

## Harnessing Competency Based Medical Education: Early Clinical Exposure by Live Patient Demonstration in Integrated Preclinical Undergraduate Curriculum

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### Abstract

**Introduction:** Early Clinical Exposure, a teaching-learning methodology, promotes exposure of medical students to patients in the first professional year, orienting them towards clinical environment and helping them to correlate their theoretical knowledge with real life situations. **Aim:** The study aimed to generate understanding of a clinical setup early in undergraduate medical training, address student perception by learning temporomandibular joint anatomy and introduce the concept of integration of basic and clinical sciences. **Methodology:** A randomized controlled trial of 100 first year medical students was performed. After a conventional lecture of all students, they were randomly divided into two groups of 50 students each. Control group was taught by the conventional cadaveric demonstrations whereas study group by Early Clinical Exposure using live subject demonstration at the department of Dentistry. Both groups were assessed by a pre- and a post-test in the form of multiple choice questions. Post-interventional feedback (5 point Likert scale) was taken from the study group. The scores were statistically assessed by paired and unpaired Student 't' test and feedback was evaluated by Chi Square Goodness of fit test. **Results:** Post test scores of the study group were significantly greater ( $7.48 \pm 0.83$ ) as compared to the control group ( $5.78 \pm 1.02$ ). In regards to the student perception, the responses favoured an extremely positive impact of Early Clinical Exposure. **Conclusion:** Early Clinical Exposure proves to be an effective integration tool and a successful learning adjunct to enhance the performance of fresh medical entrants thus helping them to become competent practitioners. **Keywords:** Early Clinical Exposure, Integration, Medical Education, Competency Based Medical Education, Temporomandibular Joint, Anatomy, Dentistry

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### Introduction

A revolution in medical education commenced in the 20<sup>th</sup> century by the establishment of the famous "Hopkins Circle." [1, 2] "Flexner Report" by Abraham Flexner laid down the foundation of pedagogic approach for training in medical schools along with two years of exclusive training in basic sciences followed by two years of patient exposure. [1, 2]

Since then the panorama of Indian medical education has been blatantly settled into stillness, thereby pursuing the same curricula as at the time of its inception. The traditional undergraduate medical education system in India focuses primarily on the classroom and laboratory teaching in the first professional year to impart knowledge in the basic sciences. In the conventional setup, students are exposed to clinical subjects only during the second professional year. However, it has been observed that students find it difficult to correlate the concepts learnt in a lecture to actual clinical scenarios during clinical postings, leading to hesitation and difficulty in patient handling. Since the subject of Anatomy forms the

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foundation for training of future doctors, many educators are of the opinion that its knowledge should be acquired in a situation resembling in which it could be applied. [3]Early Clinical Exposure (ECE), a teaching- learning methodology, promotes exposure of medical students to the patients as early as the first year of undergraduation and establishes a higher degree of cognition in professional learning. [4, 5] The modality also inherits the potential to inculcate clinical skills, behavioral attributes and affective components of learning by direct observation. In the pretext of a constructive change and reform, the Medical Council of India (MCI) has already laid the foundation of competency based medical education by introducing a competency based undergraduate curriculum for the Indian Medical Graduate, which was implemented in the sessions commencing from the year “2019”. [6] The reform has certainly emerged as a paradigm shift after two decades and focuses on enhancing integration, clinical competency, flexibility and improvement in the quality of training. One such tool happens to be the introduction of ECE. The selection of Temporomandibular Joint (TMJ) anatomy as the topic of focus in this study, is based upon its complex and enigmatic anatomical structure, its significance and the greater challenges faced by the clinicians in the diagnosis and treatment of its disorders. There is a potential involvement of many conspicuous elements namely structural, functional and psychological; which contribute to the condition. [7, 8]For this reason, the patients often address to consultants of different specialties including Oral and Maxillofacial surgery, Internal Medicine, Orthopedics, Plastic Surgery and Psychiatry; and undergo multiple laboratory and imagistic examinations with no potent diagnosis of the real underlying pathology. [9]At the time of present study, the undergraduate medical curriculum in our institution had been primarily discipline based and barely versed with integration practices. Henceforth, the study primarily aimed to generate understanding of a clinical setup early in undergraduate medical training by introducing the concept of integration of basic (Anatomy) and clinical sciences (Dentistry). We intended to enhance the knowledge of first year medical students regarding TMJ anatomy and its applied aspects so as to promote better understanding regarding a correct diagnosis of its disorders in their future years. The study also aimed to address the student perceptions essentially, in terms of their interest in the subject of Anatomy; the effectiveness of ECE and the role of facilitator in its implementation amongst other relevant components.

## Materials and Method

**Ethical guidelines:** The study was conducted after taking approval from the Institutional Ethical Committee and a written informed consent from the participants and the subject for live case demonstration.

**Study design, setting and duration:** The study was an experimental educational research and was undertaken as a “Randomized Controlled Trial” after prior registration from Clinical Trial Registry, India (CTRI/2019/11/021983). It was conducted at a premium medical college and tertiary health care centre at Jaipur, Rajasthan, India for a duration of two months (November’ 2019-December’ 2019).

**Study population:** The sample population of the study was calculated by convenient sampling method and consisted of 100 first professional year medical students. Voluntary first professional year medical students (18 years and above) who were not previously exposed to any kind of clinical teaching were included in the study. There were no exclusion criteria.

**Methodology followed:** Temporomandibular Joint (TMJ) anatomy including muscles of mastication was taught to all the students by a conventional didactic lecture. A pre-test was administered, using a validated questionnaire consisting of ten Multiple Choice Questions (MCQs) with a total score of ten marks. The questions were based on factual recalls and case-based vignettes pertaining to TMJ, TMJ disorders and muscles of mastication. Thereafter they were divided into control and study groups of 50 students each by random selection. The strategy adopted was “Lottery method”. The roll numbers of the students were written on separate pieces of paper of same size, shape and color. They were folded and mixed up in a container. A blindfold selection was made as the pieces were randomly picked, henceforth eliminating any form of bias. Control group was taught by the conventional teaching method of cadaveric demonstrations at the dissection hall in the Department of Anatomy. On the other hand, the participants of the study group were divided into five batches of ten students each. They were taught by ECE at the clinical outpatient department of Dentistry by live case demonstration on a patient suffering from TMJ disorder (Internal disc derangement) with characteristic clicking sounds on elevation and depression of the lower jaw. Structural and functional anatomy of the TMJ and muscles of mastication were taught with standard jaw movements and palpation techniques. History taking, clinical examination, radiographic interpretation with the help of Orthopantomogram (OPG) and the underlying pathophysiology were discussed. The clicking sounds

pertaining to Internal Disc Derangement were demonstrated by auscultatory method with a stethoscope. The attitude and perception of the students from the study group towards early clinical exposure were assessed by a validated feedback (questionnaire based on a five point Likert scale) immediately after the intervention. The questionnaire comprised of the following eleven questions:

1. Did early clinical exposure (ECE) generate interest in the subject of Anatomy?
2. Did the learner have a better understanding of the topic by this method?
3. Did the learner find a proper integration of knowledge between basic and clinical sciences?
4. Is the method more useful in providing relevant subject material?
5. Did the method ensure proper utilization of clinical material (patient)?
6. Did the learner experience an increase in confidence as a future doctor due to patient correlation?
7. Did this method lead to better retention of topics?
8. Did it generate interest in TMJ and motivate learners to study more on the topic?
9. Did ECE help in lifelong learning of the topics when integrated with applied aspects?
10. Did the learner feel satisfied with the involvement and guidance of teacher in ECE?
11. Would the learner like to learn other subjects and topics with this intervention i.e. ECE?

After 2 days, both groups were tested with the same questionnaire in the form of a post-test comprising of MCQs; the students being completely unaware of the post-test examination. Control group students were also given the same clinical exposure after the completion of the study as no student should be deprived of the benefits of education.

**Data collection and statistical analysis:** The collected data were then saved electronically in a secured folder in the form of Microsoft Excel sheets (Version 2010) with a limited access only to the chief investigator. There was no loss of data in the form of participant dropouts or any other means.

The students' academic performance was assessed by comparing the pre-test and post-test scores by unpaired and paired Student's *t* test. *P* value less than .05 was considered significant for the study. The student feedback responses (based on Five point Likert scale) were assessed by Chi Square Goodness of fit test. The methods used for data presentation are in the form of mean values, standard deviation, percentages and numerals. Microsoft Excel (Microsoft, USA; Version 2010) and Statistical Package for Social Sciences (SPSS) software (International Business Machines (IBM), USA; Version 18) were used as statistical softwares. Figure 1 elicits the flowchart illustrating the performed methodology.

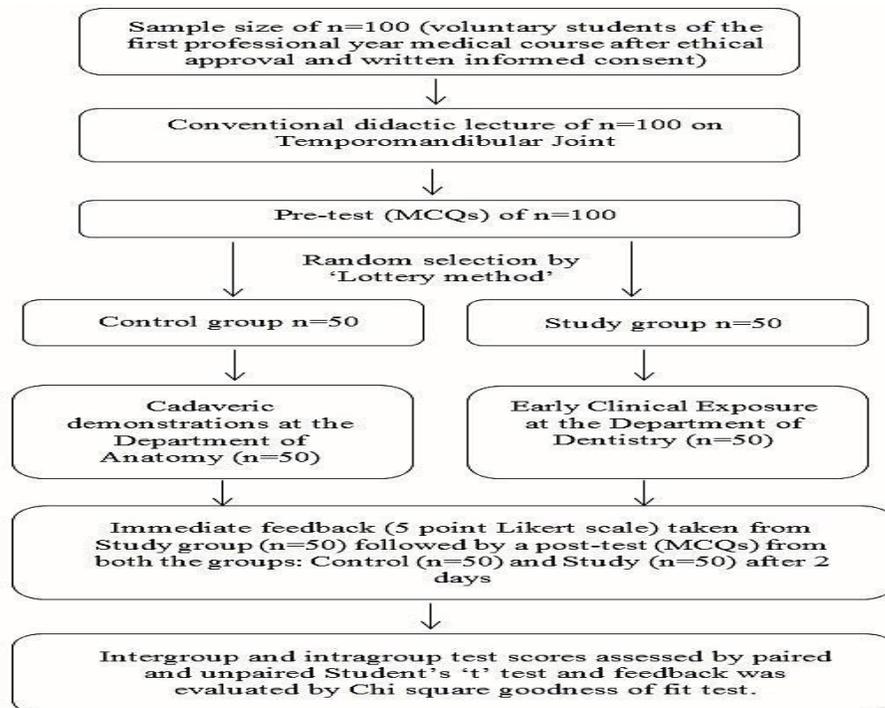


Fig 1: Methodology

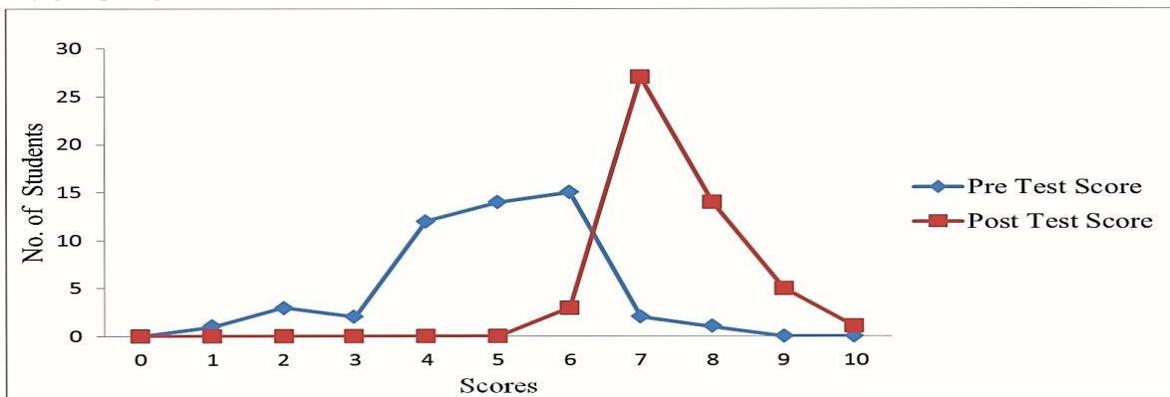
**Results**

The results are expressed in terms of numeric figures depicting obtained marks by the individual groups. Descriptive analysis of the mean pre-test and post-test marks of individual groups with standard deviation are presented in Table 1.

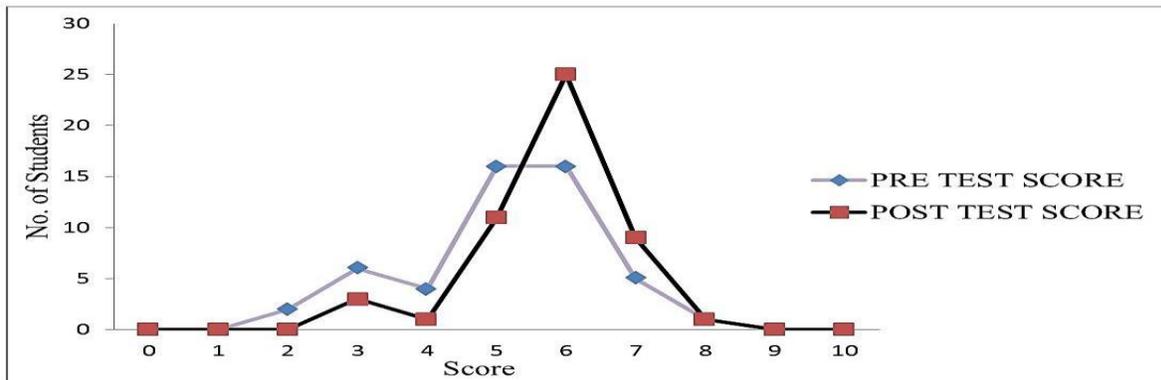
**Table 1: Descriptive analysis of mean pre-test and post-test score of control group and study group**

Variables	Control Group		Study Group	
	Pre- test	Post- test	Pre- test	Post- test
Mean	5.14	5.78	4.86	7.48
Standard Deviation	1.3418	1.0255	1.3713	0.8304

Marks obtained by each individual group in the pre-test and post-tests were statistically significant when compared by paired Student’s t-test. *P* value for Control group and Study group was found to be .000002 and .000000 respectively ( $P \leq .05$ ). Also, the post-test marks were greater in each group but remarkably higher in the study group (Figures 2 & 3).

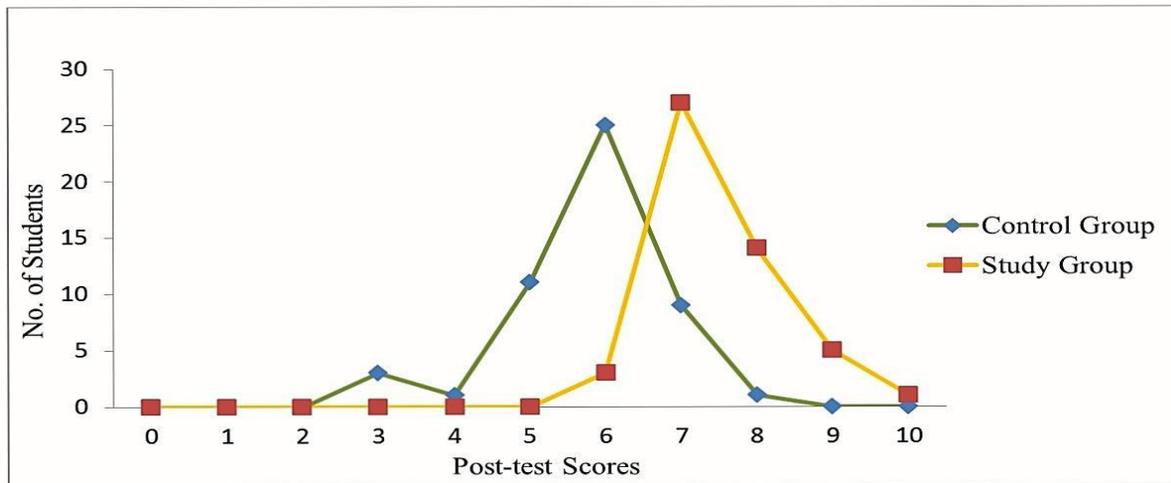


**Fig 2:Score distribution of study group**



**Fig 3: Score distribution of control group**

When comparison was done between the groups by unpaired Student’s t-test, the post-test marks showed significant difference ( $P \leq .05$ ). As evident, the post test scores of the Study group were significantly greater ( $7.48 \pm 0.83$ ) as compared to the Control group ( $5.78 \pm 1.02$ ) thereby indicating that the level of improvement was strikingly higher in the Study group (Figure 4).



**Fig 4: Comparison of post-test scores between study group and control group**

The student perceptions and opinions regarding Early Clinical Exposure, has been depicted in “Frequency Distribution of Student Responses” in Table 2. Majority of the responses favoured an extremely positive impact of ECE. The highest Chi Square values of 84.8 and 82.2 indicated an extremely large number of observed positive responses (than their expected values) suggesting that the participants had the most probability of agreement to the fact that ECE generated interest in the subject of Anatomy and better understanding of the topic respectively. This was followed by an increased interest in TMJ and enhanced motivation to further explore the topic (Chi square value of 71.4). The lowest Chi Square value of 57.6 (ECE’s role in terms of increasing confidence as a future doctor) although indicated fewer agreements as compared to other responses but a substantial large amount of observed value as compared to the expected data suggested an undoubtedly positive feedback. All *P* values were less than .00001 and statistically significant ( $P \leq .05$ ). (Table 2)

**Table 2: Frequency distribution of student responses**

S.No.	Feedback question	Strongly disagree(n)	Disagree(n)	Indifferent(n)	Agree(n)	Strongly agree(n)	Chi Square Value	<i>P</i> value
1.	Early clinical exposure (ECE) has generated interest in the subject of Anatomy.	0	0	0	32	18	84.8	<.00001
2.	I had a better understanding of the topic by this method.	0	0	0	31	19	82.2	<.00001
3.	I found proper integration of knowledge between basic and clinical sciences.	0	4	2	25	19	50.6	<.00001
4.	It is more useful in providing relevant subject material.	0	0	4	22	24	57.6	<.00001
5.	It ensured proper utilization of clinical material (Patient).	0	0	1	25	24	70.2	<.00001

6.	Increased confidence as a future doctor due to patient correlation.	0	0	4	25	21	58.2	<.00001
7.	This method leads to better retention of topics.	0	0	3	25	22	61.8	<.00001
8.	It generated interest in TMJ and motivated me to study more on the topic.	0	0	1	22	27	71.4	<.00001
9.	ECE will help me in lifelong learning of the topics when integrated with applied aspects.	0	0	3	23	24	61.4	<.00001
10.	I am satisfied with the involvement and guidance of teacher in ECE.	0	0	2	23	25	65.8	<.00001
11.	I would like to learn other subjects and topics with this intervention i.e. ECE.	0	0	1	23	26	70.6	<.00001

## Discussion

Can a two-year sabbatical from patient exposure be justified, when the students enter the wards as a novitiate and the patient handling, communication and clinical scenarios are at the most elementary level? What about a concomitant lack of confidence prevalent at a stage when the students have already surpassed important years of medical training? One of the best probable solutions for these pertinent areas of concern, emerge from the very fact that an Early Clinical Exposure (ECE) can not only lay the foundation of a trainee-patient camaraderie but also brings in various benefits including increased interest in the basic sciences, enhanced clinical application of the basic concepts and definitely better confidence levels. Patients being the best source of clinical material can render great clinical knowledge and its correlation at an early stage. Inculcation of the professional attributes of a doctor-patient relationship by observation and elimination of the level of stress a student experiences during a sudden exposure during ward postings are few of the valuable incentives that can be successfully rendered by the modality.

ECE can be implemented at a classroom setting whereby the patient being present in the lecture hall can be discussed both by the pre-clinical and clinical teachers; at a hospital setting whereby the

students are allowed to visit the Out Patient Departments and the wards; or finally at a community setting in a societal and a socio-clinical aspect. Irrespective of the form of implementation, the method provides a “Spiral integrated model”, which is a consistently graduated clinical and preclinical exposure throughout the time a student is in medical college.[1, 2] The present study follows the hospital-based setting as an implementation strategy.

Studies conducted across the globe have certainly authenticated the benefits of ECE in the pre-clinical years of medical training. R D MacLeod et al[10] in New Zealand assessed the student perception of ECE in regards to end of life care. Majorie D Wenrich et al [11] at an American medical school evaluated the student feedback of bed side clinical skill training. Pravinkumar G. Patil et al [12] in their extensive studies in India and Japan and K. Ali et al [13] at United Kingdom conducted comprehensive research on ECE and its impact on preclinical dental students. Similarly, a plethora of Indian studies on subjects such as Physiology, [14, 15, 16, 17] Anatomy, [17, 18, 19] Transfusion Medicine, Radiology, Neurology, Nephrology, Respiratory Medicine and General Surgery [15, 20] have been successfully administered to measure and perceive the effects of ECE in early clinical years. Suresh Chari et al conducted an observational study by exposing first year

medical students to clinical wards. [21] Malcolm D. Mattes et al at West Virginia executed an innovative study of ECE of preclinical students pertaining to clinical oncology. [22] Most of the studies conducted in this context have been qualitative or descriptive in nature based on student feedback after the interventions. There has been uniformity in the positive consensus regarding the concept and its usefulness. The present study too, follows the positive momentum as the students comply with the benefits and the learning experience after they received an early clinical exposure in regards to TMJ anatomy and disorders. Quantitatively, although the conventionally taught control group also demonstrated improvement in their performance, the magnitude was much less as compared to the clinically exposed study group.

Evidently, video-graphic and visual demonstration of clinical facts can help students understand better and retain longer as this media is three dimensional, and stimulates Wernicke's area through auditory as well as visual pathway leading to a better integration of the information. [23] Clinical exposure is more effective in this regard as this allows exposure to actual clinical problems and thus helps students correlate their theoretical knowledge with real life scenarios. The improved performance and post-test scores of the study group certainly indicate an inculcation of higher level of cognition by developing analytical and problem-solving skills by successfully answering questions pertaining to applied aspects of TMJ anatomy and its disorders; further leading to enhanced knowledge and insight in regards to the disease process. The method is undoubtedly cost effective and has proven to be an excellent teaching adjunct for pre-clinical subjects. However, it is not meant to replace large group teaching methods like lectures but perform as a successful supplementary. Special attention should be paid to the elements of time constraint, invested manpower and energy in its implementation. The integrating strategies of different specialities need efficient planning and cooperation with other faculty members. Henceforth, a prior orientation and training of teaching faculties should be considered. In context of the future prospects, Early Clinical Exposure can be assessed prospectively on the same batch of students in regards to their knowledge, clinical and communication skills in upcoming professional years so that a more substantial outcome can be reached. Selected important topics can be chosen for the modality as the elements of time constraint and manpower cannot be overlooked. Implementation strategies while incorporating practical feasibility as per the curriculum is the ultimate pay off.

## Conclusion

In the pretext of competency based medical education, ECE has proved to be an effective integration tool and a successful learning adjunct with large group teaching methods to enhance the performance of fresh medical entrants in a basic science subject like Anatomy. As patient care in Temporomandibular Joint disorders involves multidisciplinary and inter-professional environments, ECE ensures that its anatomy can be better taught, demonstrated and clinically applied thus helping students to become competent physicians. Faculty orientation programmes and proper allocation of time and manpower can lead to a successful implementation of the modality as a part of integrated undergraduate medical curriculum.

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