Original Research

Evaluation of Dental Students' Awareness of Endodontic Procedural Accidents in Babol University of Medical Sciences in 2013-2014

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Abstract

Background: During root canal treatment procedures, unexpected accidents may be confronted affecting long-term prognosis just as in any other dental treatment. The purpose of this study was to evaluate the knowledge of dental students of accidents and errors during endodontic treatment in Medical University of Babol. **Materials and Methods:** In this cross-sectional study, 52 senior dental students were examined. Required information was collected with a questionnaire with 20 questions relating causes, prevention, treatment and prognosis of accidents during endodontic treatment. Data was analyzed using descriptive parameters, chi-square test and T-test by the statistical software SPSS Ver.21. **Results:** The students' knowledge was moderate in all of the fields studied including causes, prevention, treatment and prognosis of accident during endodontic treatment. Their knowledge of the causes of accidents during endodontic treatment was the lowest level and their awareness of the required endodontic treatment was the highest. There were no significant differences ($P>0.05$) in the average knowledge of students in the four areas of causes, prognosis, prevention and treatment of accidents of endodontic treatment. There was a significant difference in the average knowledge of the causes between male and female dental students ($P<0.05$); however, no significant difference in the average knowledge of other fields was observed between male and female dental students. The average knowledge of causes in female dental students was higher than male students. **Conclusion:** The findings of this study suggest that the level of awareness of dental students of events during endodontic treatment in Babol University of Medical Sciences is moderate.

Keywords: accident during endodontic treatment, awareness, dental students

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Introduction

Thanks to the advent of new methods and tools, therapeutic and controlling measures applicable to pulp and pre-radicular diseases have developed significantly in the present era; so that most of the teeth pulled out because of root damages and dental carries in the past, are now maintained by undergoing endodontic treatment with a relatively good prognosis. Presently, dentists mainly focus on maintaining natural teeth in the maxillary antrum. Many of the teeth require root canal treatment due to caries, trauma or other reasons. Considering millions of people needing root canal treatment, patients should be aware of the success rate of this method. Endodontic treatment is successful in almost 95% of cases; however, in 5% of the cases, the treatment fails due to different complications (Ingle JI

& Bakland, 2002).Success of endodontic treatment depends on different factors and the probability of failure varies significantly in different cases (Al-Jewair *et al*, 2010). Although some of the complications happening during or after endodontic treatment are not predictable, some are due to therapist's failure in attending to details (Patel & Rhodes, 2007).

Some of the most common procedural accidents include: perforation of the pulp chamber during preparation of access cavity, creating ledge, broken instruments, root perforation and vertical root breakage (Siqueira, 2001);such accidents can happen in various stages of endodontic treatment such as developing access chamber, canal formation and cleaning, canal filling or preparation of post chamber (Farzaneh *et al*, 2004).

Being unaware of the causes, prevention and method of treating procedural accidents causes different complications such as canal blockage, incomplete canal cleaning or various physical, chemical and thermal stresses. Also being aware of the procedural accidents can be useful to prevent them. The therapist should also know how to diagnose and treat such accidents and should know how such accidents affect therapeutic prognosis so that they can overcome any fear or doubt that hinders the procedure (Aragon & Zibrowski, 2008). Focusing on this problem, we conducted a research to determine the knowledge of medical students of Babol University of Medical Sciences as far as procedural accidents of endodontic treatments were concerned.

Lin *et al* (2005) reviewed the outcome of endodontic procedural errors. They indicated that endodontic procedural errors are not the direct cause of treatment failure. Procedural errors typically are due to several factors among which are lack of understanding of the root canal anatomy, the principles of mechanical instrumentation and tissue wound healing.

Mozayeni *et al* (2006) reported that one of the reasons for endodontic failure is endodontic procedural errors (such as void, over filling, under filling, gouging, furcation perforations, missed canal, over perforation, strip perforation, ledge, zipping, broken files, and apical perforation).

Jafarzadeh *et al* (2007) reviewed ledge formation as a procedural endodontic treatment error in endodontic therapy. During this review, they surveyed the causes, prevalence and associated factors, prevention, treatment techniques and fixing the problem, dealing with the patient and prognosis of ledge formation. This review showed that a ledge is created when working length can no longer be negotiated and the original pathway of the canal is lost. Extension of the access cavity to provide unobstructed access to the root canals, pre-curving and not forcing instruments, using NiTi files, using passive step-back and balanced force techniques and instrumenting the canal to its full length will all help to prevent ledge formation. Initial negotiation and bypassing the ledge can be achieved using a small file with a distinct curve at the tip, whereas a slight rotational motion of the file combined with a "picking" motion can often help advance the instrument.

Rahimi *et al* (2009) studied novel methods of controlling and treating endodontic procedural accidents and listed the varied number of such procedural accidents; they stated that a dentist has to apply all his knowledge, concentration, sensitivity, patience and knowledge of the existing work limitations to minimize the risk of accidents. Moreover, they have to provide patients with information about the correction stages that may be required, alternative treatment methods and the impact of possible accidents on therapeutic prognosis. The purpose of this study was to evaluate the knowledge of dental students in Medical University of Babol of accidents and errors during endodontic treatment.

Materials and Methods

This study is a cross-sectional analytical and descriptive study conducted in 2013-2014 with 52 dental student participants working in the Endodontic Clinical Ward of Babol University of Medical Sciences, and the sampling was of a census method.

Inclusion Criteria: All students working in Endodontic Clinic of the Faculty of Dentistry in 2013-2014.

Exclusion Criteria: Students' lack of tendency for participation.

Data was collected by a questionnaire with questions assessing the students' knowledge about procedural accidents including: the holes during preparation of access cavity, cleaning and formation accidents, canal filling accidents and post-chamber preparation accidents. The students' knowledge about all accidents was assessed by 20 questions including causes (5 questions), prognosis (3 questions), prevention (7 questions) and treatment (5 questions) based on Torabinejad's Endodontics Book (2008). Each correct answer received one point and each incorrect answer received 0. At the end, the scores between 75- 100 were assessed as good, those between 50-75 were assessed as mediocre, and scores lower than 50 were assessed as weak (Rasoulzadeh and Hajhassani, 2014). The validity of the questionnaire was evaluated via content analysis and by asking experts' opinion after being designed. For this purpose, the questionnaire was presented to 5 esteemed members of the Faculty of Dentistry of Babol University of Medical Sciences and adjustments were

made in the questionnaire based on their opinions. The reliability was assessed using Crnobach's alpha test and based on the calculated α (0.78), the reliability of the questionnaire proved to be relatively proper.

Data was analyzed after collection via SPSS software (version 21) and using descriptive statistical indicators, Chi-squared nonparametric test and T-test.

Results

Fifty-two final year dental students (48% female and 52% male) participated in this research. Students answered 20 questions about endodontic treatment procedural accidents in four fields: causes (questions 1, 3, 5, 8, 10), prognosis (Questions 4, 7, 19), prevention (Question 2, 6, 11, 12.17, 18, 20) and treatment (questions 9, 13, 14, 15, 16).

Table 1 presents the distribution of correct and incorrect answers given to the questions regarding causes of procedural accidents of Endodontic treatment. As to the "Introduction of Ledge incidence", the rate of incorrect answers (70.4%) was higher than the correct ones and the difference was significant (P<0.05). As to other questions in this domain, correct answers were either higher in number compared with the incorrect answers or equal to it. Root fracture after root canal treatment was the main etiologic factor in most intracanal accidents. The difference between the frequency of correct and incorrect answers to the questions about reasons of file breaking was not significant (P> 0.05). As to the major etiological factor for accidents inside the canal, no significant difference was found between the frequency of correct and incorrect answers and the same was with the questions regarding the most common causes of the ledge (P>0.05). Distributions of correct and incorrect answers to questions regarding procedural accidents and prognosis are presented in Table 1. The rate of correct answers to "on which level of root, the prognosis of perforation is better?", "Which of the following problems have the worst prognosis?" was higher than the incorrect answers and the difference was significant (P<0.05). The rate of incorrect answers to "When determining the long term prognosis of perforation, which of the following cases should be of higher importance for the dentist during follow up?" Was higher than the rate of correct answers and the difference was significant (P<0.05). Table 1, presents the distribution of correct /incorrect answers given to the questions regarding accident prevention. As to the following Questions "what are the proper methods of preventing perforation during preparation of access cavity?"(P<0.05), "Under which condition, preparation of access cavity is preferred to be done without rubber dam?" (P<0.05), "What is the desirable degree of density of sodium hypochlorite for washing perforated canal?" (P<0.05), "What is the maximum MAF number for canals with intensive curve?" (P<0.05).The rate of correct answers was higher than the rate of incorrect ones. Furthermore, the frequency of correct and incorrect answers to the questions in the area of endodontic procedural treatment accidents is indicated in table 1.Thepercentage of correct and incorrect answers to the question "fundamental solution for the treatment of broken instruments during treatment within the channel" Were equal (P> 0.05). The percentage of correct answers than incorrect answers to the question "Which is the apical perforation treatment?" was higher (P> 0.05), and other questions in this area that this difference was significant (P <0.05).

There was no significant association between gender and answers in all four domains (cause, prognosis, prevention, treatment) (Table 2).

The level of students' knowledge based on their correct answers was categorized under three classes of weak (>50%), mediocre (50%-74%), good (75% - 100%). Students' knowledge in the domains of causes, prognosis, prevention and accidents was mediocre. However, the students' knowledge about causes was at the lowest degree while their knowledge about treatment was at the highest.

Comparing the students' knowledge based on their gender, in the four domains of causes, prognosis, prevention and treatment, via independent sample T-Test, the difference in the domains of causes and treatment was significant (P<0.05), in which female students had a higher level of knowledge about the causes of procedural accidents, whereas male students had a higher level of knowledge about the treatment of procedural accidents (Table 3).

Table 1: Distribution of correct & incorrect answers to questions regarding causes, prevention and prognosis of procedural accidents of endodontics.

Domains	Questions	Incorrect	Correct	χ^2	*p*. Value
Cause	What is the major etiological factor causing accidents inside the canal?	46.2	53.8	0.308	0.579
	What is the introductory phase of ledge?	67.3	32.7	6.23	0.013
	What is the most important cause of root breakage after root canal treatment?	50	50	0.001	1
	Which items are the causes of short filling of the root canal?	46.2	53.8	0.308	0.579
	Which of the followings are not the usual causes of file breakage?	26.9	73.1	11.07	0.001
Prognosis	On which level of root is the prognosis of perforation better?	21.2	78.8	17.3	0.001
	Which of the following problems has the worst prognosis?	19.2	80.8	19.7	0.001
	When determining the long term prognosis of perforation, which of the following conditions should be of higher importance for the dentist during follow up?	75	25	13	0.001
Prevention	Preparation of which part of the canal can be desirable for ledge prevention?	51.9	48.1	0.077	0.782
	What is the key to obturation prevention?	73.1	26.9	11.07	0.001
	What measures can be taken to prevent perforation during preparation of access cavity?	13.5	86.5	27.7	0.001
	What is the best auxiliary device for locating canals?	76.9	23.1	15.1	0.001
	How does fiber optic light function to find canal entry?	51.9	48.1	0.07	0.78
	What is the most desirable density of sodium hypochlorite for washing a perforated canal?	40.4	59.6	1.9	0.166
	What is the desirable MAF number for canals with intensive curve?	21.2	78.8	17.3	0.001
Treatment	Which one is the proper treatment for apical perforation?	36.5	63.5	3.7	0.05
	What is the important factor in a successful apexification treatment?	34.6	65.4	4.9	0.027
	Which one is the special treatment for apical transportation?	32.7	67.3	6.2	0.013
	What is priority emergency in root fracture treatment?	28.8	71.2	9.3	0.002
	What is the fundamental solution for the treatment of broken instruments within the canal?	50	50	0.0	1

Table 2: Distribution of correct & incorrect answers to questions regarding causes, prevention and prognosis of procedural accidents of endodontic treatment based on gender.

Domains	Questions	Female		Male		*p*.Value
		Incorrect	Correct	Incorrect	Correct	
cause	What is the major etiological factor causing accidents inside the canal?	19.2	28.8	27	25	0.2
	What is the introductory phase of ledge?	30.8	17.3	36.6	15.4	0.423
	What is the most important cause of root breakage after root canal treatment?	13.5	34.6	36.5	15.4	0.06
	Which items are the causes of short filling of the root anal?	17.3	30.8	28.8	23.1	0.128
	Which of the followings are not the usual causes of file breakage?	9.6	38.5	17.3	34.6	0.22
Prognosis	On which level of root is the prognosis of perforation better?	9.6	38.5	11.5	40.4	0.55
	Which of the following problems has the worst prognosis?	9.6	38.5	9.6	42.3	0.58
	When determining the long term prognosis of perforation, which of the following conditions should be of higher importance for the dentist during follow up?	32.7	15.4	42.3	9.6	0.21
Prevention	Preparation of which part of the canal can be desirable for ledge prevention?	25	23.1	26.9	25	0.6
	What is the key to obturation prevention?	36.6	11.5	36.5	15.4	0.44
	What measures can be taken to prevent perforation during preparation of access cavity?	1.9	46.2	11.5	40.4	0.06
	What is the best auxiliary device for locating canals?	36.6	11.5	40.4	11.5	0.56
	How does fiber optic light function to find canal entry?	19.2	28.9	32.7	19.2	0.08
	What is the most desirable density of sodium hypochlorite for washing a perforated canal	15.4	32.7	25	26.9	0.18
	What is the desirable MAF number for canals with intensive curve?	11.5	36.6	9.6	42.3	0.44
Treatment	Which one is the proper treatment for apical perforation?	11.5	36.6	25	26.9	0.064
	What is the important factor in a successful apexification treatment?	11.6	36.5	22.1	28.8	0.104
	Which one is the special treatment for apical ransportation?	11.5	36.6	19.2	32.7	0.237
	What is priority emergency in root fracture treatment?	11.5	36.6	17.3	34.6	0.33
	What is the fundamental solution for the treatment of broken instruments within the canal?	25	23.1	25	26.9	0.5

Table 3. Mean comparison of knowledge of male and female students in four areas

Domains	gender	Mean	Standard Deviation	Mean difference	T	*p*. Value
Cause	Female	62.4	24.02	18.7	3.01	0.004
	Male	43.7	20.8			
Prognosis	Female	64	28.7	4.7	0.6	0.55
	Male	59.3	28.2			
Prevention	Female	56.6	18.2	6.9	1.25	0.218
	Male	49.7	21.1			
Treatment	Female	70.4	21.7	12.6	2.03	0.048
	Male	57.8	23.1			

Discussion

In the present era, thanks to the advent of new methods and tools, therapeutic and controlling measures applicable to pulp and pre-radicular diseases have been developed significantly to an extent that most of the teeth pulled out because of root damages and dental carries in the past, are now maintained by underdoing endodontic treatment with a relatively good prognosis. Many teeth require root canal treatment due to caries, trauma or other reasons. Considering millions of people needing root canal treatment, patients should be aware of the success rate and soundness of this method. Investigations have revealed that the majority of root canal failures are due to procedural faults; hence most of these failures 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 (Hasheminia& Khajavi, 1999)

The findings of this study revealed that the knowledge of dental students of Babol University of Medical Sciences about the procedural accidents is mediocre. They also revealed that female students are significantly more aware of the causes of such accidents compared with male students. Moreover, based on these findings, the level of students' knowledge about treatment and prognosis are far higher than their knowledge about the causes and prevention methods. There has not been any research to compare the level of knowledge of male and female dental students about endodontic procedural accidents; however, increasing hours of practical teaching and workshops can be helpful in increasing students' awareness in this area. Also, it is essential to have sufficient knowledge about the procedural accidents. Moreover, therapeutic and diagnostic methods and the impacts of such accidents on prognosis should be learnt. Most of pertinent problems can be prevented by observing the fundamental principles of diagnosis, tooth selection, treatment plan, preparation of access cavity, canal formation and cleaning, canal filling and preparation of post chamber (Torabinejad & Walton, 2009).

Dental students acquire required knowledge about uncomplicated and simple treatments in the faculty before their pre-clinical and clinical courses. Through the educational stages, students acquire the required skill and are assessed by the professors before proceeding to higher levels of therapeutic and educational courses. However, there may still remain some failures or misunderstanding not recognized by the professor. Almost all essays written on the procedural accidents relate to the high frequency of the accidents, their causes and prognosis. No researches are reported to be focused on dentists or dental students' knowledge about these accidents unless those carried out as students' final theses.

The study conducted by Lin et.al (2005), on the impact of procedural accidents on the final outcome of the treatment, revealed that such accidents cannot be the primary cause of treatment failure. They consider treatment failure to be mostly due to the lack of proper understanding about the root canal anatomy, inefficient tools and devices of endodontic treatment and lack of proficiency. Rahimi *et al* (2007), states that having the proper knowledge, awareness, concentration, patience, and understanding about the work limitations, minimizes such accidents. This study did not evaluate the students' performance. It was their awareness and knowledge which were the main focus of assessment and according to the findings of our study, their knowledge was at a mediocre level.

Conclusion

According to the findings of the present study, students had a higher level of knowledge about treatment and prognosis of procedural accidents than about the causes and prevention. This can be acquired due to clinical experience. The present study, considering the level of knowledge of dental students of Babol University of Medical Sciences, can serve as a preliminary stage for future studies focusing on students' performance. The research findings proved that dental students of Babol University of Medical

Sciences had a mediocre knowledge about procedural accidents of Endo.

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