

Perception and confidence levels among dental students and interns in performing various endodontic procedures.

Niveles de percepción y confianza entre estudiantes de odontología y pasantes en la realización de diversos procedimientos de endodoncia.

Ahmed A. Madfa,^{1,2}
Elham M. Senan.¹

Affiliations: ¹Restorative and Prosthodontics department, college of dentistry, University of Science and Technology, Yemen. ²Department of conservative dentistry, Faculty of dentistry, Thamar University, Yemen.

Corresponding author: Ahmed A. Madfa. Dept. of Conservative Dentistry, Faculty of Dentistry, Thamar University, Dhamar, Yemen. Phone: (00967)6501278 - 6501278. E-mail: ahmed_um_2011@yahoo.com

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Abstract: Aim: The present study aimed to collect information from senior students and new interns enrolled at the College of Dentistry, University of Science and Technology (UST), regarding their confidence levels in performing endodontic treatments. Materials and Methods: Anonymous surveys were distributed to 40 senior students and 37 new interns at UST, in Sana'a, Yemen. They were asked to indicate their self-confidence level using a Likert scoring system ranging from 1 and 5. Mann-Whitney U test and chi-squared test were used to determine statistical significance between the studied groups. Results: 37.5% of students and 35.1% of interns rated endodontic practice as difficult. Only 55% of students found that the number of treated cases were satisfactory, similar to that reported by interns (56.8%). There were no statistically significant differences between both groups regarding self-confidence levels for most endodontic procedures ($p < 0.05$). Placing of a rubber dam, followed by managing inter-appointment flare-ups were procedures in which both groups reported the lowest confidence. On the other hand, both groups felt the lowest confidence in the treatment of maxillary followed by mandibular molars. Statistically significant differences were reported between the two groups for performing root canal treatments (RCT) ($p < 0.05$). Self-confidence levels on the management of most different indications showed no statistically significant differences between both groups ($p > 0.05$) with exception to the management of irreversible pulpitis, necrotic pulp, asymptomatic apical periodontitis, chronic abscess, and traumatic cases, in which significant differences were noticed ($p < 0.05$). Immature apices, root resorption, endodontic-periodontal (EP) lesions, trauma, symptomatic apical periodontitis and acute abscess were ranked as the cases in which both groups reported the lowest confidence. Canal blockage and ledge formation were the main mishaps encountered during practice among students and interns. Conclusion: Students and interns displayed neutral confidence in performing endodontic treatments.

Keywords: Education; endodontics; students, medical; self-assessment; dental internship.

Resumen: Objetivo: El presente estudio tuvo como objetivo recopilar información de estudiantes de último año y nuevos pasantes inscritos en la Facultad de Odontología, Universidad de Ciencia y Tecnología (UST), con respecto a sus niveles de confianza en la realización de tratamientos de endodoncia. Materiales y métodos: se distribuyeron encuestas anónimas a 40 estudiantes de último año y 37 nuevos pasantes en UST, en Sana'a, Yemen. Se les pidió que indicaran su nivel de confianza en sí mismos utilizando un sistema de puntuación Likert que oscilaba entre 1 y 5. Se utilizaron la prueba U de Mann-Whitney y la prueba de ji al cuadrado para determinar la significación estadística entre los grupos estudiados. Resultados: el 37.5% de los estudiantes y el 35.1% de los pasantes calificaron la práctica de endodoncia como difícil. Solo el 55% de los estudiantes encontró que el número de casos tratados fue satisfactorio, similar al reportado por los pasantes (56.8%). No hubo diferencias estadísticamente significativas entre ambos grupos con respecto a los niveles de autoconfianza para la mayoría de los procedimientos de endodoncia ($p < 0.05$). La colocación de una presa de goma, seguida de la gestión de brotes entre citas, fueron procedimientos en los que ambos grupos informaron la menor confianza. Por otro lado, ambos grupos sintieron la menor confianza en el tratamiento del maxilar seguido de los molares mandibulares. Se informaron

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diferencias estadísticamente significativas entre los dos grupos para realizar tratamientos de conducto radicular (ECA) ($p < 0.05$). Los niveles de autoconfianza en el manejo de la mayoría de las indicaciones diferentes no mostraron diferencias estadísticamente significativas entre ambos grupos ($p > 0.05$) con excepción del manejo de pulpitis irreversible, pulpa necrótica, periodontitis apical asintomática, absceso crónico y casos traumáticos, en los cuales se notaron diferencias ($p < 0.05$). Los ápices inmaduros, la reabsorción radicular, las lesiones endodóncicas-periodontales

(EP), los traumatismos, la periodontitis apical sintomática y el absceso agudo se clasificaron como los casos en que ambos grupos informaron la menor confianza. El bloqueo del canal y la formación de repisas fueron los principales percances encontrados durante la práctica entre estudiantes y pasantes. Conclusión: los estudiantes y los pasantes mostraron una confianza neutral en la realización de tratamientos de endodoncia.

Palabras Clave: Educación; endodoncia estudiantes de medicina; auto evaluación; pasantía dental.

INTRODUCTION.

Dental students generally believe that dentistry is one of the most difficult programs, which warrants altruism and financial resources. In addition, it includes stressful factors such as frequent examinations, maintenance of a sound patient-student relationship and successful clinical application of theoretical knowledge. Therefore, their perspectives on the educational experiences are an essential component of curriculum planning, which can direct program changes that enhance the learning process.¹⁻³

Endodontic treatment could be considered one of the most difficult dental procedures within the field of dentistry for undergraduate dental students and for general practitioners as well. This difficulty is thought to be due to its expansion in recent years in terms of clinical managements of pulp and periapical diseases as well as the complex anatomical diversity and the huge number of currently available instruments, materials and techniques used during the treatment, which along with a lack of self-confidence tends to make several students feel inadequately prepared to deal with endodontic treatment procedures.⁴

Confidence levels in performing various dental procedures independently are expressed by new graduates at the completion of house job. This can be a measure to assess their capability to provide comprehensive and quality dental health services in the future when they will start working as independent dental practitioners.^{5,6} Gaining skills and subsequently confidence plays an important role in controlling dentists' stress during dental treatments. On the other hand, dentists who have less work experience and training express higher levels of stress while treating patients.⁷ It is postulated that this may be due to a number of reasons including the

inherent difficulty of the technical procedures, a lack of understanding of the principles and aims of treatment, poor remuneration for the time required to complete such procedures, and inadequate teaching at undergraduate level.⁷ For students to reach such level of skill, they must be exposed to a sufficient number of endodontic cases of variable difficulty. However, different dental schools have varying prerequisites for graduation in each dental discipline, and endodontics is no exception. The number of endodontic treatments a student is obliged to complete to be eligible for graduation differs from school to school and various factors such as the proportion of patients available to the number of enrolled clinical students per dental school may have an impact on this difference.⁸

The aim of teaching the field of endodontics for undergraduate students is to produce an experienced dentist who has gained confidence in performing endodontic therapy. Some studies have found that general practitioners achieved a high degree of confidence in performing root canal procedures.^{9,10} On the other hand, other studies have shown a high frequency of poorly executed root canal treatments with periradicular disease apparently going undetected and untreated.¹¹⁻¹³

In general, it is important to assess the self-confidence levels of senior dental students regarding endodontic treatment procedures.⁸ However, there is limited information regarding the way students perceive endodontics and their level of self-confidence about various aspects of endodontic treatment with respect to their future practice. Until now, no study in Yemen has been conducted to determine the self-confidence levels regarding various aspects of root canal treatment. Therefore, the present study aimed to collect information from final year dental students and new interns enrolled at the College of Dentistry, University of Science and

Technology (UST) in relation to their self-assessed confidence levels in performing various procedures of endodontic treatment.

MATERIALS AND METHODS.

Study Design

This cross-sectional study was conducted at the College of Dentistry, UST, in Sana'a, Yemen.

Bioethical Considerations

The scientific committee of the College of Dentistry at UST approved this study and participants' anonymity was strictly respected. Participants had the freewill to participate in the survey and written consent was obtained. Data were kept confidential and were used only for the purpose of this study.

Study Population

This study was conducted during the last week of the academic year on July 2017 through a self-administered questionnaire among 40 final year dental students and 37 new interns attending the clinics of the College of Dentistry at UST, Sana'a, Yemen. This college is the oldest in Yemen, and is well organized and equipped. Therefore, the dental services offered in dental polyclinics attract thousands of patients who can get access to this free dental service. This dental service is provided by undergraduate students, interns and postgraduate students supervised by teaching staff. The patients came from Sana'a city and its surroundings. This city is the largest in the Republic of Yemen, with a population of about three million people. Moreover, the majority of the population is migrants from all governorates of the country.

Prior to the study, participants were informed that they were not held obliged to complete and return the forms and completion of the survey would have no influence on their overall academic grading or performance.

The participants were asked to score the number of endodontic procedures with different diagnosis, different steps of endodontic treatment as well as types of teeth according to their self-confidence levels.

The participants used a five-point Likert scoring system to indicate their level of confidence as follows:

- 1=Very little confidence,
- 2=Little confidence,

- 3=Neutral,
- 4=Confident, and
- 5=Very confident.

During the survey, the participants were also asked about their opinion regarding whether this required number of endodontic cases was satisfactory or not. They were also asked about their future endodontic practice while working independently, whether they wish to perform all endodontic procedures by themselves or they would choose to refer the cases for a specialist whenever they felt necessary. They were also asked about their perception of endodontics in terms of difficulty and whether they would choose endodontics as a line of specialty or not. They were also asked to report the most common mishaps they encountered during their practice. The form filled by the participants in this study is shown in Figure 1.

Statistical Analysis

Data analysis was performed using SPSS 21.0 for Windows (SPSS Inc., Chicago, IL, USA), using descriptive statistical methods. Mann-Whitney U test and chi-squared test were used to determine statistical significance between final year dental students and new interns. The significance level was set at 5%.

RESULTS.

The response rate of the survey was 100%. Among the 77 participants who were handed the survey, 40 (51.9%) were final year undergraduate students while 37 (48.1%) were interns, 37.5% of students and 35.1% of interns rated endodontic practice as difficult.

Generally, self confidence levels for performing various endodontic procedures for final year students were higher compared to those of new interns (Table 1).

Statistically significant differences were found between both groups for most endodontic procedures ($p < 0.05$) with exception of history taking, local anaesthesia demonstration, rubber dam placement, working length determination, management of inter-appointment flare-ups; in which a not significant difference was shown between students and interns ($p > 0.05$). The results revealed that rubber-dam application was the area where both students and interns felt the lowest confidence followed by management of inter-appointment flare-ups.

Table 1. Average self confidence scoring regarding various endodontic procedures among students and interns.

Procedure	Study level	Average ±SD	Minimum	Maximum
History taking	Final year	3.35±1.00	2	5
	Interns	3.27±1.12	1	5
Diagnosis and treatment planning	Final year	3.50±0.96*	2	5
	Interns	2.97±0.83	1	4
Radiograph taking	Final year	3.83±1.24**	1	5
	Interns	3.11±1.10	1	5
Injecting local anesthesia	Final year	3.98±0.86	2	5
	Interns	3.62±0.98	1	5
Endodontic cavity preparation	Final year	3.88±0.88**	2	5
	Interns	3.27±1.07	1	5
Rubber dam placement	Final year	2.88±1.14	1	5
	Interns	2.62±1.30	1	5
Measuring working length by radiograph	Final year	3.33±0.97	1	5
	Interns	3.16±1.01	1	5
Root canal shaping by hand files	Final year	3.65±1.00*	1	5
	Interns	3.24±0.86	1	5
Root canal irrigation	Final year	4.00±1.04**	2	5
	Interns	3.22±0.92	1	5
Root canal obturation	Final year	3.73±0.96**	2	5
	Interns	3.00±0.91	1	5
Management of inter-appointment flare-ups	Final year	3.23±1.12	1	5
	Interns	2.92±0.80	1	5
Restoration	Final year	3.83±0.96*	2	5
	Interns	3.27±1.10	1	5

(*) Mann-Whitney U test $p < 0.05$. (**) Mann-Whitney U test, $p < 0.01$.

Table 2. Average self confidence scorings for performing endodontic treatment in different teeth among students and new interns .

Procedure	Study level	Average±SD	Minimum	Maximum
Maxillary anterior teeth	Final year	4.13±1.07*	1	5
	Interns	3.49±1.26	1	5
Maxillary premolars	Final year	3.88±1.02*	1	5
	Interns	3.38±1.14	1	5
Maxillary molars	Final year	3.23±1.05*	1	5
	Interns	2.62±1.04	1	5
Mandibular anterior teeth	Final year	4.03±1.19*	1	5
	Interns	3.38±1.26	1	5
Mandibular premolars	Final year	4.08±1.07*	1	5
	Interns	3.54±1.17	1	5
Mandibular molars	Final year	3.58±0.98*	2	5
	Interns	3.03±1.09	1	5

(*) Mann-Whitney U test $p < 0.05$.

Table 3. Average self confidence scorings for managing different endodontic indications among students and interns.

Procedure	Study level	Average±SD	Minimum	Maximum
Vital pulp treatments	Final year	3.53±1.13	1	5
	Interns	3.24±1.21	1	5
Irreversible pulpitis	Final year	3.60±1.13*	1	5
	Interns	3.08± 0.95	1	5
Necrotic pulp	Final year	3.95±1.06**	1	5
	Interns	3.14±0.79	1	4
Symptomatic apical periodontitis and acute abscess	Final year	3.13±1.16	1	5
	Interns	2.95±0.91	1	4
Asymptomatic apical periodontitis and chronic abscess	Final year	3.28±1.15*	1	5
	Interns	2.73±0.77	1	4
EP lesions	Final year	2.85±0.93	1	5
	Interns	2.51±0.79	1	4
Traumatic cases	Final year	3.18±1.08**	1	5
	Interns	2.32±0.88	1	4
Root resorption	Final year	2.73±1.11	1	5
	Interns	2.43±0.73	1	4
Immature apices	Final year	2.60±1.06	1	5
	Interns	2.43±1.07	1	5
Non-surgical endodontic retreatment	Final year	3.38±1.19	1	5
	Interns	2.92±0.98	1	5
Emergency cases in general	Final year	3.25±1.15	1	5
	Interns	3.05±1.05	1	5

(*) Mann-Whitney U test $p < 0.05$. (**) Mann-Whitney U test, $p < 0.01$.

Figure 1. Questionnaire applied to the final year students and interns of dental medicine.

Average self confidence scorings for managing different endodontic indications among students and interns

Part I: Study population.						
Participants	Final year	New interns				
Part II: Self-confidence levels of the participants about various endodontic procedures.						
Questions	Student response	1	2	3	4	5
1. What is your confidence level in history taking?						
2. What is your confidence level in diagnosis and treatment planning?						
3. What is your confidence level in radiograph taking?						
4. What is your confidence level in injecting local anesthesia?						
5. What is your confidence level in endodontic cavity preparation?						
6. What is your confidence level in placing rubber dam?						
7. What is your confidence level in measuring working length using radiograph method?						
8. What is your confidence level in root canal shaping by hand files?						
9. What is your confidence level in root canal irrigation?						
10. What is your confidence level in root canal obturation?						
11. What is your confidence level in management of inter-appointment flare-ups?						
12. What is your confidence level in restoration of endodontically treated teeth?						

[Please use Lickert's scoring system from 1 to 5 to indicate your level of confidence as follows: (1= Very little confidence, 2= Little confidence, 3= Neutral, 4= Confident, 5= Very confident)]

Average self confidence scorings for managing different endodontic indications among students and interns

Part III: Self-confidence levels of the participants about the endodontic treatment of different teeth.						
Questions	Student response	1	2	3	4	5
13. What is your confidence level in performing endodontic treatment in maxillary anterior teeth?						
14. What is your confidence level in performing endodontic treatment in maxillary premolars?						
15. What is your confidence level in performing endodontic treatment in maxillary molars?						
16. What is your confidence level in performing endodontic treatment in mandibular anterior teeth?						
17. What is your confidence level in performing endodontic treatment in mandibular premolars?						
18. What is your confidence level in performing endodontic treatment in mandibular molars?						

[Please use Lickert's scoring system from 1 to 5 to indicate your level of confidence as follows: (1= Very little confidence, 2= Little confidence, 3= Neutral, 4= Confident, 5= Very confident)]

Part IV: Self-confidence levels of the participants about the management of different endodontic indications.						
Questions	Student response	1	2	3	4	5
19. What is your confidence level in management of vital pulp treatments (direct pulp capping, amputation)?						
20. What is your confidence level in management of irreversible pulpitis?						
21. What is your confidence level in management of necrotic pulp?						
22. What is your confidence level in management of symptomatic apical periodontitis and acute apical abscess?						
23. What is your confidence level in management of asymptomatic apical periodontitis and chronic apical abscess?						
24. What is your confidence level in management of endodontic-periodontal combined (EP) lesions?						
25. What is your confidence level in management of traumatic cases?						
26. What is your confidence level in management of root resorption?						
27. What is your confidence level in management of teeth with immature apices?						
28. What is your confidence level when you do non-surgical endodontic retreatment?						
29. What is your confidence level in management of emergency cases in general?						

[Please use Lickert's scoring system from 1 to 5 to indicate your level of confidence as follows: (1= Very little confidence, 2= Little confidence, 3= Neutral, 4= Confident, 5= Very confident)]

Part V: Opinion of the participants about endodontic requirements determined by the Endodontics Unit and their endodontic practice in general		
Questions	Student response	
	Yes	No
30. Do you think the endodontic requirements determined by the Endodontics Unit are enough?		
31. Do you think that your confidence level in endodontic will increase when perform more endodontic cases?		
32. In future, do you wish to perform all endodontic procedures in all cases by yourself?		
33. In future, will you choose to refer the cases for a specialist whenever you feel necessary?		
34. Would you choose endodontics as a line of specialty in the future?		
35. Do you think that endodontic practice is:	Easy	
	Average	
	Difficult	
	Very difficult	

Part VI: Mishaps that may be encountered during root canal treatments (and their frequency).			
Questions	Student response		
	Yes	No	Frequency if yes
36. Which of the following mishaps did you encounter during your practice:			
1. Treating the wrong tooth			
2. Gouging			

3.	Crown perforation			
4.	Missed canal			
5.	Overestimation of length			
6.	Underestimation of length			
7.	Canal over preparation			
8.	Canal blockage			
9.	Ledge formation			
10.	Root perforation			
11.	Strip perforation			
12.	Instrument fracture (which tooth, which canal, cause of fracture)			
13.	Irrigant accident			
14.	Under extended obturation			
15.	Over extended obturation			
16.	Vertical root fracture			
17.	Post fracture			
18.	Damage to existing restoration if you access cavity is done through it			
19.	Bifurcation perforation			
20.	Zippering formation			
21.	Separated instruments			
22.	Tissue emphysema			
23.	Crown fractures during endodontic appointment			
24.	Others:			

.....Thank you.....

For students, higher scores of self-confidence were found in root canal irrigation, followed by root canal shaping by hand instrument. However, for interns, higher scores were found in administering local anesthesia, followed by history taking, final restoration and root canal shaping by hand instrument as shown in Table 1.

When rating self-confidence levels for different teeth during root canal treatment, students also showed higher confidence levels compared to new interns. Statistically significant differences were reported between the both groups ($p < 0.05$). The findings demonstrated that maxillary followed by mandibular molars were what both students and interns felt the least confident treating (Table 2).

Table 3 shows the scorings regarding self-confidence levels for managing different endodontic indications. Self-confidence levels for students were also higher compared to the new interns. However, no statistically significant differences were noticed between both groups ($p > 0.05$) with exception of irreversible pulpitis, necrotic pulp, management of asymptomatic apical periodontitis and chronic abscess, and traumatic cases, in which a

significant differences between both groups were found ($p < 0.05$). Immature apices, root resorption, combined endodontic-periodontal (EP) lesions, trauma cases, symptomatic apical periodontitis and acute abscess were ranked as the cases in which both students and interns reported the lowest confidence levels. For students, higher scores of self-confidence were noticed in treating necrotic pulp, followed by treatment of irreversible pulpitis. However, for interns, higher scores were found in treating vital pulp, followed by treatment of necrotic pulp as. (Table 3)

The majority in both groups (90% of students and 92% of interns) planned to refer to a specialist when confronted with challenging endodontic situations beyond their experience level. Twenty-two students (55%) found the number of teeth to be treated as requirements satisfactory, which is a close to that reported by interns (56.8%). The majority of students (90%) and interns (89.2%) reported that their confidence level in endodontics would increase with more practice and treatment of various endodontic cases. Eighteen students and interns (45% and 48.6%,

respectively) wished in the future to specialize in endodontics. Canal blockage and ledge formation were the predominant mishaps encountered during practice among both students and new interns who answered this question.

DISCUSSION.

The aim of undergraduate dental education is to produce a competent dentist. Many undergraduate students and new interns feel the need to work as an 'apprentice' with another experienced dentist until they gain confidence and additional skills, which can otherwise be taught in the learning years at dental school. Therefore, self-assessment of undergraduate students and new interns of their own expertise serves as helpful means to make a realistic evaluation of dental curricula and assessment of the effectiveness of specific courses.^{14,15} In addition, these self-assessments assist in unfolding many issues that need to be resolved and reconsidered, aiming for better assimilation of knowledge and development of practical skills.⁸

There are numerous studies that evaluate the quality and outcome of endodontic treatments carried out by dental students; however, there is scarce information regarding their level of self-confidence about various aspects of endodontic treatment with respect to their future practice. Therefore, this survey aimed to gather information about the general opinion of senior students and new interns regarding endodontic treatment procedures. This in turn will draw a general picture regarding their self-evaluation in a branch of dentistry that they will encounter very frequently in their daily practice.

This study was held at the College of Dentistry, at UST, because it has a well-qualified full-time teaching staff and each department is well equipped with sufficient dental units. In addition, the college has a charity hospital policy just to keep a high patient flow rate, with a set of conditions and local requirements according with and derived from the European recommendations to regulate the treatment services provided in college clinics.

This college also has an adequate dental curriculum that follows American guidelines for undergraduate students that is set to join both academic knowledge and practical clinical skills in order to graduate a well competent dentist. In this study, the confidence levels regarding endodontic treatment

for undergraduate students were higher compared to those of new interns.

One of the possible explanations of these unexpected results is that about half of the interns participated in this study graduated from different dental schools at other Yemeni universities, which have varying endodontic prerequisites, and requirements for graduation that differ from those required at UST. Within the five-year dental program provided by the College of Dentistry at UST, endodontics is taught within three academic years based on regional (Saudia Arabia and Jordan) and global (American) benchmarks.

Teaching of endodontics is started from the third year as "Endodontics (I)" in which a preclinical annual course is taught. The students in this course are required to complete all root canal treatment steps from preoperative radiograph until root canal obturation on at least eight extracted natural teeth (five single-canal teeth including maxillary and mandibular anterior teeth and premolars; one two-canal tooth, normally a maxillary premolar tooth; and two molars, one maxillary molar and one mandibular molar). In the following fourth year, "Endodontics (II)" is taught, which is a clinical annual course in which students have to perform all root canal treatment steps clinically on at least three single- or two-canal teeth from diagnosis and treatment plan until final restoration.

Finally, on the fifth year of the dental program, clinical Endodontics is taught within a subject called Clinical Comprehensive Practice (CCP), which is an annual clinical course in which each student must at least complete all root canal treatment steps clinically on at least one mandibular molar tooth and one maxillary molar tooth. In addition, one endodontic retreatment case on a previously treated single-canal tooth is required.

However, in other dental faculties at public and private Yemeni universities, endodontics is taught only within the fourth and fifth years. Furthermore, the number of endodontic treatment cases at UST that students are obliged to complete to be eligible for graduation is higher than those required in other institutions in Yemen. This is facilitated and can be achieved in part due to the higher proportion of patient frequency in relation to the number of enrolled students at the College of Dentistry at UST that is higher than on other Yemeni dental schools.

Although rubber-dam application is a prerequisite for endodontic treatments and students are not allowed to complete their treatments without the use of this significant adjunctive tool, in the present study the scoring regarding self-confidence levels of rubber dam placement was the area where both students and interns felt the lowest confidence. This is because students only start working with rubber dam in their final year due to its unavailability, even though it is an indispensable element of contemporary endodontic practice. Moreover, there may be some reluctance in the usage of this tool, including difficulty of its application and patients' dislike.

These results coincide with previous studies.¹⁶⁻¹⁹ Madfa *et al.*,²⁰ found that the use rubber dam during endodontic treatment among general practitioners in Yemen was only 7.1%. Therefore, development of skills in terms of rubber dam application including management of difficult clinical cases with extensive tooth tissue loss should be given priority by college instructive and supervising staff in order for students to gain and report higher levels of confidence in the future. In the present study, the management of inter-appointment flare-ups showed the second lowest confidence level.

These results are in agreement with Tanalp *et al.*,⁸ who found that bleaching of endodontically treated teeth had the lowest confidence level by students, followed by rubber dam application and management of inter-appointment flare-ups. However, the occurrence of flare-ups does not directly affect the outcome of the endodontic procedure. This is because inter-appointment flare-ups are distressful situations resulting from the disruption of the balance between the host defense mechanism and irritating agents.⁸ One of the other reasons for the occurrence of inter-appointment flare-ups may be due to accidental extrusion of intracanal contents into the periradicular tissues.²¹ This frequently happens because students and new interns have insufficient experience and their tactile skills have not been developed as adequately as those of an experienced dentist, to reduce or even prevent over-instrumentation or extrusion of irrigants and intracanal debris into the periradicular tissues. Moreover, undergraduate students and new interns might not have enough communication with patients to tolerate this complication.

When types of teeth were scored in terms of self-

confidence levels, as expected, both undergraduate students and new interns reported the least confidence levels during treatments of molar teeth; this is anticipated due to the complexity of the root canal system and difficult accessibility of these teeth in the dental arch.²² Obviously, this explains why the poorly quality of root canal fillings and high prevalence of apical periodontitis were associated with molar teeth than those in anterior region among Yemeni population in previous publications.^{23,24}

These findings are consistent with the results of other authors.^{20,25,26} Bartlett *et al.*,²⁰ indicated that dental schools might have the opinion that students can develop their skills in challenging cases better in general practice rather than the clinical environment offered by dental schools; therefore, they might prefer to provide students with the knowledge of basic principles of these cases only. This comment may not be valid for the school in which this survey was conducted as students are expected to dedicate a significant proportion of their endodontic practice to molar endodontics. The lower result obtained may be rather the manifestation of inherent problems related to the management of molar teeth which may pose difficulty both in terms of their location and morphological characteristics.

In this study, it is observed that relatively lower confidence levels were reported with endodontic treatments of different endodontic indications rather than with the regular main steps of endodontic treatment. This is not quite unexpected as more challenging cases such as root resorption, immature apices, root resorption, combined EP lesions, trauma cases, symptomatic apical periodontitis and acute abscess were those associated with relatively lower self-confidence levels.

In case any of these endodontic situations are encountered at the undergraduate students' clinic, they are generally referred to the post-graduate clinic to be managed there, rather than at undergraduate clinics. It is debatable whether students should be introduced to challenging cases during their educational years or not. It is quite likely that they will somehow encounter these situations in the future when they start to practice independently. On the other hand, Cowpe *et al.*,²⁸ indicated the acquisition of adequate competence by the undergraduate to perform endodontic treatment on uncomplicated single and uncomplicated multi-rooted teeth. Recognizing indications for surgical and complicated non-surgical root canal therapy and

taking appropriate action is also one of the competences a student is expected to acquire. This implies that the student should at least adopt the skills to differentiate between cases within their level of expertise and refer to a specialist when necessary. Therefore, the relatively lower levels of confidence reported in this study for more challenging cases should not create concern from an educational perspective, but should rather be regarded as a reflection of the current limitation of expertise expected from an undergraduate.

Although the quality of the completed work is a very significant parameter in deciding whether a student has gained enough proficiency, it is generally accepted that the more cases a dental student encounters during their educational years, the more prepared they will be in terms of endodontic practice in the years of working independently.²⁵

Therefore, the European Society of Endodontology recommends the completion of root canal treatments in 20 teeth including extracted teeth prior to graduation.⁷ However, in the College of Dentistry at UST, the number of endodontic treatments that a student is obliged to complete to be eligible for graduation is 13 teeth including extracted teeth. This may explain why self-confidence levels were lower than in previous studies,^{8,25} where the number of endodontic treatments required for graduation was higher than that required at College of Dentistry, UST. In addition, these results explain why about half the undergraduate students and new interns felt that the number of cases were not satisfactory when compared to what is reported by Awooda *et al.*²⁵

Some authors reported factors that may influence students' self-confidence levels in clinical dental practice. Murray *et al.*,²⁹ defined one of the limits to developing confidence in performing clinical practices as insufficient clinical exposure within the undergraduate curriculum. Lynch *et al.*,³⁰ on the other hand, suggested that an insufficient number of patients, lack of adequate physical space within the dental school, limitations posed by the busy curriculum and lack of well-trained staff are major obstacles, which may hamper high clinical self-confidence levels. In the present study, 60% of undergraduate students and 78.4% of new interns stated that they would perform endodontic treatments within their expertise limit in the future, which indicates a neutral confidence level, probably due to the low exposure level to endodontic cases compared to other

recommendations.^{1,6,24}

In the College of Dentistry at UST where the present study was conducted, it is not anticipated that the above-mentioned parameters may be causative of lower confidence levels regarding various aspects of endodontic treatment. This study focused only on the senior students and new interns at UST. Further research is required that includes other clinical subjects as well as post-graduate students who finished their internship year of practice after graduation, in order to obtain more reliable information on the clinical program of the evaluated college. In the meantime, the survey can be disseminated to other dental schools to make comparisons and make necessary plans for improvement of the dental curriculum and its clinical contents. Subsequent research comprising other dental schools is warranted to identify the weak areas during endodontic treatment in order to bring resolutions for the delivery of skills during endodontic procedures. In addition, studies comprising other dental schools will be helpful in precisely determining the extent of instillation of adequate skills in endodontics and major missing areas that need further improvements.

CONCLUSION.

Within the limitations of the present study, it can be concluded that undergraduate students and new interns at the College of Dentistry at UST displayed neutral confidence levels in performing various endodontic procedures. More exposure is recommended to enhance the students' self-confidence. More similar studies are required to aid in developing and refining the educational process.

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