

## Radiographic Evaluation of Root Canal Obturation by Undergraduate Students in AIMST Dental Institute

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ARTICLE INFO	ABSTRACT
Published Online: 30 June 2018	Successful root canal therapy depends on accurate diagnosis, effective cleaning, shaping and three-dimensional obturation of the root canal system. The aim of the study is to gauge the quality of root canal obturation performed at AIMST dental clinic by undergraduate students using radiographs. Fifty-five post-operative intraoral periapical radiographs were selected for the study with evidence of procedural errors. This study required categorizing endodontic mishaps into under-obturation, over-obturation and obturation with voids based on which the IOPAs were interpreted and measured. Data was tabulated and descriptive statistical analysis was carried out. From the study, the quality of root canal obturation performed by AIMST undergraduate dental students was satisfactory.
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<b>KEYWORDS:</b> Obturation, Root canal filling material, Under-Obturation, Over-Obturation, Endodontic mishap.	

### Introduction

Preservation of tooth structure has progressively gained utmost importance in major aspects of treatment modalities in dentistry. Hence, endodontic therapy has become a gradually more predictable part of general dental practice<sup>1</sup>. The aim of the current study is to assess the quality of root canal obturation performed in AIMST dental clinic and the method of assessment of root canal obturation was based on radiographic evaluation.

The main objective of endodontic treatment is to deliver hermetic seal of the root canal system with an inert, biocompatible and dimensionally stable filling material. An acceptable obturation of the root canal requires the filling material and the endodontic instruments to be limited to the root canal without extending into the periapical tissues or other neighboring structures<sup>2</sup>. Filling material, broken files and gutta-percha extruded into the periapical area may cause unwanted reaction (the connective tissue tends to absorb the foreign body or more frequently surround it with a fibrous capsule) within the connective tissue depending on the individual's immune system<sup>1</sup>.

There were numerous cases reported in the literature that mention and document numerous disabling complications to the alveolar bone, neurovascular anatomy and maxillary sinus as a deleterious effect due to over-extension of root canal filling materials. These injuries require a thoughtful

approach for prevention during endodontic obturation as well as methodical approach to manage in the event of such occurrences. There is a direct association between the quality of the root canal obturation and the success of endodontic therapy<sup>3</sup>. One of the most iatrogenic complications in endodontic treatment is the over-filling of the root canal which has a harmful effect on the prognosis of endodontically treated teeth<sup>4</sup>. Moreover, the prognosis for an endodontically treated tooth with over-filling depends upon the response of the periradicular tissue to the canal obturation material. It is a spontaneous interaction between the materials and the host defenses<sup>5</sup>. Alternatively, under-filling of root canal might lead to endodontic treatment failure due to micro-leakage along the root canal walls<sup>10</sup>. Thus, the obturation related mishaps detected using radiographs require treatment modification depending on the extent of procedural accident to produce a successful root canal procedure.

### Materials and Methods

Interpretation and obturation evaluation of fifty-five IOPAs from endodontic treatment in patients by Year 4 and Year 5 students in the academic year 2015-2016 in AIMST dental institute was assessed. A total of fifty-five students from their respective batch volunteered to take part in the research (Table I)

Table I- The table above shows the number of students from their respective Years involved in the research. A total of 58.2% of the students from the participants are from Year 4 and 41.8% of the students are from Year 5.

	Batch	Frequency	Percentage	Valid percentage	Cumulative Percentage
Valid	Year 4	32	58.2	58.2	58.2
	Year 5	23	41.8	41.8	100.0
	Total	55	100.0	100.0	

These specific intra-oral periapical radiographs (IOPAs) were chosen due to presence of procedural errors. No specific methods were preferred for selection of tooth number, tooth position and age of the patient involved in the following study (randomized sampling technique). The procedural errors were classified into under obturation, over obturation and presence of void in this study. The IOPAs were interpreted and measured according to under-obturation or over-obturation from the tooth apex. The effective obturation lengths in IOPAs were measured using a divider and a ruler vertically to assess the obturation quality. The procedure involved measuring the obturation length using a divider and transferring to a ruler to record the precise reading. However, in case of presence of voids, calculation was done using the same method but, the length was measured horizontally from the outer wall of the tooth surface.

Root canal procedure requires four radiographs to be taken at various stages to ensure successful treatment outcome. A pre-operative IOPA is taken at the start of the endodontic procedures. Successively, access opening is performed with a thorough irrigation using the recommended solution (saline and sodium hypochlorite or chlorhexidine). Additional IOPA is taken to determine the working length based on which cleaning and shaping is carried out methodically following the treatment guidelines. The preferred and

suggested technique to students at AIMST dental institute is either step-back or crown-down technique. A mandatory master-cone radiograph is taken before the obturation is done with the gutta-percha placed in the root canal. Finally, a postoperative radiograph is taken on completion of obturation with gutta-percha using cold lateral condensation technique. Comprehensive examination for detecting root canal obturation errors is done using the final postoperative radiograph.

### Results

The data were tabulated and descriptive statistical analysis was carried out. The results of the study depict that the most frequent endodontic obturation mishap is under-obturation with when over-obturation and inadequate density of the obturation (presence or absence of the voids) respectively.

Table II shows the percentage of underobtured root canal lengths along with frequency amongst the students. The maximum number of students who made the obturation short of 2 mm from radiographic tooth apex contributed to 23.6 % of the total participants. Consecutively, eight students who fell short of 3 mm in obturation length represented 14.5 % of the total participants. However, only 02 students had obturated 1.5mm short of working length which is the least common error in obturation procedure among the total participants. (Figure I)

Table II.- shows the number of underobtured root canal lengths errors amongst the students

	Short of Length from radiographic apex*	Frequency	Percentage	Valid percentage	Cumulative Percentage
Valid	0.5 mm	03	05.5	05.5	5.5
	1.0 mm	06	10.9	10.9	16.4
	1.5 mm	02	03.6	03.6	20.0
	2.0 mm	13	23.6	23.6	43.6
	2.5 mm	05	09.1	09.1	52.7
	3.0 mm	08	14.5	14.5	67.2
	3.5 mm	04	07.3	07.3	74.5
	4.0 mm	04	07.3	07.3	81.8
	No error	10	18.2	18.2	100.0
	Total	55	100.0	100.0	

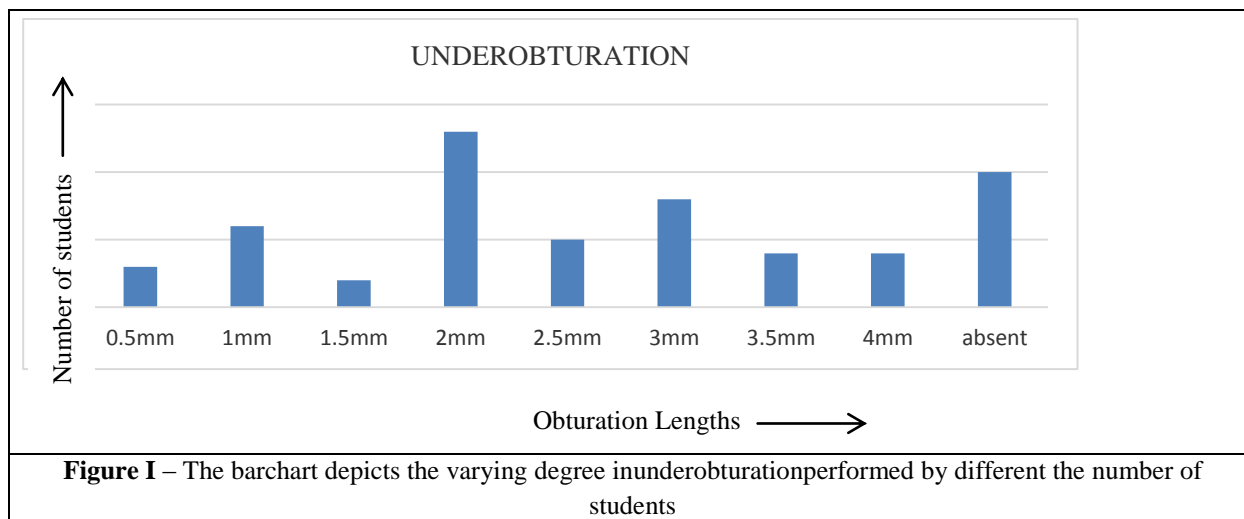
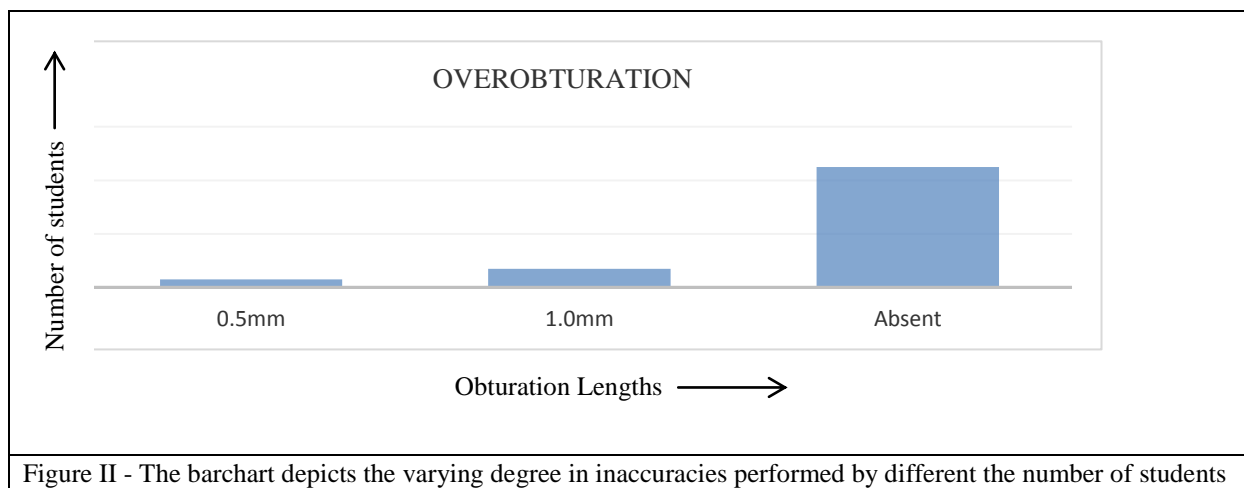


Table III indicates the errors in overobtured root canal lengths. The most common error in overobturation is 1 mm which represents 12.7% of the total participants followed by

0.5mm which represents 5.5% of the total participants. However, 81.8 or the maximum number of students did not perform any overobturation (Figure II)

Table III - shows the number of overobtured root canal lengths errors amongst the students					
	Excess in Length from radiographic apex	Frequency	Percentage	Valid percentage	Cumulative Percentage
Valid	0.5mm	03	05.5	05.5	05.5
	1.0mm	07	12.7	12.7	18.2
	Absent	45	81.8	81.8	100.0
	Total	55	100.0	100.0	



Finally, Table IV shows the presence or absence of voids evident during the obturation procedure amongst the participants. Occurrences of voids were evident in 5.5 % of

the total participants while 94.5 % of the participants had no voids in their obturation.

Table IV - shows the occurrence of voids in the obturation procedure amongst the number of canal obtured by students.					
		Frequency	Percentage	Valid percentage	Cumulative Percentage
Valid	Presence of voids	03	05.5	5.5	5.5
	Absence of voids	52	94.5	94.5	100.0
	Total	55	100.0	100.0	

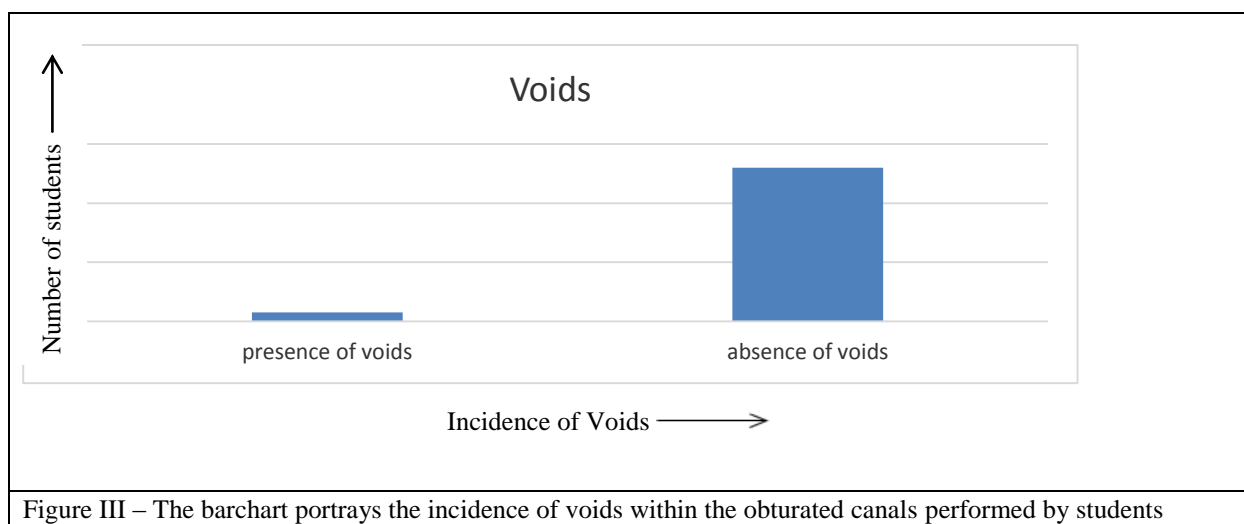


Figure III – The barchart portrays the incidence of voids within the obturated canals performed by students

## Discussion

The success of a clean, well-prepared root canal system may be compromised if the root canal system is improperly obturated<sup>12</sup>. Therefore, the root canal system must be effectively sealed both coronally and apically to prevent reinfection for an efficient endodontic treatment<sup>13</sup>.

From this study, the most common obturation related mishap performed in AIMST dental institute is underobturation. A total of forty-five students had done underobturation compared to only 10 students who had overobturation error. While amongst the 55 students, 03 students had voids in their root canal obturation.

A large number of endodontic iatrogenic accidents are access-related, instrumentation-related, obturation-related or miscellaneous. Concerning obturation-related mishaps, root canals are either over-filled or under-filled. Overextension and underextension of the filling material denote solely to the vertical dimension of the root canal filling, beyond or short of the root apex. Features of well-done obturation are well-defined and classified as the three-dimensional filling of the whole root canal system as close to the cemento-dentinal junction as possible, without overextension or underfilling in the present of a patent canal<sup>6</sup>.

According to Cohen, the apical points of termination should be 1 mm from the radiographic apex<sup>14</sup>. This particular measurement forms the basis of this study based on which the faults were categorized. Underfilling represents to a tooth whose root canal system has been incompletely obturated in any aspect, leaving large reservoirs and resultant voids that might become focus for recontamination and infection that cannot be corrected by greater instrumentation force. These unfilled areas may create complications due to presence of bacteria that can multiply when in contact with nutrients via the periapical region or lateral canals<sup>12</sup>. Numerous factors like canal blockage, incomplete cleaning of the root canal and ledge formation due to improper instrumentation may result in underfilling of a canal. Incomplete obturation may foster bacterial growth in the underfilled root canal resulting in

inflammation or abscess requiring root canal retreatment, surgical endodontics or extraction.

Regarding the overextension of root canal filling materials, complications may involve the periodontal ligament, alveolar bone, neurovascular anatomy and the maxillary sinus. Neural complications are a serious problem<sup>6</sup>. The filling material may push through the apex and sealed into the ligament and bone. This may results in postoperative pain once the anesthesia wears off. Endodontic etiology can affect the maxillary sinus, which include extension of periapical infections into the sinus. The introduction of endodontic instruments, and filling materials beyond the apices of posterior teeth can lead to sinus complications due to proximity of maxillary posterior teeth to the sinus floor membrane<sup>6,7</sup>.The consequences of overfilling can therefore result in infective periapical periodontitis caused by the transport of bacteria beyond the apex and an incomplete cleansing, foreign body reactions and pain symptoms which contribute to painful stimulus even in the absence of radiological evidence<sup>9</sup>.

According to the American Dental Association, overfilling by more than 2 mm past the radiological apex represents a technical error ascribable to over-instrumentation, inadequate measuring, or a lack of an apical stop<sup>8</sup>. On the other hand, obturation is considered adequate when there are no voids within and between the root canal fillings and root canal walls. Post treatment disease is also caused by extrusion of necrotic debris into the periapex<sup>11</sup>. Thus, the quality of endodontic treatment is determined by the length of root canal obturation in relation to the radiographic apex and the density of obturation based on the presence of voids<sup>3</sup>.

Incorporating a stringent obturation regime plays an important role in the success of endodontic treatment. Identifying the common causes of obturation-related mishaps will help the students decide upon the suitable management and precautions required to integrate in their clinical treatment approach.

## Conclusion

From the study, the quality of root canal obturation performed by AIMST undergraduate dental students was satisfactory. The study reveals that underobturation is the chief error amongst the obturation-related mishaps at AIMST dental institute. Inaccuracy in determining the precise radiographic working length appears to be the principle cause of underobturation at AIMST dental Institute. Other contributing factors for underobturation may be due to ledging, extrusion of gutta-percha while cutting the excess material and defective radiographs.

This research enables us recognize the importance of a proper root canal obturation for the success of root canal treatment. To prevent such errors, the students require additional contact hours and exposure through training courses, simulation lab procedures and lectures within the pre-clinical and clinical setup at AIMST dental institute. This positive methodology will improve the quality of the root canal obturation and the students competency in dealing complex endodontic cases.

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