECE group.

In our study, student's response on perception of ECE, showed better visualization and understanding of impression procedure which shows improved correlation of subject knowledge with practical skills. This factor helped students to learn more about the impression procedure. Student's also felt after viewing the video motivated to learn more and also recommended for ECE teaching method. There were other studies which showed similar results reported by Rawekar et al.<sup>18</sup>.

Limitation of the study is only one exercise is conducted and applied with students of only one institution. Further studies can be done to evaluate ECE implementation with practical classes of different clinical subjects involving preclinical exercises.

Students may have better performance with their practical classes and evaluations by taking advantage of ECE modules.

In conclusion, Early clinical exposure through video exposure had beneficial effects on preclinical training in undergraduate dental students. Improvements are observed in knowledge capturing and hand skills of the students which is indicative of higher impact of teaching. The above method could be included when we plan for a curriculum modification and would be helpful for both students and teachers at undergraduate preclinical level.

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## Conflict of Interest

The authors have no conflict of interest to disclose.

## Data availability

Datasets related to this article will be available to the corresponding author upon request.

## Author Contribution

**Charan M Shettigar** have done substantial contributions to the design of the work and acquisition, analysis, or interpretation of data for the work; Involved with drafting the work or reviewing it critically for important intellectual content. **Mahesh Mundathaje** have done substantial contributions to the design of the work and acquisition, analysis, or interpretation of data for the work; Involved with drafting the work or reviewing it critically for important intellectual content. **Srikant Natarajan** have done substantial contributions to the design of the work and acquisition, analysis, or interpretation of data for the work; Involved with drafting the work or reviewing it critically for important intellectual content. **Thilak Shetty** have done substantial contributions to the acquisition, analysis, or interpretation of data for the work; Involved with drafting the work or reviewing it critically for important intellectual content. **Shobha Rodrigues** have done substantial contributions to the acquisition, analysis, or interpretation of data for the work; Involved with drafting the work or reviewing it critically for important intellectual content. **Sharon Saldanha** have done substantial contributions to the acquisition, analysis, or interpretation of data for the work; Involved with drafting the work or reviewing it critically for important intellectual content. **Puneeth Hegde** have done substantial contributions to the acquisition, analysis, or interpretation of data for the work; Involved with drafting the work or reviewing it critically for important intellectual content. **Prashant Banjantri** have done substantial contributions to the acquisition, analysis, or interpretation of data for the work; Involved with drafting the work or reviewing it critically for important

ant intellectual content. All authors actively revised and approved the final version of the manuscript.

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