Research Article

Awareness of Endodontic Procedural Accidents among Students in University of Medical Sciences and Technology & University of Sciences Technology in 2017-2018

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Abstract

Background. *The endodontic procedure is considered a stressful condition for undergraduate dental students because it requires skills and practice to perform this treatment without mishaps which determines the outcome of the treatment. The study was conducted to evaluate the awareness, knowledge, and incidence of mishaps and their contributing factors among undergraduate dental students.* ***Material and Method.*** *A cross-sectional study with a sample of 116 dental students in the 5th year. The data was collected through a questionnaire.*

Results. *There was a high percentage of procedural errors among students in both universities 81.9%, and ledge formation was the most common mishap in posterior teeth followed by the overfilled canal in anterior teeth, and the most contributing factor to the mishaps was the poor quality of the instruments, according to the knowledge evaluation there was no significant difference in the knowledge between the two universities with 57.8% of students having high knowledge,34.5% of mid-core knowledge, and 7.8% of low knowledge.* ***Conclusion.*** *The overall percentage of procedural errors among students in both universities was found to be 81.9% and the most common one was ledge formation in posterior teeth then overfilled canal in anterior teeth, and the most contributing factor to the mishaps was found to be the poor quality of the instruments. 57.8% were found to have a high level of knowledge, 34.5% were found to have moderate knowledge, and 7.8% were found to have low knowledge from both universities.*

Introduction

Endodontics is the study of prevention and management of problems and diseases involving dentine, pulp, and periapical tissues. **[**1**]**

A healthy pulp is essential for the Completion of root formation in immature teeth, to Continue lifelong tooth development, Protecting against infection, maintaining sensory/nociceptive function, and maintaining the elasticity of dentine. **[**1**]**

Thanks to the advent of new methods and tools, therapeutic and control measures applicable to pulp and pre-radicular diseases have developed significantly in the present era; so that majority of the teeth that were being extracted because of root damages and dental caries in the past are now maintained by undergoing endodontic treatment with a relatively good prognosis **[**2**]**

Infection of the pulp can be caused by affecting pulp tissues by caries, trauma, and tooth surface loss which result in irreversible pulpitis and, if left untreated, periapical periodontitis. **[**1**]**

Root Canal Treatment is Indicated in irreversibly damaged or necrotic pulp &/or evidence of apical periodontitis also in elective devitalization before further restorative treatment, and it involves the removal of microbes and pulpal remnants by cleaning and shaping (root canal preparation) and obturation of the root canal system, to prevent or manage microbial proliferation within the root canal system and apical periodontitis **[**1**]**

The operator's performance during procedures without any mistakes decides the outcome of the treatment **[**3**]**

Endodontic mishaps are accidents that may occur during the different stages of the treatment: diagnosis, access cavity, instrumentation, and obturation **[**4**]**

Failure to grasp the rationale behind the stages of the treatment concepts can increase the occurrence of needless procedural errors **[**5**]** more accurate planning of root canal instrumentation and minimizes the impact of the anatomic difficulties and limitations of the endodontic instruments. This method permits the maintenance of the curves associated with continuously tapered shapes and prevents structural deformations of the endodontic instruments. In this way, disastrous consequences to root canal preparation can be avoided, such as loss of working length, apical transportation, creation of ledges, elbows, zips, and perforations, and fracture of instruments. **[**6**]**

A lot of these problems can be avoided by having acceptable and correct knowledge about the instruments use and suitable treatment plans. Being aware of these accidents and their occurrence leads in to useful treatment and decrease the incidence. One mistake in each step can cause a problem during the following steps of the procedure [7]

The procedure is considered a stressful procedure for undergraduate students and requires practice and skill to avoid any mishaps [8]

Endodontic teaching requires scientific knowledge and appropriate methodological strategies to optimize the use of materials and techniques. Several challenges are present during undergraduate teaching, in particular, the recent conceptual changes in terms of the shaping of curved root canals. [9] most of these accidents can be prevented by improvement in knowledge and tactfulness. Study of procedural faults in the students' practice training and presentation of preventive strategies can increase the rate of successful treatment, On the other hand, Investigations have revealed that the majority of failures are due to procedural faults so patients should be aware of the success rate and soundness of this method.[10]

In a study done by Dummer, dental school, university of wales UK in 1991, he mailed a questionnaire and covering letter to the head of Departments of Conservative Dentistry, the questionnaire was designed details of the teaching of root canal treatment in permanent teeth only, information was obtained from a total of nine dental schools in Europe and the United States then both dental schools were visited then Dummer compared undergraduate endodontic teaching programs in Britain to those in United State and reported that one of the causes of poor quality endodontic treatment in general practice was lack of expertise and a poor understanding of the principles involved by the graduated students. [11]

Another study was done by K.M Barrieshi-Nussair at the dental teaching hospital in Jordan,2004,using periapical radiographs to assess the technical quality of root canal treatments performed by under graduate dental students, results were found to be that 61% of treatments were of acceptable length, while 34.5% were short and 4.2% were overfilled, and adequate fillings were found to be more in maxillary than mandibular teeth, and concluded that specialized clinical supervision and increasing the time of training at the preclinical and clinical levels should improve this quality. [12]

Materials and Methods

Study Design: cross-sectional analytical descriptive study was conducted.

Study Area: UMST and UST universities in Academy dental hospital and UST dental hospital respectively

Study Duration: From February 2018 - April 2018

Study Population: undergraduate final year dental student from both UMST and UST

Sample Size: 116 students of total 138

Sampling Technique: stratified random sampling technique according to universities

Data collection Tools: A self-administered structured and pretested questionnaire which was modified from a previous study.

Methods:

The questionnaire inquires demographic features, then about whether they have or haven't experienced an endodontic mishap and if they had they were asked which mishap have they experienced including (access cavity perforation, swallowing or aspiration of endodontic instruments, treating the wrong tooth, destructed crown, ledge formation, artificial canal creation, root perforation, instrument separation, extrusion of irrigating solution periapical, under or overfilled canal, and vertical root fracture) , and if they had it on an anterior or posterior tooth, then a question was asked about which factor do they think is the factor contributing to their mishap, six questions were asked to assess level knowledge and scoring system was done for the assessment, if a student answers 65% or more questions it's considered as high knowledge if from30-65% it's considered as moderate knowledge if less than 30% its considered low knowledge.

Statistical and Data Analysis:

Data were coded and entered in an excel sheet and analysed by SPSS version 23.0, so data as described in figures, tables, and graphs. The uni-variate analysis was done for the dependent and independent variables. The bi-variate analysis was performed using the Chi-square test in which P value less than 0.05 considered statically significant and cross-tabulation tests were used to assess associations between dependent and independent variables.

Ethical consideration:

Approval was obtained from UMST and UST Research ethical committee and permission was taken from deans of faculties since confidentiality of the data was insured, the privacy of the participants and their right to withdraw without explanation was insured, informed consent was be obtained from research participants.

Results:

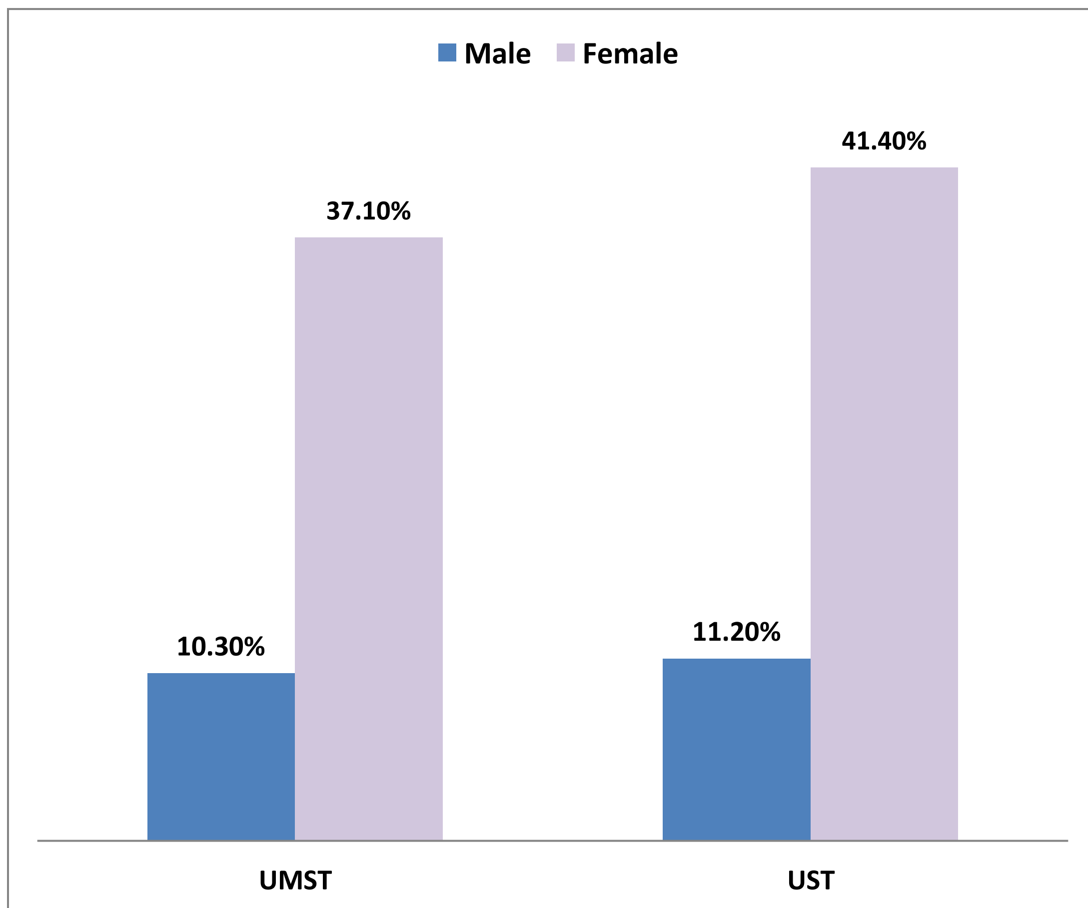

Figure (1): Distribution of the study sample according to (gender among university)

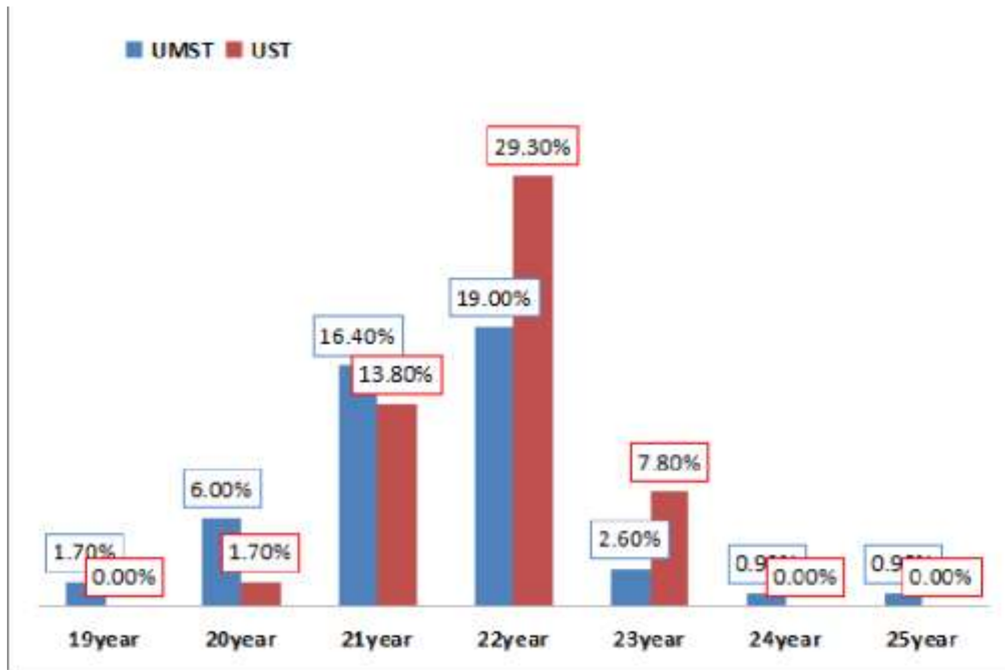

Figure (2): *Distribution of the study sample according to* (Age among university)

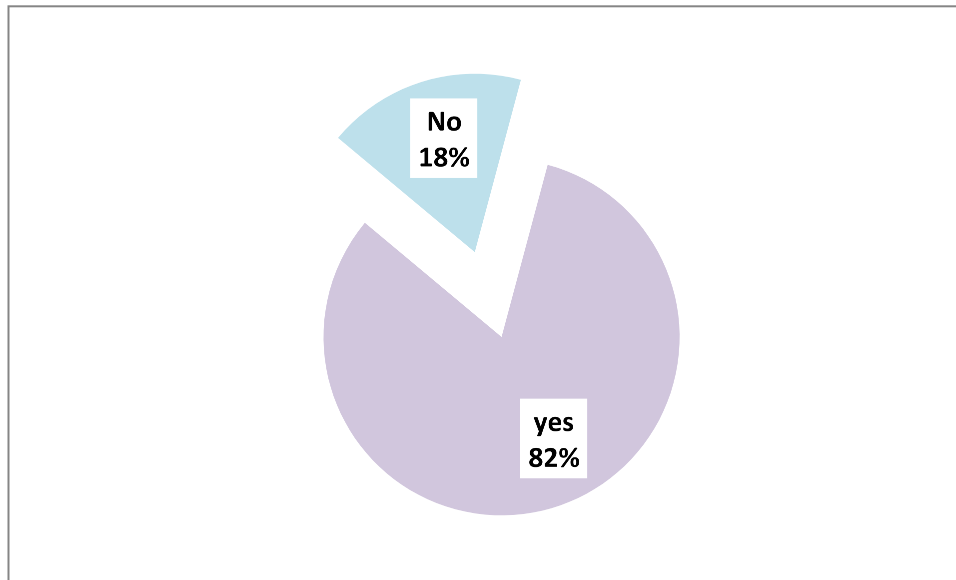

Figure (3) : Distribution of the study sample according to the question -if have a student had a mishap or not.

Table (1): Distribution of the study sample according to (the type of mishap students have experienced and tooth position)

	Answer		
Type of mishap	Anterior tooth	Posterior tooth	Anterior tooth %*
swallowing /aspiration of endodontic instrument	5	1	83.3%
treated wrong tooth	5	3	62.5%
destructed crown or existing restoration	18	4	81.8%
access cavity perforation	7	6	53.8%
Ledge formation	22	41	34.9%
Artificial canal creation	5	2	71.4%
Root Perforation	13	12	52%
instrument separation	16	23	41%
Extrusion of the irrigating solution periapically	12	2	85.7%
Under filled canal	18	23	43.9%
Over filled canal	26	22	54.2%
Vertical root fracture	5	1	83.3%

Table (2): Distribution of the study sample according to factors contributing to mishaps reported by students.

	umst		ust	
	Frequency	***Percent***	***Frequency***	***Percent***
Bad quality of instruments(1)	24	25%	37	39%
Poor usage of instruments(2)	11	12%	0	0.0%
Lack of supervision(3)	3	3%	4	4%
Lack of experience(4)	5	5%	4	4%
Lack of knowledge(5)	1	1%	1	1%
Lack of patient cooperation(6)	2	2%	1	1%
Poor x-ray quality(7)	0	0.0%	1	1%
Poor isolation(8)	1	1%	0	0.0%
Lack of skills(9)	1	1%	0	0.0%
Total	48	51%	47	49%

Table (3): Distribution of the study sample according to (Do you know methods of prevention of endodontic mishaps?

	Frequency	***Percent***
Yes	103	88.8%
No	13	11.2%
Total	116	100.0%

Table (4): Distribution of the study sample according to (Did you treat an endodontic mishaps your self?

	Frequency	*Percent*
Yes	64	55.2%
No	62	44.8%
Total	116	100.0%

Table (5): Distribution of the study sample according to (Did you follow up patients with endodontic mishaps to see the prognosis of the treatment?

	Frequency	Percent
Yes	69	59.5%
No	47	36.2%
Total	116	100.0%

Table (6): Distribution of the study sample according to (what is the function of fiber optic light in endodontic procedure)?

	Frequency	Percent
Retrieve broken instruments	32	27.6%
Identify canal entry	84	72.4%
Total	116	100.0%

Table (7): Distribution of the study sample according to (what is the desirable concentration of Sodium hypo-chloride)?

	Frequency	Percent
5.25%	103	88.8%
7.25%	13	11.2%
Total	116	100.0%

Table (8): Distribution of the study sample according to (In which level of tooth prognosis of perforation is better)?

	Frequency	Percent
Below the crestal bone	35	30.2%
Above the crestal bone	81	69.8%
Total	116	100.0%

Table (9) : Difference between the two universities in the incidence of swallowing /aspiration of endodontic instrument :

			universities		Total	Chi-Square Tests
			umst	ust		p-value
swallowing /aspiration of endodontic instrument	Anterior tooth	Count	3	3	6	0.350 Pearson's R(0.354)
		% of Total	42.9%	42.9%	85.7%	
	Posterior tooth	Count	0	1	1	
		% of Total	.0%	14.3%	14.3%	
Total		Count	3	4	7	
		% of Total	42.9%	57.1%	100.0%	

Table (10) : Difference between the two universities in the incidence of treating wrong tooth:

			universities		Total	Chi-Square Tests
			umst	ust		p-value
treated wrong tooth	Anterior tooth	Count	0	5	5	0.035 Pearson's R(-0.745)
		% of Total	.0%	62.5%	62.5%	
	Posterior tooth	Count	2	1	3	
		% of Total	25.0%	12.5%	37.5%	
Total		Count	6	2	8	
		% of Total	46.2%	25.0%	100.0%	

Table (11): Difference between the two universities in the incidence of destructed crown or exicting restorations:

			universities		Total	Chi-Square Tests
			umst	ust		p-value
destructed crown or existing restoration	Anterior tooth	Count	8	10	18	0.269 Pearson's R(-0.236)
		% of Total	36.4%	45.5%	81.8%	
	Posterior tooth	Count	3	1	4	
		% of Total	13.6%	4.5%	18.2%	
Total		Count	6	11	22	
		% of Total	46.2%	50.0%	100.0%	

Table (12) : Difference between the two universities in the incidence of access cavity perforation

			universities		Total	Chi-Square Tests
			umst	ust		p-value
access cavity perforation	Anterior tooth	Count	1	6	7	0.013 Pearson's R(-0.69)
		% of Total	7.7%	46.2%	53.8%	
	Posterior tooth	Count	5	1	6	
		% of Total	38.5%	7.7%	46.2%	
Total		Count	6	7	13	
		% of Total	46.2%	53.8%	100.0%	

Table (13) : Difference between the two universities in the incidence of artificial canal creation

			universities		Total	Chi-Square Tests
			umst	ust		p-value
Artificial canal creation	Anterior tooth	Count	0	5	5	0.008 Pearson's R(-1.000)
		% of Total	.0%	71.4%	71.4%	
	Posterior tooth	Count	2	0	2	
		% of Total	28.6%	.0%	28.6%	
Total		Count	2	5	7	
		% of Total	28.6%	28.6%	28.6%	

Table (14) : Difference between the two universities in the incidence of root perforation:

			universities		Total	Chi-Square Tests
			umst	ust		p-value
Root Perforation	Anterior tooth	Count	2	11	13	0.000 Pearson's R(-0.703)
		% of Total	7.4%	40.7%	48.1%	
	Posterior tooth	Count	12	2	14	
		% of Total	44.4%	7.4%	51.9%	
Total		Count	14	13	27	
		% of Total	51.9%	48.1%	100.0%	

Table (15) : Difference between the two universities in the incidence of ledge formation:

			universities		Total	Chi-Square Tests
			umst	ust		p-value
Ledge formation	Anterior tooth	Count	2	20	22	0.000 Pearson's R(-0.74)
		% of Total	3.1%	31.2%	34.4%	
	Posterior tooth	Count	35	7	42	
		% of Total	54.7%	10.9%	65.6%	
Total		Count	37	27	64	
		% of Total	57.8%	42.2%	100.0%	

Table (16) : Difference between the two universities in the incidence of instrument separation:

			universities		Total	Chi-Square Tests
			umst	ust		p-value
instrument separation	Anterior tooth	Count	0	16	16	0.000 Pearson's R(-0.858)
		% of Total	.0%	40.0%	40.0%	
	Posterior tooth	Count	21	3	24	
		% of Total	52.5%	7.5%	60.0%	
Total		Count	21	19	40	
		% of Total	52.5%	47.5%	100.0%	

Table (17) : Difference between the two universities in the incidence of extrusion of the irrigation solutio periapically :

			universities		Total	Chi-Square Tests
			umst	ust		p-value
Extrusion of the irrigating solution periapically	Anterior tooth	Count	3	9	12	0.040 Pearson's R(-0.548)
		% of Total	21.4%	64.3%	85.7%	
	Posterior tooth	Count	2	0	2	
		% of Total	14.3%	.0%	14.3%	
Total		Count	5	9	14	
		% of Total	35.7%	64.3%	100.0%	

Table (18) : Difference between the two universities in the incidence of under filed canal:

			universities		Total	Chi-Square Tests
			umst	ust		p-value
Under filled canal	Anterior tooth	Count	3	15	18	0.000 Pearson's R(-0.641)
		% of Total	7.7%	38.5%	46.2%	
	Posterior tooth	Count	17	4	21	
		% of Total	43.6%	10.3%	53.8%	
Total		Count	20	19	39	
		% of Total	51.3%	48.7%	100.0%	

Table (19) : Difference between the two universities in the incidence of overfilled canal :

			universities		Total	Chi-Square Tests
			umst	ust		p-value
Over filled canal	Anterior tooth	Count	7	19	26	0.000 Pearson's R(-0.526)
		% of Total	15.2%	41.3%	56.5%	
	Posterior tooth	Count	16	4	20	
		% of Total	34.8%	8.7%	43.5%	
Total		Count	23	23	46	
		% of Total	50.0%	50.0%	100.0%	

From the previous cross-tabulations There was no significant difference between the two universities in the incidence of the following mishaps: swallowing or aspiration of endodontic instruments and destructing crown or excising restoration on the other hand there was a highly significant difference between the two universities in the incidence of ledge formation, instruments separation, under-filled

canal, overfilled canal, root perforation, artificial canal creation, access cavity perforation, Extrusion of the irrigating solution periapical, and treating the wrong tooth.

Table (20) : Difference between the anterior and posterior teeth in the incidence of the following mishaps:

	p-value	
swallowing /aspiration of endodontic instrument -	0.052	Significant different
treated wrong tooth	0.220	no Significant different
destructed crown or existing restoration	0.029	Significant different
access cavity perforation	0.83	no Significant different
Ledge formation	0.000	High Significant different
Artificial canal creation	0.878	no Significant different
Root Perforation	A*	
instrument separation	0.000	High Significant different
Extrusion of the irrigating solution periapically	0.000	High Significant different
Under filled canal	0.340	no Significant different
Over filled canal	0.043	Significant different
Vertical root fracture	b	

Normal p-value is 0.05; therefore the statistical difference is highly significant

A* Std. Deviation (ust)= Std. Deviation(umst)

b. t cannot be computed because at least one of the groups is empty.

Table (21): difference between the two universities in the level of knowledge in endodontic mishaps:

			un			**Chi-Square Tests**
			umst	ust	Total	p-value
level	high	Count	36	31	67	
		% of Total	31.0%	26.7%	57.8%	0.052
	mid	Count	18	22	40	
		% of Total	15.5%	19.0%	34.5%	Pearson's R(0.203)
	low	Count	1	8	9	
		% of Total	.9%	6.9%	7.8%	
Total		Count	55	61	116	
		% of Total	47.4%	52.6%	100.0%	

Discussion

This study included 166 undergraduate dental students in the university of medical sciences and technology and university of technology the results show that there were more participant from UST(52.6%) than UMST and also the higher female dentist in both universities with UST with the higher percentage (41.4%) ,the mean age of students in both universities was found to be 22 years , according to participants there was a high percentage of procedural errors among students in both universities 81.9%, study in KSU also showed high percentage of endodontic mishaps among undergraduate students (68%) **[**14**]** This result may be because of insufficient preclinical endodontic training of the students' operators or because of the introduction of students to endodontic clinical practice late in their program **[**13**]**, then students were asked about which procedural errors they have experienced and results showed that most common mishaps was ledge formation then overfilled canal was the second most common mishap ,then under-filled canal ,instrument separation ,Root Perforation,destructed crown or existing restoration,Extrusion of the irrigating solution periapically,access cavity perforation,treating wrong tooth,artificial canal creation , and the least were swallowing or aspiration of endodontic instruments and vertical root fracture equally , in a Study carried by Bahareh Dadresanfar in 2006 in at the Islamic Azad University , to evaluate the technical quality of root canal treatment (RCT) performed by undergraduate dental students in Four-hundred records of patients only 17.5% experienced ledge formation and 19.5% experienced overfilled canal **[**16**]** which disagrees with my study , majority of students have experienced their mishaps in posterior teeth which agrees with the study done by deimah F alhekeir in KSU, who found that Nearly two-thirds of endodontic mishaps among under graduate students happen in posterior dentition**[**14**]** , may be this is due to the canal curvature of of posterior teeth **[**16**]**

Regarding the most contributing factor related to their mishap according to participants answers was the poor quality of instruments with a percentage of 64% followed by poor usage of instruments 12%, then lack of experience 9%, lack of supervision 7%, lack of patient cooperation 3%, lack of knowledge 2%, and the least were lack of skills, poor x-ray quality and poor isolation with a percentage of 1% each which disagrees with a previous study done by Dummer who compared undergraduate endodontic teaching programs in Britain to those in United State and reported that one of the causes of poor quality endodontic treatment was lack of expertise and a poor understanding of the principles this difference may be due to the different dental instruments qualities in the different countries.

To evaluate the knowledge of students, they were asked about prevention, treatment, and prognosis, 88% of them assumed they are familiar with the prevention,55% were able to treat mishaps by themselves, and 59.5% follow up with their patients to see the prognosis after mishaps, then 72.4%

answered correctly about the function of fiberoptic light in the endodontic procedure, 88.8% of the students answered correctly about the desirable concentration of Sodium hypo-chloride, and 69.9% answered correctly about the better prognosis of perforation.

In a previous Study performed by Mohammed Kashif Nejad at the Medical University of Babol in 2014, their results concluded that students had a higher level of knowledge about treatment and prognosis of procedural accidents than about the prevention which disagrees with this study.

There was no significant difference between the two universities in the incidence of the following mishaps: swallowing or aspiration of endodontic instruments and destructing crown or excising restoration on the other hand there was a highly significant difference between the two universities in the incidence of ledge formation, instruments separation, under-filled canal, overfilled canal, root perforation, artificial canal creation, access cavity perforation, Extrusion of the irrigating solution periapical, and treating the wrong tooth.

There was also a highly significant difference between anterior and posterior teeth in the following mishaps: ledge formation, instrument separation, and Extrusion of the irrigating solution periapical. while destructed crown or existing restoration, and overfilled canal were of significant difference, and there was no significant difference related to access cavity perforation, Artificial canal creation, Under filled canal, treating the wrong tooth, and swallowing /aspiration of the endodontic instrument.

Of the 116 students who participated in this study 57.8% were found to have a high level of knowledge, 34.5% were found to have moderate knowledge, and 7.8% were found to have low knowledge, anyhow there was no significant difference in the level of knowledge between the two universities.

Conclusion

The overall percentage of procedural errors among students in both universities was found to be 81.9% and the most common one was ledge formation in posterior teeth then overfilled canal in anterior teeth, and the most contributing factor to the mishaps was found to be the poor quality of the instruments.

57.8% were found to have a high level of knowledge, 34.5% were found to have moderate knowledge, and 7.8% were found to have low knowledge from both universities.

Recommendations:

-Quality control of dental instruments should be applied in dental hospitals.

-Early introduction to endodontics should be applied

-From the present study we recommend further studies to be conducted to compare between private and government universities.

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