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Title:

**IMPACT OF EARLY CLINICAL EXPOSURE ON THE LEARNING EXPERIENCE
OF UNDERGRADUATE DENTAL STUDENTS**

K. Ali¹, D Zahra², E McColl³, V Salih⁴, C. Tredwin⁵

¹ Associate Professor / Consultant in Oral Surgery, Peninsula Dental School, Plymouth University

²Senior Psychometrician Plymouth University Peninsula Schools of Medicine and Dentistry,

³Associate Professor, Peninsula Dental School, Plymouth University

⁴Associate Professor, Peninsula Dental School, Plymouth University

⁵Head of Peninsula Dental School, Plymouth University

Correspondence Author: Kamran Ali

Peninsula Dental School
Portland Square
University of Plymouth
Drake Circus
Plymouth
PL4 8AA
E-mail: kamran.ali@plymouth.ac.uk

ABSTRACT

Aims: The aim of this research is to evaluate the impact of early clinical exposure on the learning experiences of undergraduate dental students.

Methods: This study was based on mixed methods. The first phase involved administering a purposely designed questionnaire consisting of 16 items, grouped into three subscales. The second phase of the research was conducted using qualitative semi structured interviews to explore the perceptions and experiences of stakeholders regarding early clinical exposure.

Results: In total 134 undergraduate dental students and 8 clinical supervisors responded to the questionnaire and reported positive perceptions regarding the learning experiences, professional relationship, and learning environment. Qualitative interviews were conducted with 12 participants and early clinical exposure was perceived to be useful in providing a context to theoretical learning and development of interpersonal skills. Curriculum over-load and further need for consolidation were highlighted as the main challenges.

Conclusions: This study provided insights into the clinical training model in an undergraduate dental programme and highlights the benefits and challenges of early clinical exposure in the study population. The study served as a vehicle for engagement with a range of stakeholders using a mixed methods approach to inform further development of the training model.

Key Words: Clinical; Early experience; Dental; Students

INTRODUCTION

Dental students are expected to acquire a high standard of cognitive, psychomotor and affective skills during the undergraduate programme.^{1, 2} Training in dentistry involves students performing irreversible operative procedures on patients under supervision of a qualified dentist. Clearly, due to the high levels of skills needed in operative dentistry, dentistry can be a demanding and often stressful experience for the students.³

Traditionally, dental students learn basic medical and dental sciences during the first two years of undergraduate programmes and clinical training on patients is delivered in the subsequent years. Although early clinical exposure has been reported to be beneficial to medical as well as dental students, there is limited published literature to ascertain if this has been implemented uniformly in undergraduate dental programmes across Europe.

Peninsula Dental School is one of the first schools based in community settings in the United Kingdom.⁴ The students gain clinical exposure to patients after the first 6 months of the course and their clinical exposure increases progressively each year. Knowledge, skills and, to some extent, attitudes are co-constructed at the chair-side between the expert clinical supervisor and the novice student.⁵ Following pre-clinical training assessment in the Simulated Dental Learning Environment (SDLE), students treat patients on clinic under supervision. During the first Year of the BDS programme, students carry out basic treatments on patients including clinical assessment, temporary fillings and non-surgical periodontics. During the second year, clinical procedures carried out by the students include tooth coloured and amalgam fillings, and non surgical tooth extractions. More complex procedures such

as endodontics, surgical extractions and crown and bridge work are reserved for the latter years. Although students report enjoying the early clinical exposure, this training model has not been evaluated systematically with the stakeholders.

The aim of this research is to determine the impact of early clinical exposure on the learning experiences of undergraduate dental students.

METHODS

Ethical approval for this study was obtained from the institution research ethics committee (Reference number 14/15-412). This research project was based on mixed methods. The setting for the study was a dental school in the South West of England. Purposive sampling was used to recruit participants representing a range of stakeholder groups in undergraduate dental education including dental students, dental academics, clinical supervisors and dental nurses.

The first phase of the study involved administering a purposely designed questionnaire consisting of 16 items, grouped into three subscales; Learning Experience (A, 6 items), Relationship with Supervisors (B, 5 items), and Practice Environment (C, 5 items) as shown in the Appendix. All items were responded to using five-point Likert agreement scales scored as -2 (Strongly Disagree), -1 (Disagree), 0 (Unsure), 1 (Agree), 2 (Strongly Agree). The questionnaire was initially piloted with ten participants (five dental students, three dental academics and two dental nurses) to check that all items on the questionnaire were comprehensible, unambiguous and the participants could interpret the scoring categories appropriately. Subsequently, the questionnaire was administered to undergraduate dental students in Year 1, 2, 3 and their clinical supervisors.

The second phase of the research was conducted using one-to-one qualitative semi structured interviews to explore the perceptions and experiences of stakeholders regarding early clinical exposure. The interviews were aimed at gaining a deeper understanding of the strengths and weaknesses of the clinical training model. Recruitment of participants was carried out by e-mail invitations through the Head of the Dental School on a purely voluntary basis. All potential participants for

interviews were provided with a participant information sheet and a consent form along with the contact details of the research team. Participants who were willing to participate in the interviews contacted the dental programme administrator who acted as the gatekeeper. A mutually convenient date, time and location at the university premises were worked out with each participant. Recruitment of the participants was completed prior to analysis of the questionnaire data. The interviews were conducted by three members of the dental academic faculty who were known to all the participants including the students. All interviews were recorded using a digital audio device and transcribed verbatim.

Data Analysis

The questionnaire data was analysed using SPSS 22 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp).

The interview data was analysed thematically using N Vivo 11 (QSR International Pty Ltd, Doncaster, Vic., Australia). The transcripts were anonymised using pseudonyms to protect the identity of the participants. The process of data analysis was started by listening to the audio recordings repeatedly along with reading the transcripts and paper notes and was aimed at situating learning experiences of students within the narratives of stakeholders. Systematic reading through the entire data set, sentence by sentence, was carried out for an initial coding of the data. Repetitive revisiting of the transcripts, audio recordings and the accompanying notes helped to collapse the nodes into broader codes. Further analysis and reflection helped to establish links between nodes, which facilitated development of *tree nodes* from *free nodes* and ultimately helped shape the themes. The *tree nodes* effectively linked coded categories of data and helped map connections within the data. Thematic analysis was used to identify broad areas, which captured the views and experiences of the participants. Segments of verbatim quotes from different participants were incorporated as coded text to provide the contextual material supporting different themes. Initial data analysis was carried out by the principal researcher (correspondence author). The results and interpretations of the data analyses undertaken were discussed with two other members of the research team in a group setting. Minor differences of interpretation emerged which were ironed out by mutual deliberations and discussions.

RESULTS

Questionnaire

Responses were received from 134 undergraduate students: Year 1 ($n=50$), Year 2 ($n=45$), Year 3 ($n=39$), and eight clinical supervisors ($n=8$). The response rate for students was 76.57% and 66.66% for clinical supervisors. The overall internal consistency of the scale was good (Cronbach's Alpha= 0.84) and the three subscales were coherent, with each item measuring a related theme.

In order to make scores between subscales comparable, the mean score for each respondent was calculated. Scores thus provide an indication of the extent to which the individual agrees or disagrees on average across the items comprising the subscale (and total). Descriptive statistics for each subscale by each group are shown in Table 1. Positive scores indicate agreement; negative scores indicate disagreement. It can be seen that the participants across the board reported positive perception across all elements of the scale. However, the lowest scores were reported for subscale B by students in all years, highlighting the need for further improvements in the student-supervisor relationship.

Correlations between subscales and total scores by Group are shown in Table 2. Columns represent Pearson correlation coefficients (r) and p -values (p) for each correlated pair of scores. Prefixes to column headers (Tot, Y1, Y2, Y3, S) represent division by Group (Tot. denotes all Groups collapsed together). All correlations show positive relationships. Overall, subscale-total correlations are statistically significant across groups, but subscale-subscale correlations are strongest for Y1, Y3, and when all groups are treated together. The only two non-significant correlations

involved Y 2 students. There is no definite explanation for this observation and it could possibly be a incidental finding.

Finally, Mean (M), Standard Deviation (SD), and point-biserial correlations (PtB) for each item by Group (Y1/Y2/Y3/Supervisors) were calculated and are depicted in Table 3.

Table 1: Descriptive statistics by group and subscale

Group	Scale	N	Mean	SD	Min	Max
Supervisor	Subscale A	8	1.15	0.64	0.33	2.00
Supervisor	Subscale B	8	1.25	0.35	1.00	1.80
Supervisor	Subscale C	8	1.70	0.35	1.00	2.00
Supervisor	Total	8	1.35	0.39	0.94	1.88
Year 1	Subscale A	50	1.48	0.48	0.17	2.00
Year 1	Subscale B	50	1.18	0.61	-0.20	2.00
Year 1	Subscale C	50	1.30	0.52	0.00	2.00
Year 1	Total	50	1.33	0.45	0.25	2.00
Year 2	Subscale A	45	1.40	0.39	0.50	2.00
Year 2	Subscale B	45	1.12	0.51	0.00	2.00
Year 2	Subscale C	45	1.34	0.42	0.60	2.00
Year 2	Total	45	1.29	0.32	0.56	2.00
Year 3	Subscale A	39	1.38	0.40	0.67	2.00
Year 3	Subscale B	39	1.11	0.45	0.20	2.00
Year 3	Subscale C	39	1.27	0.51	0.40	2.00
Year 3	Total	39	1.26	0.36	0.69	2.00

Table 2: Pearson correlation coefficients between subscale by group

r= Pearson's correlation coefficient; p= p value

Pair	r	p	r	p	r	p	r	p	r	p
	Total	Total	Y 1	Y1	Y2	Y2	Y3	Y3	Supervisor	Supervisor
Total-A	0.79	<0.001	0.87	<0.001	0.67	<0.001	0.79	<0.001	0.93	0.001
Total-B	0.81	<0.001	0.83	<0.001	0.79	<0.001	0.80	<0.001	0.88	0.004
Total-C	0.79	<0.001	0.84	<0.001	0.76	<0.001	0.81	<0.001	0.66	0.074
A-B	0.44	<0.001	0.56	<0.001	0.24	0.120	0.47	0.002	0.75	0.032
A-C	0.43	<0.001	0.67	<0.001	0.26	0.089	0.43	0.007	0.39	0.341
B-C	0.50	<0.001	0.52	<0.001	0.49	0.001	0.48	0.002	0.51	0.201

Table 3: Analysis of individual items by group

M= item mean; SD=item standard deviation; PtB= item-total (point-biserial)

Q	M	SD	PtB									
	Y1	Y1	Y1	Y2	Y2	Y2	Y3	Y3	Y3	Sup	Sup	Sup
Q01	1.76	0.43	0.38	1.62	0.53	0.39	1.49	0.51	0.37	1.38	0.52	0.97
Q02	1.36	0.90	0.62	1.31	0.70	0.14	1.13	0.73	0.29	1.38	0.52	0.97
Q03	1.32	0.71	0.55	1.24	0.86	0.30	1.44	0.50	0.58	1.38	0.52	0.97
Q04	1.76	0.52	0.50	1.71	0.51	0.30	1.64	0.58	0.47	1.50	0.53	0.80
Q05	1.20	0.97	0.67	0.89	0.88	0.27	1.00	1.00	0.35	0.25	1.04	0.68
Q06.	1.46	0.89	0.16	1.62	0.58	0.21	1.59	0.59	0.31	1.00	1.07	0.68
Q07	1.22	0.79	0.65	1.16	0.74	0.51	1.23	0.48	0.61	0.50	0.76	0.43
Q08	1.16	0.96	0.68	1.18	0.65	0.48	1.18	0.51	0.66	1.25	0.46	0.80
Q09	0.88	0.94	0.63	0.91	0.85	0.24	0.92	0.81	0.43	1.38	0.52	0.52
Q10	1.24	0.56	0.26	1.22	0.70	0.43	1.03	0.63	0.43	1.50	0.53	0.24
Q11	1.42	0.61	0.60	1.16	0.77	0.53	1.18	0.68	0.46	1.63	0.52	0.51
Q12	1.12	0.69	0.42	1.42	0.58	0.48	1.28	0.60	0.49	1.75	0.46	0.39
Q13	1.22	0.82	0.50	1.40	0.75	0.13	1.36	0.54	0.51	1.75	0.46	-0.01
Q14	1.56	0.50	0.58	1.51	0.51	0.50	1.33	0.58	0.57	1.75	0.46	0.50
Q15	1.42	0.64	0.60	1.40	0.54	0.32	1.21	0.80	0.55	1.63	0.52	0.60
Q16	1.18	0.90	0.66	0.96	0.85	0.54	1.15	0.78	0.56	1.63	0.52	0.60

correlation within group; Sup= Supervisor

Qualitative Interviews

Twelve participants were interviewed (4 Dental Students; 5 Clinical Supervisors; and 3 Dental Nurses). Analysis of the data allowed articulation of a number of themes highlighting the strengths and weaknesses of the clinical training model.

Overall participants shared positive perceptions regarding the training model and considered it to be very useful to enhance students' learning experience.

"Our model works tremendously well for our students. I think it is the best that it could be for the students and is pitched at the right level because they need to become familiar with the clinic". Clinical Supervisor 4

The key themes along with verbatim quotes from the participants are discussed below.

- *Development of interpersonal skills*

One of the main advantages of early clinical exposure perceived by participants across the board was development of interpersonal communication skills with patients and members of the clinical dental team.

"It is great for the students coming onto clinic so early so they are familiar with clinic and interacting with patients a lot earlier so they are not so nervous later because they see people for assessment before their treatment". Dental Nurse 2

"The biggest advantage is learning to communicate with patients. They also get exposed to hygienists and they can see how the team are communicating with each other". Clinical Supervisor 2

- *Context to theoretical learning*

Participants considered early clinical exposure to be very valuable in providing a context to theoretical learning. Interaction with patients provides valuable opportunities to put theory into practice from an early stage in the undergraduate programme, allowing students to understand how knowledge gained in the plenaries and life sciences sessions relates to their future clinical practise.

“The theory made sense in my head, but then exploring examinations in clinic it was like everything you had learnt put into practice” Dental Student 1

“It helps them contextualise it and see how students always enjoy seeing why they are doing something. They can see the bigger picture and it impacts on their learning”. Clinical Supervisor 4

- *Patient safety*

The participants felt that the students were well-trained in simulated dental environment and despite the students being inexperienced, there were no concerns regarding patient safety

“But like I say, for me personally, I don’t want to hurt anyone and there is always the potential that something could happen. But the support network is there so, touch wood, these things are not going to happen”. Dental Student 2

“They are well enough supervised. They may be doing basic procedure but I think there wouldn’t be any patient safety concerns”. Clinical Supervisor 2

The participants also recommended further improvements in the training model to enhance the students' learning experiences.

- *Curriculum overload*

Curriculum-overload in Year 1 emerged as a strong theme and participants felt that the Year 1 curriculum was quite intense and demanding for the students.

"They have to learn all the anatomy, physiology, biochemistry, histology all the rest of it and the life sciences, and they are in the simulated dental learning environment!"

Clinical Supervisor 1

"When we first started clinic I was running tight, like in terms of appointments and work-load, but then obviously as I got on, the weeks went by, I got better and better".

Dental Student 4

- *Consolidation Opportunities*

The participants expressed the need for additional opportunities to consolidate basic clinical and affective skills during the early years of the programme.

"I think they would feel more confident if they were perhaps examining each other a little bit more before they see the patients". Clinical Supervisor 3

"Although we learn charting in simulated environment, we didn't revisit charting before starting in clinic to refresh our memory". Dental Student 2

DISCUSSION

Clinical training is at the heart of the learning experience in dental education and it not only equips the dental students with essential clinical skills but also ensures that they develop and demonstrate their communication skills and professionalism in clinical settings. The training model at our school is built on the premise that early interaction with patients and real life clinical situations provides an appropriate context to develop, assimilate, and apply learning achieved in academic settings^{5, 6}.

Clinical exposure should not be solely viewed through the lens of acquisition of clinical skills. Clinical competence of students only represents a point on a continuum and needs several years of consolidation in clinical practice settings.^{7, 8} Furthermore, competence in clinical practice is dependent on a habit of lifelong learning⁹ The results of our study show that the early clinical exposure has a positive impact in providing a context to students' theoretical learning, and improves their understanding regarding the application of knowledge in clinical practice. Providing clinical exposure in the initial years of medical curricula has also shown to enhance students' understanding of their future role.¹⁰⁻¹²

The results of our study are in accord with those on medical students. Clinical exposure helps students develop their interpersonal and team-working skills which are essential to function within the multidisciplinary teams which characterise the modern healthcare environment.¹³ Moreover, early clinical exposure may help students to develop their clinical skills and an understanding of their future lifestyle as well as a broad exposure with regards to their future career options.¹⁴

Although no concerns were raised regarding treatment of patients by early year students, ensuring patient safety is of fundamental importance in all clinical

disciplines and is the main source of public concern.¹⁵ Dentistry routinely involves invasive operative procedures and poses a significant risk of irreversible harm to patients.¹⁶ Our students receive rigorous training in a simulated dental learning environment and are authorised to carry out only those clinical procedures for which they have been assessed summatively. Moreover, the students are supervised closely when performing treatment on patients and structured remediation processes are in place for underperforming students.

This study was based on a mixed methods approach, combining qualitative and quantitative methods to capitalise on their respective strengths and avoid inherent weaknesses.¹⁷ The interviews were conducted by dental academics with an “insider” role. The impact of “insider” role in qualitative research has generated intense debate.¹⁸ Nevertheless, an insider researcher is legitimate and may in fact offer several advantages to the quality of the study including familiarity with the research topic and better understanding of the participants to produce richer data.¹⁹

The participants included key stakeholders involved in dental education. However, the data reported is from a single undergraduate dental programme. The inferences may only be applicable to the study population and there is a potential risk of bias. It would be helpful to explore the perceptions and experiences of stakeholders regarding early clinical exposure at other dental schools in Europe and beyond to determine if the findings can be generalised to other programmes. Moreover, it is recognised that there are alternate models of undergraduate dental education which may also serve to enhance communication skills and put theoretical knowledge into context. Further research, preferably using multi-centre studies, is required to

compare different education models to help the dental educators to develop their clinical training models. Further improvements in training models may enhance the ability of dental graduates to meet the growing challenges of clinical dental practice.

CONCLUSION

This study provided insights into the clinical training model in an undergraduate dental programme and highlights the benefits and challenges of early clinical exposure. The data indicated that, within this study population, early clinical exposure had a positive impact on the learning experience of dental students and offered multiple benefits. Nevertheless, adequate pre-clinical training in simulated settings is essential for patient safety and further improvements in the clinical training model are required. The study served as a vehicle for engagement with a range of stakeholders using a mixed methods approach to inform future development of the training model. Further research is required to determine if these findings can be generalised to the learning environments in other dental schools across Europe and beyond.

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Disclosure

None of the authors have any conflict of interest

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QUESTIONNAIRE ON THE PERCEPTIONS REGARDING CLINICAL EXPOSURE IN BDS YEAR 1

**Reverse scored*

Subscale A: LEARNING EXPERIENCE
1. Clinical training during year 1 has been good for my learning
2. My training has helped me consolidate my skills learnt in simulated environment
3. My training has improved my understanding of topics covered in my self-directed learning
4. Early clinical exposure has enhanced my motivation to practice dentistry
5. I received adequate pre-clinical training to provide appropriate treatment to patients
6. Clinical training in year 1 is too early and can be delayed until the latter years*
Subscale B: RELATIONSHIP WITH SUPERVISORS
7. My supervisors devote adequate time to address my learning needs
8. My supervisors attach appropriate importance to my learning needs
9. My supervisors are too busy with other matters to be able to devote his/her time to my learning*
10. I receive adequate feedback from my supervisors to support my learning
11. I get adequate opportunities to ask questions from my supervisors when providing clinical treatment
Subscale C: PRACTICE ENVIRONMENT
12. Patient-care on clinics is individualised for each patient
13. Patient's best interests are prioritised during clinical treatment with students
14. There is a good team-working ethos in the clinical environment
15. The Dental Education Facility is a happy place for all students, staff members and patients
16. I am treated as an individual at the Dental Education Facility rather than as "another student".