Introduction of Laboratory Endodontics: Evaluating the Perception of Undergraduate Clinical Dental Students at A Nigerian University

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ABSTRACT

Background: Root canal treatment (RCT) forms a part of the requirements for the graduation of dental students. The students are expected to perform the procedure during their clinical training. However, most students are presented to the clinic without formal laboratory practical training.

Aim: To introduce laboratory endodontic training, and evaluate the perception of Nigerian undergraduate clinical dental students about the program.

Methodology: A two-day hands-on training on RCT was done for a set of final-year dental students in the operative technique laboratory of the Department of Restorative Dentistry of the Institution. The training included taking the participants through all the steps involved in RCT. The participants performed all the stages of RCT on extracted lower molar teeth mounted on a phantom head with paraffin wax. Each student performed the two methods of biomechanical preparation taught: manual and rotary instrumentation, and later evaluated the training in terms of confidence and preparation for clinical exposure.

Result: Twenty-one (53.9%) students within the age range of 23 to 30 years and a mean age of 25.4±1.7years completed the program. The majority, (81%) of the participants claimed the hands-on demonstration was very helpful in performing the procedure, and all submitted it will help their confidence during clinical exposure to RCT. The participants further suggested the incorporation of the training into the regular school program.

Conclusion: The laboratory endodontic hands-on training was accepted by all the participants, and it was opined that it will boost their confidence in performing the procedure in the clinic.

INTRODUCTION

Endodontics is a major part of the curriculum for dental training, and root canal treatment (RCT), which is a main scope of endodontics is a core area of dentistry that is saddled with appropriate management of pain from pulpal disease and the sequelae in order to adequately conserve the tooth for the function that it serves[1]. The teaching of endodontics is challenging and requires the trainer to deliver the essential knowledge and skills[2]. Besides, many studies[3,4] have reported students having low confidence, low competence, and also anxiety towards the procedure. Furthermore, a study among a group of dental students in New Zealand reported that the students viewed endodontics as a difficult course compared to other branches of dentistry and they found it hard to perform endodontic procedures, especially on molars,[5] thus, resulting in inadequate root fillings and procedural errors[6]. Gbadebo and Sulaiman[7] also observed a low confidence level among the undergraduate clinical dental students, in carrying out RCT and managing complications arising from the procedure especially if performed on molar teeth. Similarly, many general practitioners also find root canal treatment challenging due to its complexity and the challenges involved in the stages of the procedure, which are experienced during both undergraduate and postgraduate training levels[8,9]. Therefore, there is a need for trainers in the field of endodontics to look for methods of making endodontic training and practice easier for both undergraduate and postgraduate students.

According to a report by Moor et al,[10] as part of requirement for graduation, dental students are expected to perform the procedure with some degree of confidence and competence before graduation. Al Raisi et al,[11] in a recent publication stated that many schools align with the recommendation of the European Society of Endodontics (ESE) guidelines.

Pre-clinical practical exposure involves the use of a simulator or extracted teeth to introduce and train the students, and it is aimed at providing a bedrock for effective patient care[12]. It achieves exposure and familiarization with tooth anatomy, as well as increases the confidence of students prior to their clinical exposure. Furthermore, Al Raisi et al,[11] reported that all the schools that participated in their survey had pre-clinical training for students prior to clinical exposure. However, in Nigeria, while the dental curriculum emphasizes the need for clinical exposure in endodontics, pre-clinical laboratory training which is essential to endodontic training is obviously missing from the students' curriculum[13].

Prior to this time, dental students at the study center, a foremost University in the South-west of Nigeria were not formally trained on RCT as a cohort in the laboratory, even though they were given the opportunity as individuals at different times during their clinical rotations to perform certain stages of the procedure on extracted teeth before patients' management.

Therefore, this study set out to introduce laboratory training formally to final-year dental students at the study center and assess their evaluation of the program. This may serve as a step to the proposal for inclusion of the pre-clinical practical training into the dental school program.

MATERIALS AND METHODS

This was a cross-sectional observational study that involved a 2-day hands-on training for the final year dental students that consented to participate in the voluntary training program. Ethical approval was given by the ethical review board of the training Institution. The training program which invited all 39 final-year students (who had already completed their didactic lectures on stages involved in endodontics/root canal therapy) took place at the Operative technique laboratory of the

Restorative Department of the Faculty of Dentistry, of the training institution. The trainers were the academic staff of the same department who have been involved in the teaching of endodontics in the faculty. Hands-on training of all the stages of root canal treatment was done for 2 hours on a 2-day basis. This training included rubber dam application, access cavity preparation, working length determination using an apex locator, biomechanical preparation, and obturation. Two methods of biomechanical preparation were taught: manual/hand instrumentation and rotary instrumentation. The step-back technique of manual instrumentation was employed while the cold lateral compaction technique was used for obturation. Thereafter, the participants performed each stage of the RCT on extracted lower molar mounted on a phantom head with paraffin wax. The first day of the training had 30 participants in attendance. All the stages of RCT were taught on the first day with an emphasis on manual biomechanical instrumentations. On the second day of training, the main focus was on the rotary instrumentation of the root canal along the other stages of RCT. This second day was attended by only 25 participants. Data was collected after the hands-on training using a self-administered questionnaire. The questions included the participants' age, gender, opinion on the program, the possible effect of the training program on their confidence in performing RCT in the clinic, and possible suggestions for improvement of the training program. The effect of the training on their hands-on performance was assessed with a 4-point Likert scale (very helpful, moderately helpful, helpful, and not helpful). Those that participated in the two sessions of the training were included in the final analysis.

The data collected was entered, cleaned, and analyzed using Statistical Package for Social Sciences (SPSS) (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.). Descriptive analysis was done using frequency and presented in tables and charts. The association between categorical variables was tested using Chi-square. The level of significance was placed at $p \leq 0.05$.

RESULTS

Twenty-one (53.9%) final-year clinical students out of 39 completed the 2-day training program. The participants were within the age range of 23-30 years, with a mean age of 25.5 ±1.7(SD) years and there were 10 males and 11 females. A greater proportion of participants (13; 61.9%) were less than 25years, and the majority (20;95.2%) were single (Table 1).

Table 1: Socio-demographic characteristics of the study participants

Variable	(N=21) N (%)
Age groups (years)	
<25	13 (61.9)
26-30	8 (38.1)
Mean age (mean ± SD)	25.5 ± 1.7
Gender	
Male	10 (47.6)
Female	11 (52.4)
Marital Status	
Single	20 (95.2)
Married	1 (4.8)
Tribe	
Yoruba	18 (85.7)
Igbo	3 (14.3)
Religion	
Christianity	15 (71.4)
Islam	6 (28.6)

The majority (81%) of the participants claimed the hands-on demonstration was very helpful in performing the procedure (Figure 1).

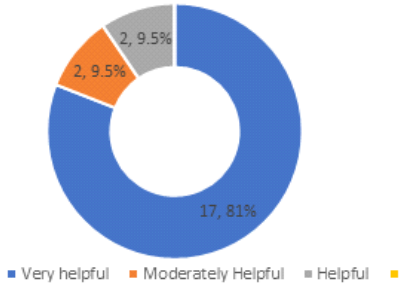

Figure 1: Perceived effect of the laboratory demonstration on participants' performance

The participants (4; 19%) that said the program was moderately helpful or just helpful claimed they had challenges with access cavity preparation and obturation parts of the procedure. The performance, however, was not affected by age or gender (fishers exact- 3.638, p=0.0.255; 1.890, p=0.724 respectively) (Table 2).

Table 2: Students' Perception of Training on Performance

Variable	Very Helpful	Moderately helpful	Helpful	Not helpful	X^2 test	p-value
Age Group						
<25	11	2	0	0		
26-30	6	0	2	0	3.638*	0.255
Gender						
Male	9	0	1	0		
Female	8	2	1	0	1.890*	0.724

**fishers exact test*

Meanwhile, all (100%) submitted that the training will help their confidence when they are exposed clinically to root canal therapy procedures. Furthermore, while accepting the laboratory training, the participants gave various suggestions among which is to make it a part of the student's training curriculum (Table 3).

Table 3: Participants' suggestions for improvement of laboratory endodontic training

Suggestions by Participants	N =21	%
Students should be exposed to laboratory training before clinical exposure and should be incorporated into school programs.	9	42.9
The training session should be repeated as many times as possible	4	19.1
More time is required for the training schedule	3	14.3
Training adequate with no new suggestions.	5	23.8

DISCUSSION

As part of the requirements for graduation, dental students are expected to perform endodontic procedures with some degree of confidence and competence before graduation. However, the students are presented to the clinic without formal practical training on the protocol of the procedure at the study center. This study, therefore, was set to introduce laboratory endodontics to the students and assess their perception of the program.

The 2-day hands-on training attended by the final year clinical students showed how enthusiastic some of them were about being trained in the laboratory before their clinical exposure. However, 21 out of the 39 (53.9%) students invited participated fully. This result agrees with the experience of Barakat et al,[14] where only 23 out of 46 registered students participated in an elective endodontic pre-clinical practical training. The seemingly low number of participants in our study may also be because it was not made compulsory for the students even after all were invited to participate. However, further encouragement for participation may be gained if such training is included in the curriculum. Moreover, once the students are aware that this will be part of their formative assessment, it is believed that they will take it more seriously.

In addition, medical and dental education/training presently favours the use of simulation to introduce students to different medical conditions and management before actual exposure to live patients[14-16]. At the study center, there is established exposure to laboratory operative techniques such as cavity preparation for direct restorations and advanced extra coronal restorations like crowns[17], but there is no such facility/program for laboratory endodontic training. Thus, the acceptance of the program by more than half of the clinical students was not a surprise. The use of simulation has the advantage of allowing repeatable and reversible training of clinical skills while giving students a more flexible training experience before clinical exposure. It also provides a safe, repeatable environment for learning and prevents exposure of dental patients to risks by inexperienced students.

Furthermore, to the best of the knowledge of the authors of the present study, there is no simulator for endodontics training in dental schools in Nigeria. Thus, we made use of extracted natural teeth, in accordance with the study by Barakat et al[14]. Also, extracted teeth when compared with artificial teeth in pre-clinical training showed no difference in the clinical performance of students[18], and have been more used for pre-clinical training in endodontics[19]. More importantly, the present study was based on training that exposed the students to both manual and rotary endodontic biomechanical preparations. This agrees with the previous studies that have shown the need to train students on rotary endodontics[20,21]. Rotary endodontics is the recent advancement in biomechanical preparation of the root canal that has been adopted in developed countries and added to dental training[20,21]. At the study center, clinical students' endodontic exposure is basically for manual biomechanical preparation of the root canal. It is, however, necessary to expose students to advancements in different fields of dentistry, which include endodontics. It is also important for the trainers; the university faculties, to impart knowledge of new techniques and materials, and plan educational approaches that will enhance undergraduate endodontic teaching significantly. This is to further prepare the undergraduate students for the future tasks ahead.

In addition, introducing the rotary technique in the biomechanical preparation of the canal in this training conforms to the recommendation of ESE for trainers to give continuous training and exposure to advances in the field of endodontics[10]. The

rotary biomechanical preparation of the root canal has the advantage of the ease of protocol and use of flexible files[21], and it is being incorporated into endodontic training and practice in developed countries[20,21].

Interestingly, all the participants in the laboratory training showed that the training will boost their confidence in their clinical exposure. This positive assertion agrees with a study by Murray et al,[5] that reported that students felt increased use of extracted natural teeth would be beneficial in their practice. Our students were, therefore, encouraged to practice with more extracted teeth of different tooth types, especially the posterior teeth, in order to get familiarized with various root canal morphologies. This is imperative since the confidence and competence of clinical skills can be dependent on the number of cases treated and the frequency of exposure. Moreso, pre-clinical exposure was seen to reduce clinical procedural errors significantly when a comparison was made between those that participated and those that did not participate in elective pre-clinical training in endodontics[14].

In addition, the suggestions given by 42.9% of the participants focused more on incorporating laboratory endodontic training into the regular school program. This agrees with what obtains in dental schools in developed countries where students are introduced to pre-clinical laboratory training before exposure to patients[14,18,20]. Therefore, it is necessary to pay attention to pre-clinical endodontic training as students have attributed great importance to pre-clinical training in helping them acquire the necessary skills in root canal treatment[22].

This study involved only the final-year students at a single academic dental training school in Nigeria because endodontic training is only introduced at the final year level according to the curriculum being used currently[13]. However, the sample size, single-center, and the fact that the stages of endodontic procedure taught were not assessed separately constitute the limitation. However, the study is the first to be conducted in Nigeria on laboratory endodontic training. This constitutes the strength of the study and informs the need to include this training in the dental curriculum as it may apply in other developed countries. In addition, the use of simulation for endodontic training should be considered and made available to improve students' training as they are being prepared for the future tasks ahead.

CONCLUSION

The laboratory endodontic hands-on training was accepted by all the participants, and it was opined that it will boost their confidence in performing the endodontic treatment on live patients.

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